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THE EUROPEAN BISON.

THE ROYAL
NATURAL HISTORY

THE ROYAL NATURAL HISTORY

EDITED BY

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SECRETARY OF THE ZOOLOGICAL SOCIETY OF LONDON

ILLUSTRATED WITH

Seventy-two Coloured Plates and Sixteen Hundred Engravings

BY

W. KUHNERT, F. SPECHT, P. J. SMIT, G. MÜTZEL, A. T. ELWES, J. WOLF,

GAMBIER BOLTON, F.Z.S.; AND MANY OTHERS

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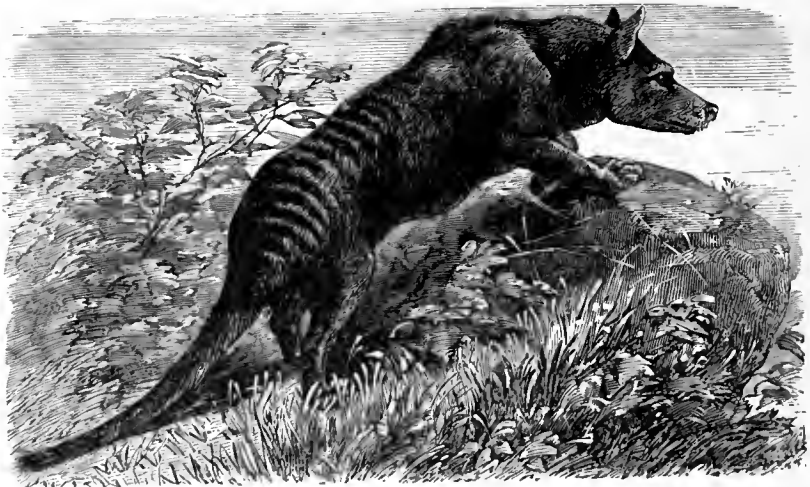
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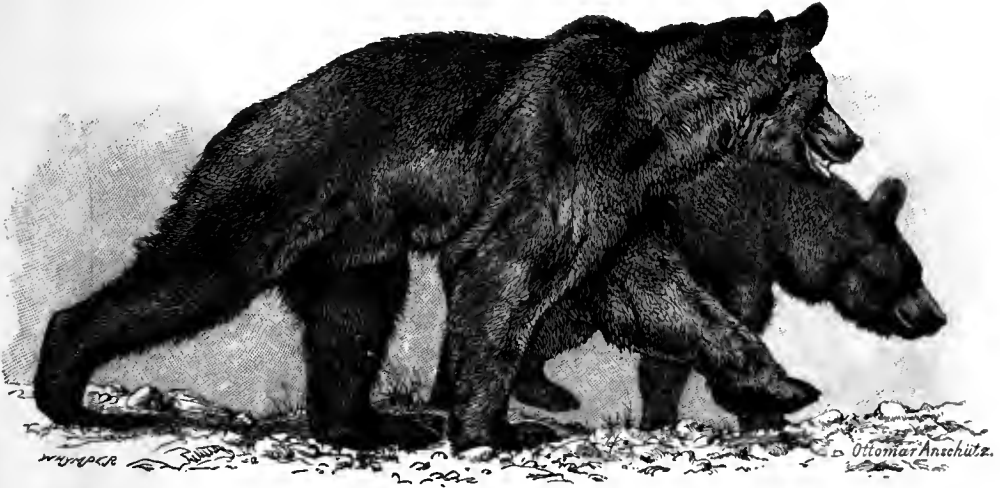
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THE ROYAL NATURAL HISTORY.



MAMMALS.

CHAPTER XVI.

CARNIVORES,—*continued.*

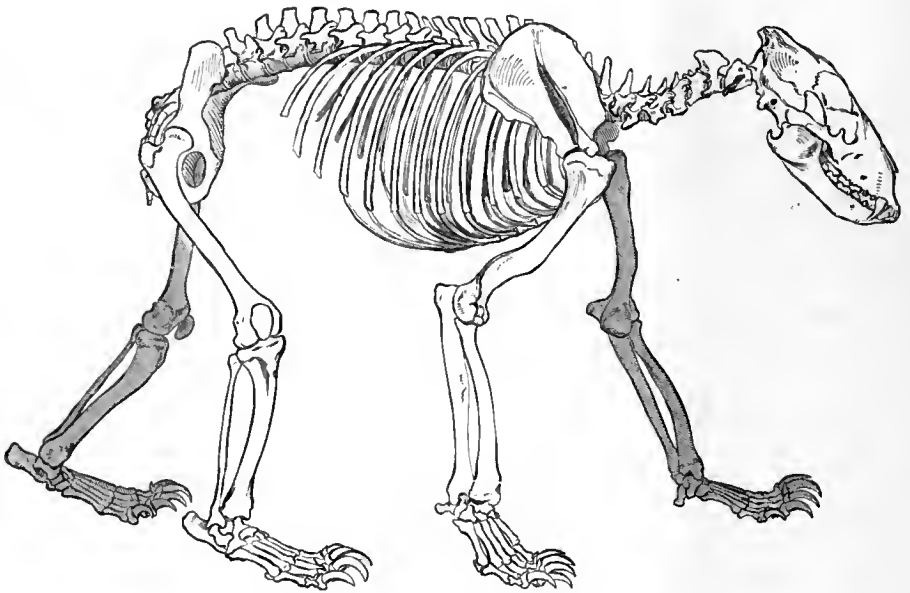
BEARS.

Family *URSIDÆ.*

THE bears are so different in appearance from the other Carnivores that no one could fail to recognise their representatives at a glance, or would hesitate to admit that, so far at least as living forms are concerned, they are entitled to constitute a group by themselves. The number of species included in the family is comparatively small; and the whole of them are arranged under three genera, two of which are represented by but a single species each.

Bears differ from the Carnivores hitherto noticed in an important feature connected with the hinder-part of the under-surface of the skull. Thus, whereas in all the preceding families the so-called tympanic bulla at the base of the internal portion of the ear forms an inflated bladder-like capsule, which is

generally divided internally by a larger or smaller bony partition, in the bears (as well as in the following families of the raccoons and weasels), this bulla is depressed and flattened, and has no trace of an internal partition; and its mouth, leading to the external ear, is produced much further outwards. There are also other characters connected with the skull which help to distinguish the bears and the members of the next two families from the Carnivores hitherto described, but the bulla alone is sufficient to determine at a glance to which of the two groups any given skull may belong, and the reader will accordingly perceive how important is this apparently insignificant feature. The degree of inflation of the bulla of the skull is doubtless associated with the acuteness of hearing; the Carnivores with the longest ears, like the African fennec, having larger bullæ than their nearest



SKELETON OF BEAR.

relatives. Bears are notoriously deficient in the sense of hearing; and it is probable that raccoons and weasels are also less acute in this respect than cats, civets, and dogs. Although many of the Carnivores with inflated bullæ have, like the cats, comparatively small ears, it is noteworthy that no bear, raccoon, or weasel has these organs of very large dimensions, while in some instances they are almost absent.

The members of the bear family are characterised by their heavy and massive build, their thick limbs, extremely short tails, and the presence of five toes, armed with powerful claws, on both the fore and hind-feet. Moreover, when walking, the whole sole of the foot is applied to the ground, in the old-fashioned plantigrade manner, so that the impression of a bear's foot presents a considerable superficial resemblance to that of a man. The claws of the feet are incapable of being retracted, and are well adapted for digging, although no members of the family are in the habit of constructing burrows for themselves after the manner of foxes. In most bears the under surface of the sole of the foot is

completely devoid of hair; and the ordinary gait is peculiarly slow and measured. All the bears are of considerable bodily size, while some of them are among the largest of the Carnivores.

The living species of bears, with which alone we are at present dealing, are likewise readily distinguished from other Carnivores by the characters of their teeth. They agree with the true dogs in having two pairs of molars in the upper jaw, and three pairs in the lower jaw, but the shape of these teeth is different; the crowns being nearly flat, very broad, and mainly adapted for grinding, while those of the upper jaw are either oblong or square, and, therefore, quite unlike the triangular upper molars of the dogs. Then, again, the flesh-tooth in both jaws is very unlike that of ordinary Carnivores; the upper one being small, and having no inner root, and its crown looking much like that of a molar. Similarly, the lower flesh-tooth (which we may once more remind our readers is the first of the molar series, while the upper one is a premolar) is very like the two molars by which it is followed. A third distinctive feature is that the first three premolar teeth in both jaws are exceedingly minute, and are very generally shed when their owner attains maturity.

The peculiar characteristics of the cheek-teeth clearly indicate that the food of the bears is very different from that of other Carnivores; and, as a matter of fact, the majority of these animals subsist on a vegetable diet, or on insects, to a much greater extent than on flesh. From their evident descent (as we shall fully indicate later on) from dog-like animals, it is clear that the peculiar features of the dentition of the bears have been acquired; and we may hence regard these animals, so far as their teeth are concerned, as highly specialised. The loss of the tail is likewise a specialised feature. On the other hand, in their retention of the old-fashioned plantigrade mode of walking, bears are much more generalised animals than dogs, and in this respect retain a feature which was present in the ancestral types from which the two groups have sprung.

The whole of the members of the family have a marked resemblance to one another, so that the characters by which the different species are distinguished are apparently somewhat trivial. Their fur is coarse, and generally long, thick, and shaggy, although it may be short and thinner in some of the tropical species. Except for the not unfrequent presence of a white collar round the throat, the fur is nearly always of one colour, and generally some shade of either brown or black. It is true, indeed, that the Polar bear is a marked exception to this rule, but in this case the colour of the fur has evidently been specially modified to suit the natural surroundings. The great prevalence of black among the bears is a feature unknown in any other group of Carnivores, and is, indeed, rare among Mammals in general.

Bears have a wide geographical distribution, occurring throughout Europe, Asia, and North America, while one species inhabits the South American Andes, and another the African Atlas. South, however, of the Atlas not a single member of the family is to be found throughout the length and breadth of Africa. Geologically speaking, true bears, that is to say those which can be referred to the genera now living, are of comparatively recent origin, none being yet known before the Pliocene, while it is not till the succeeding period that they became abundant. This late appearance of the bears is in harmony with what we have already stated as to their specialisation.

CARNIVORES.

THE TYPICAL BEARS.

Genus *Ursus*.

With the exception of the Indian sloth-bear and a peculiar species from Tibet, all the bears are now generally included in the genus *Ursus*. This genus is characterised by having a total of 42 teeth (when all the small premolars are present), of which $\frac{2}{3}$ are incisors, $\frac{1}{4}$ canines, $\frac{1}{4}$ premolars, and $\frac{2}{3}$ molars on each side. In the adults, as already mentioned, several or all of the three anterior premolars may disappear from both jaws, although the one immediately behind the tusk may remain longer than the others. The molar teeth are characterised by their crowns being longer than they are broad; the last upper molar being a much elongated tooth, while in the lower jaw the last molar is shorter than the tooth which precedes it. As a rule, the soles of the feet are naked; and the claws are of moderate length and curvature. As in the other genera of the family, the ears are small, erect, and thickly haired; and the pupil of the eye is round. The geographical distribution of the genus is coextensive with that of the family.

THE POLAR BEAR (*Ursus maritimus*).

Not only does the Polar bear differ from all other bears by its pure white coat, but it is also distinguished from the greater number of white Mammals in that this colour is retained at all seasons of the year, instead of being exchanged in summer for a darker tint. In addition to this distinctive white coloration, the Polar bear is further characterised by the relatively small size and extremely elongated form of its head, as well as by the molar teeth being relatively smaller and narrower than in the other members of the genus. Moreover, the soles of the feet have a certain amount of hair growing upon them, doubtless for the purpose of enabling the animal to have a better hold upon the ice. The neck is also longer than in other bears, while the ears are unusually small. It is one of the largest members of the group, not unfrequently attaining a length of close upon 9 feet, although exact measurements from recently killed wild examples are but few.

The Polar bear is found throughout the Arctic regions of both hemispheres. It is now rare on the south-western coasts of Spitzbergen and Novaia Zemlia, where the ice almost completely disappears in summer. According to Baron Nordenskiöld, it is more common on the northern parts of those islands, where there is perpetual ice. On the north coasts of America and Asia it is found everywhere, and becomes more and more numerous as we travel northwards. In Labrador, where it is now very rare, there is evidence that it was once comparatively common, and Dr. A. S. Packard is of opinion that its range originally extended even down into the State of Maine. The white bears seen by John Cabot in the year 1497 are believed by Dr. Packard to have been observed in Newfoundland; while further evidence of their former existence is afforded by the observations of Corte Real in 1500 and Cartier in 1534. The bones found in the shell-mounds of Goose Island, Casco Bay, Maine, are considered to belong to the present species, and thereby indicate the probability of its range having extended thus far south.

In Southern Labrador the Polar bear seems to be totally extinct, the last specimen that was seen on the shores of the Strait of Belle Isle (dividing Labrador from Newfoundland) having been killed in the year 1849. In Labrador the range of the white bear overlaps that of the American black bear.

Habits. Baron Nordenskiöld states that the Polar bear generally lives on such coasts and islands as are surrounded by ice, while it is often found on the ice-fields far out at sea, which form its best hunting-grounds. In regard to the numbers of these animals, he states that the Norwegian "vessels from Tromsøe brought home in 1868 twenty, in 1869 fifty-three, in 1870 ninety-eight, in 1871 seventy-four, and in 1873 thirty-three bears. It may be inferred from this that the Norwegian walrus-hunters kill yearly on an average at least a



POLAR BEAR CLIMBING A FLOE.

hundred bears. It is remarkable that in this large number a pregnant female or one with newly-born young is never found. The female bear appears to keep herself well concealed during the time she is pregnant,—perhaps in some ice-hole in the interior of the country."

In Nordenskiöld's opinion it is uncertain if the Polar bear hibernates, although there are several circumstances indicating that it probably does so. In the most northerly wintering-stations of ships, the bears almost completely disappear during the long arctic winter, while there are cases where some of them have been found concealed in holes. It will, however, be obvious that this disappearance from the more northern regions in winter may well be due to migration, while the individuals found in concealment may all have been females, which are known to bring forth their young beneath the snow. Other writers, as we shall see below, definitely state that in many districts males and young cubs are to be

found in active life throughout the winter; but it is quite possible that in the most northern portions of its range both sexes may habitually hibernate. According to Eskimo accounts, the female bears are very fat at the time they retire beneath the snow. During their extended excursions after prey, the male and the female, the latter generally attended by one or two good-sized young ones, keep each other company. More are seldom seen together, unless at places where many carcases of walrus, seals, or white whales are lying. Formerly the sight of a bear created dismay in Arctic travellers, but now the walrus-hunters do not hesitate a moment to attack, lance in hand, considerable numbers of bears. The bear's principal food consists of the seal and walrus. There is not the least doubt, continues Nordenskiöld, "that, along with flesh, the bear also eats vegetable substances, as seaweed, grass, and lichens. The flesh of the bear, if he is not too old or has not recently eaten putrid seal-flesh, is very eatable, being intermediate in taste between pork and beef. The flesh of the young bear is white, and resembles veal." In addition to seals and walrus, the Polar bear also subsists on the flesh of certain Cetaceans, and our illustration represents a female carrying a porpoise in her mouth. In some districts the Polar bear consumes a large quantity of fish, more especially salmon. It is in summer that it resorts to a vegetable diet.

From the personal experience of Dr. Robert Brown it appears that the accounts given by the older voyagers of the ferocity of the Polar bear were considerably exaggerated, although at close quarters it is a formidable foe. "Unlike its congeners," writes Dr. Brown, "it does not hug but bites; and it will not eat its prey till it is dead, playing with it like a cat with a mouse. I have known several men who, while sitting watching or skinning seals, have had its rough hands laid on their shoulders. Their only chance then has been to feign being dead, and manage to shoot it while the bear was sitting at a distance watching its intended victim. Though Eskimo are often seen who have been scared by it, yet, unless attacked or rendered fierce by hunger, it rarely attacks man. During our last trip to Greenland none of our party saw one; indeed, they are only killed in the vicinity of Disco Bay during the winter or spring, when they have either come or drifted south on the ice-floes."

Much the same account is given by Mr. G. S. M'Tavish, of the Hudson's Bay Company, who states that in his district it is only occasionally that a Polar bear will attack first. This observer writes that "although the Polar bear is synonymously termed the white bear, they are not all white. Those that are most likely to run away from the hunter are pure white. From the smallest to the largest size these white bears are timid, and I have noticed, on their being killed, they are the fattest. The most dangerous and aggressive kinds, other than females with cubs, is the large-sized male bear of a yellowish, dirty colour. . . . Another sort is the small-sized bear, of both sexes, neither white nor yellow, but rather dirty-looking; and these are likewise the best runners."

Mr. M'Tavish proceeds to observe that the pace of a Polar bear is considerable, and that he has known instances where they have overtaken and killed Indians in a fair chase. Their fleetness depends, however, largely upon their condition at the time, the thinner they are the greater being their speed. The weight of a large and fat Polar bear is estimated at from 600 to 700 lbs.



POLAR BEARS AND THEIR PREY.



In the Hudson's Bay district, the female bears proceed to their winter hibernation for the purpose of producing their young at the end of September or beginning of October, and return in March, April, or May. The hibernation always takes place some distance inland, and the males accompany their consorts to their resting-places, after which they come back to the coast, where they hunt throughout the winter. Generally two cubs are produced at a birth, but the number may be sometimes diminished to one, and occasionally increased to three.

Mr. M'Tavish gives the following account of the manner in which these bears capture their prey:—"The bear having discovered a seal asleep on an ice-floe immediately slips into the water if he himself be on another ice-floe. Diving, he swims under water for a distance, then reappears and takes observations. Alternately diving and swimming, he approaches close to his victim. Before his final disappearance he seems to measure the intervening distance, and when he next appears it is alongside of the seal. Then, either getting on the ice, or pouncing upon the seal as it tries to escape, he secures it. Both seals and porpoises are not unfrequently met with, bearing the marks of a bear's claws upon their backs."

THE BROWN BEAR (*Ursus arctos*).

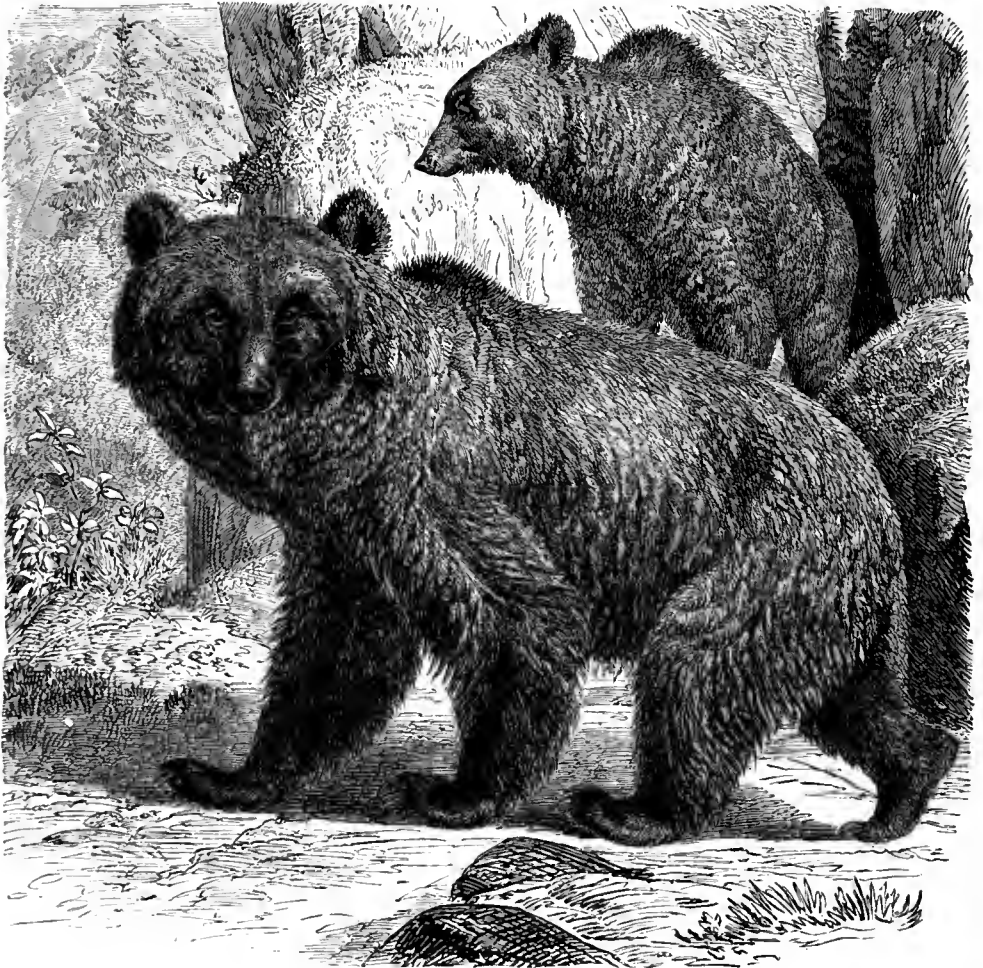
With the brown bear we come to the typical and best known representative of the entire group. It is distinguished from the Polar bear, not only by its colour, but also by its larger and wider head, in which the muzzle is shorter, the profile more curved, and the ears larger. The neck is also shorter and thicker, the teeth are relatively larger, and the soles of the feet are entirely naked.

Owing to variations in colour several so-called species, such as the Syrian bear and the snow or isabelline bear of the Himalaya, have been established on what are now known to be merely local races of the brown bear.

Including all these varieties, the brown bear may be described as one of the largest species of the genus, furnished in winter with long, thick, shaggy, and soft fur, beneath which is a thick and woolly under-fur; the ears being of moderate size, and covered with long hair. The colour is generally some shade of brown, although subject to great individual and local variation. In general it varies from very pale to very dark brown, some of the lighter varieties being almost cream-coloured in certain parts; while, in a variety from Eastern Tibet, the fur on the back and limbs is blackish, with tawny tips to the hairs. In other varieties, again, the fur has a silvery tinge, owing to the hairs being tipped with white; while some specimens have a decidedly reddish tinge. In the light Himalayan variety the colour deepens with age, this darkening being generally most developed in old males, which are frequently indistinguishable in colour from the ordinary European form. Young animals have a white collar on the throat, traces of which may frequently be observed in the newly-grown fur of the adult. The summer coat is much shorter and thinner than the winter dress, and is likewise darker in colour. The claws are of moderate length, and their colour varies from brown to nearly white.

Mr. Blanford suggests that the generally lighter colour of the Himalayan

brown bear may be due to the circumstance that it inhabits more open ground than the European variety. To this I would add that the silver-barked birch, among which these bears are so often found, suggests another reason why their colour should so generally be comparatively light, as among such surroundings a dark animal would be conspicuous. Moreover, it may be that the snow lies longer on the ground in the regions frequented by the Himalayan bear than is the



THE BROWN BEAR ($\frac{1}{10}$ nat. size).

case in the habitats of the European bear. It should also be mentioned that Himalayan bears are decidedly lighter when they issue from their winter sleeping-places than they are later on in the season; and as it is then that they are generally shot, on account of the fur being in its best condition, the prevalent idea as to their extremely light colour has been intensified.

Although, as in the other species of the genus, the males are considerably larger than the females, there is nearly as much variation in point of size in the brown bear as there is in respect of colour. As a rule, the Himalayan race is

smaller than the European. Exact measurements of large European examples are not easy to obtain, but it is probable that some specimens reach at least 8 feet from the tip of the snout to the root of the tail. In the Himalaya the same dimensions are not generally more than 5 or 5½ feet, but large specimens reach about 7 feet, and one has been recorded of 7½ feet in length and 3 feet 5 inches in height. The tail does not measure more than 2 or 3 inches.

The brown bear may be regarded as an inhabitant of almost the whole of Europe, and of Asia northwards of the Himalaya; its former range extending from the British Islands and Spain in the west to Kamshatka in the east. Bears are still found in the Pyrenees, and are comparatively common in many parts of Scandinavia, Germany, Hungary, and Russia. At what date they finally disappeared from the British Islands cannot be determined. Mr. Harting, however, adduces evidence to show that bears were still in existence in the eighth century; and, in the time of Edward the Confessor, the town of Norwich had to furnish annually one bear to the king. There is no decisive historical evidence as to the existence of bears in Ireland, but remains have been found there in various parts, which in all probability belonged to the present species, although they have been referred by some to the American grizzly bear.



HEAD OF BROWN BEAR. (From Sclater, *Proc. Zool. Soc.* 1867.)

In the Himalaya the brown bear is found from Afghanistan in the west to Nipal in the east. It does not occur in the more or less Tibetan districts of Zanskar and Ladak, but extends up the valley of the Indus as far as Gilgit. In the mountains around the valley of Kashmir brown bears were once very numerous, but they have, I believe, become much rarer now. When I first knew Kashmir, in 1874, it was no uncommon event in the Tilel district to see several at once, when standing on a mountain ridge; but eight years later I saw but very few the whole time I was there, and it would be interesting to hear the reports of sportsmen who have recently visited Tilel and the neighbouring valleys.

In Kamshatka, Dr. Guillemard, in the *Cruise of the Marchesa*, speaks of brown bears being extremely plentiful and attaining large dimensions. The country near the rivers is there covered by an almost impenetrable jungle, but the bears manage to force themselves through it without much apparent difficulty. "Just inside the forest," writes Dr. Guillemard, "at a distance of six or eight feet

from the river-bank, is a firmly-trodden path some two feet in width, made entirely by these animals; and, as these paths are to be found without a break on either side of the river in its whole course through the forest country—a distance of about five hundred miles—it will be understood why bears' skins do not command a very high price in the peninsula."

The brown bear is a comparatively unsociable animal, though not unfrequently a male and a female may be seen together, while the females are, of course, accompanied by their cubs. Their favourite haunts are wooded, hilly districts. In the Himalaya the brown bear is to be found at considerable elevations, in the spring haunting the higher birch and deodar forests, while in the late summer it ascends to the open grass-lands above, where it may not unfrequently be seen grazing close to herds of ponies and flocks of sheep or goats. Both in these regions, and the colder districts of Europe and Northern Asia, these bears regularly hibernate; and while they are extremely fat at the commencement of their winter sleep, they are reduced to little more than skin and bone at its conclusion. In the Himalaya the winter's sleep generally lasts till April or May, but varies somewhat in different districts according to the date at which the snow melts. The cubs are generally born during the latter part of the hibernation, and accompany the mother when she issues forth. They are almost invariably two in number, and are born blind and naked, in which condition they remain for about four weeks. In Europe the brown bear not unfrequently kills and eats other animals, its depredations extending, it is said, even to cattle and ponies; but in the Himalaya, except when carcasses come in its way, the animal is almost exclusively an insect and vegetable feeder. There it is fond of the numerous species of bulbous plants growing on the mountains around Kashmir; but it will also descend into the orchards of the upland villages to plunder the crops of mulberries, apricots, walnuts, etc. On such occasions it ascends the trees readily enough, although it is by no means such a good climber as its cousin the Himalayan black bear. It seeks for insects by overturning stones.

In Kamschatka the brown bear is stated to subsist for a certain portion of the year upon salmon; Dr. Guillemard observing that in some places he met with numerous half-eaten fish left by the bears, and adding that he found in almost every instance that "though the head had been crunched up, it had, together with the tail and intestines, invariably been rejected. We were never fortunate enough to witness these animals fishing, but we were told that they walk slowly into the water, where it is about eighteen inches in depth, and, facing down stream, motionless await their prey. The incautious fish, swimming heedlessly up the river, doubtless mistake the bear's broad legs for a rock or tree-stump, and those who have once witnessed the almost lightning-like rapidity of a stroke from Bruin's fore-paws will have no difficulty whatever in completing the drama for themselves. The fish is apparently always taken to the bank to be devoured, for even the small ones do not appear to be eaten whole."

As we have already had occasion to mention, the brown bear, in common with its relatives, is dull of hearing, and it is also by no means well gifted as regards sight. What it lacks in these respects it makes up for, however, in the great development of the sense of smell. Owing to this deficiency of hearing, a bear can

be approached from the leeward to within a very short distance, and the writer has shot many in the Himalaya with a smooth-bore gun. Care should, however, always be taken to approach a bear from above, as a wounded one rolling down hill on to the hunter is a very dangerous object. If two bears are feeding together and one is hit by a bullet, it will not unfrequently turn fiercely on its companion, apparently under the impression that the latter was its aggressor. In the Himalaya, at least, the brown bear never voluntarily attacks human beings if unmolested, and it rarely turns on them when wounded, unless brought to close quarters. There is but little doubt that the current stories of the fierceness of the European bear are exaggerated. In regard to the proverbial "hug," Mr. Blanford observes that the story is apparently devoid of foundation. "A bear, from its anatomical structure, strikes round with its paws, as if grasping, and the blow of its powerful arm drives its claws into the body of its victim, causing terrible wounds, but the idea of its 'hugging' appears not confirmed by recent observers."

At the best, a brown bear is uncomely and grotesque in its movements, and in no case is this more marked than when one of these animals suddenly catches a whiff of human scent, and starts off with a loud "whuff" at a shambling gallop. In spite, however, of their uncomeliness, bears can travel pretty quickly when so minded, although their usual gait is deliberate in the extreme.

The brown bear is easily tamed, and both in Europe and India is the companion of itinerant showmen, by whom it is taught to dance, and go through various other performances. Formerly native English bears, and subsequently foreign ones imported for the purpose, were kept in England for the purpose of "bear-baiting," and the office of Master of the Bears was a Crown post, while every nobleman kept his "bear-ward." Bear-baiting was continued up to the reign of Queen Anne. The well-known bear-garden at Berne in Switzerland is doubtless a survival of the mediæval establishments kept up for this so-called sport. As showing the age to which the brown bear may live, it is worthy of mention that one kept in the garden at Berne survived for upwards of forty-seven years, while it is on record that a female gave birth to young at the age of thirty-one years. From the beauty of their colour, and the length of their fur, the skins of the Himalayan brown bear, if procured early in the spring, are held in high estimation.

We have already mentioned that fossil remains, referred to the brown bear, have been found in the superficial deposits of Ireland; and it may be added that bones and teeth undoubtedly belonging to this species occur in the fens, brick-earths, and caverns of this country, as well as the corresponding deposits of the continent. Whether the remains from the same formations that have been assigned to the grizzly bear do not likewise belong to the European species, may, we think, be a subject of doubt.

Crowther's bear (*U. crowtheri*) is a closely-allied if not identical form from the Atlas Mountains, and it is probable that a bear exists in Morocco and Algeria which may be either the common brown bear or Crowther's bear, if the latter be distinct.

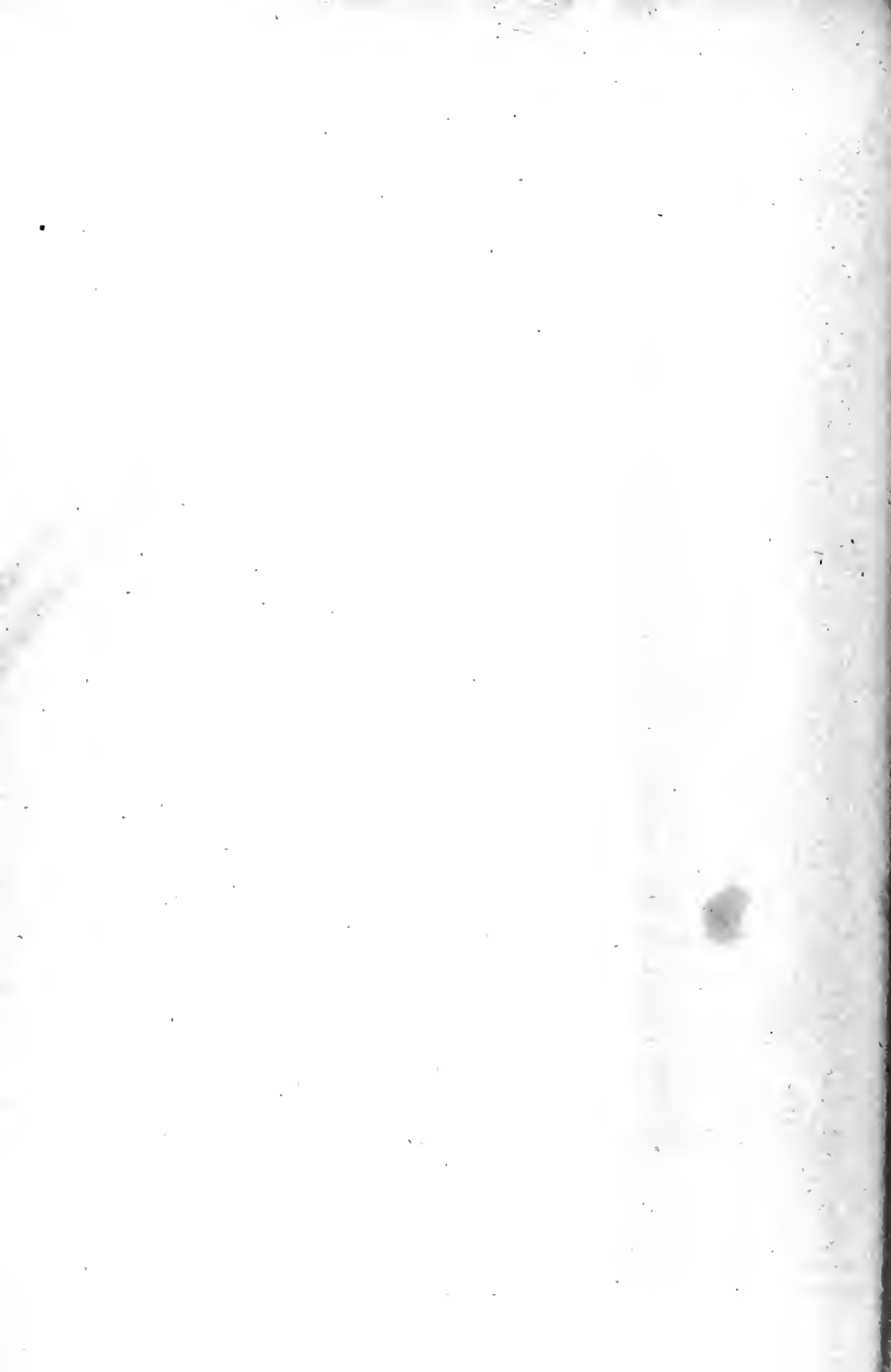
THE GRIZZLY BEAR (*Ursus horribilis*).

The gigantic grizzly bear of Western North America, whose range extends from Alaska through the Rocky Mountains to Mexico, is generally regarded as a species distinct from the brown bear, although there can be no question but that the two are very closely related. There are, however, some slight differences in the characters of the skull and cheek-teeth in the two forms, while the grizzly bear is generally larger in size, greyer in colour, and has shorter and less valuable fur than its European cousin. Some of the brown bears from Northern Asia are probably nearly or quite as large as an average-sized grizzly; while the difference in this respect between brown bears from different districts indicates that mere size cannot be a matter of much importance. All the American hunters recognise several varieties of greyish bears, respectively known as the "silver-tip," "roach-back," and the "barren-ground" bear, in addition to the typical grizzly; and Dr. Hart Merriam is disposed to regard the last as a distinct species, under the name of *U. richardsoni*. We prefer, however, to adopt the view that there are but two distinct species of North American bears. Occasionally, as in the case of the black bear, there may be cinnamon-coloured varieties of the grizzly; and it was at one time considered that such yellow-haired bears constituted a distinct species—the so-called cinnamon bear (*U. cinnamomus*), but it is now known that such coloration is merely a phase common to each species. Dr. W. S. Rainsford states, indeed, that he has seen a female grizzly with three cubs, of which one was almost yellow, a second nearly black, and the third grey. The so-called barren-ground bear of Arctic America is stated to come very close to the European brown bear, and may indeed prove to be the connecting link between it and the typical grizzly. Whether, then, the grizzly bear be rightly regarded as a distinct species, or whether it be merely a well-marked race of the brown bear, we take it to include all the grey and brownish bears of North America. In addition to this wide range in colour, there are considerable differences in form. Thus some have a well-marked hump at the back of the head, extending to the shoulders, which is totally wanting in others; while the width of the sole of the hind-foot is subject to great individual variation.

Dimensions. The accounts of the size and weight of the grizzly are very discrepant, and have probably been much exaggerated; most of the measurements having been taken from pegged-out skins, while the weights are mere estimates. It is said that the finest grizzlies hail from Alaska, but it is probable that those formerly inhabiting the Pacific flanks of the high Sierra Nevada were really the largest. These, however, have been nearly or completely exterminated by the shepherds, who poisoned them on account of the ravages they committed on their flocks. These Sierra grizzlies are reported to have been of the enormous weight of 1800 lbs.; and there seems no doubt that instances of 1400 and 1200 have been reached. Dr. Rainsford states, however, that he estimates the weight of the largest grizzly with which he was acquainted at 1000 lbs., and gives 900 lbs. as that of an unusually large male. The skin of this animal measured 9 feet 3 inches from the nose to the hind-foot, when pegged out without undue stretching; another skin measured in the same manner reached



THE GRIZZLY BEAR.



10 feet, while a third was still larger. Unfortunately the length from the nose to the root of the tail is not given, but it is probable that in large specimens this must be close on 9 feet.

Distribution. We have already seen that the grizzly is found from Alaska to Mexico; and it may be added that from east to west it reaches from the Coast Range across the Sierra Nevada to the Big-Horn Range in Wyoming, and some distance on to the plains at its foot. Its distribution is, however, becoming gradually more and more restricted. In 1868 bears were to be found on the plains for several hundred miles eastward of the Big-Horn, but they are now rare even in that range itself. Similarly, they have greatly diminished in numbers in Southern California and the parallel valleys of the Coast hills further to the northward.

Habits. That the grizzly bear will eat flesh whenever it has the chance is admitted by all, but there is some discrepancey of opinion as to whether it ever kills large mammals for the sake of their flesh. Thus while Sir Samuel Baker denies that they ever do so, Dr. Rainsford relates a case where his hunter saw a grizzly attack one of three bisons. Wherever wapiti are abundant there will grizzly bears be found. Failing meat, they, according to Dr. Rainsford, thrive on nuts, acorns, etc.; "and," he says, "the fattest grizzlies I ever killed were those that had been feeding for weeks on the pine-nuts that the mountain squirrels stow away in such great plenty in the little colonies on the upper hillsides. Where the nut-pine is plentiful, you may also expect to find bears." The grizzly is a bad climber, and seldom resorts to trees at all. Its strength is, however, prodigious. One has been seen to break the neck of a tall bison with a single blow of its paw; another has bodily carried off, over very rough ground, a male wapiti, weighing nearly 1000 lbs.

Sir Samuel Baker states that a frequent practice in bear-shooting is to kill several deer, and leave them untouched on the ground as baits. "At daybreak on the following morning the hunter visits his baits, and he will probably find that the bears have been extremely busy during the night in scratching a hole somewhat like a shallow grave or trench, in which they have rolled the carcase; they have then covered it with earth and grass, and in many cases the bears may be discovered either in the act of working, or, having completed their labour, they may be found lying down asleep, half gorged with flesh."

In the northern part of its range the grizzly bear hibernates, but it is probable that in the south it remains active throughout the winter. When it first comes out in the spring, it has a habit of standing upright against a pine or other tree and scoring its bark with its claws. Very incorrect conclusions have been drawn from these marks as to the size of the bears by which they were made, it having been forgotten that the animals were generally standing on from three to five feet of snow when they thus scored the trees.

The grizzly has been accredited with extreme ferocity towards man; but, granting that its great strength and extreme tenacity of life make it a most formidable foe when brought to close quarters, Dr. Rainsford is inclined to think that there has been considerable exaggeration on this point, and many of the stories of these animals charging is due to their rolling downhill upon the hunter who

has incautiously fired at them from below instead of from above. The same writer also considers that at the present day Winchester repeaters and other rifles have established in the grizzly a wholesome dread of man, and that it is now altogether a more cautious and timid animal than formerly.

THE AMERICAN BLACK BEAR (*Ursus americanus*).

The American black bear is a well-marked species, differing from the brown bear much more decidedly than does the grizzly. It is a smaller animal than the brown bear, from which it differs by the proportionately smaller head, the sharper



AMERICAN BLACK BEAR ($\frac{1}{2}$ nat. size).

muzzle, and more regularly convex profile of the face, as well as by the much shorter hind-foot. In length this bear seldom exceeds 5 feet. The fur is less shaggy, and altogether smoother and more glossy than that of either the brown or grizzly bear; being typically of a uniformly black colour, except on the muzzle, where it becomes tawny yellow. Occasionally, however, specimens are found with white margins to the lips and white streaks on the chest. The smaller size of the hind-feet of this species renders its trail distinguishable at a glance from that of the grizzly bear. As already mentioned, the so-called cinnamon bear may be a pale-coloured variety, either of the black bear or of the grizzly.

The black bear formerly had a wider distribution than the grizzly, extending from Labrador and Canada to the Gulf of Mexico, and from the east to the west coasts of the continent. Colonel D. G. Alexander states that it frequented "all

the mountains, the thickets of the vast plains, and every creek, river, and bay or bottom. At the present day its habitat is, however, confined to some portions of the various ranges of mountains south of the St. Lawrence River, the Great Lakes, and, east of the Mississippi River, to parts of those portions of the Mississippi River and its tributaries which are yet unsettled, and where it has been able to escape destruction from hunters. Some few are yet found in the dense thickets of the Colorado, Trinity, and Brazor rivers." As with other bears, the male of this species is much larger than the female; when full grown the former, according to Colonel Alexander, will stand about 3 feet in height, and will often turn the scale at from 600 to 700 lbs.

According to Dr. Merriam, the food of the American black bear "consists not only of mice and other small mammals, turtles, frogs, and fish, but also, and largely, of ants and their eggs, bees and their honey, cherries, blackberries, raspberries, blueberries, and various other fruits, vegetables, and roots. He sometimes makes devastating raids upon the barn-yard, slaying and devouring sheep, calves, pigs, and poultry." Another writer, Mr. C. C. Ward, states, as the result of his own experience, that the black bear "is growing more carnivorous and discontented with a diet of herbs. Assuredly, he is growing bolder. He is also developing a propensity to destroy more than he can eat, and it is not improbable that his posterity may cease to be frugi-carnivorous. It is fortunate that an animal of the strength and ferocity which he displays when aroused seldom attacks man. The formation of his powerful jaws and terrible canine teeth are well adapted to seize and hold his prey, and his molars are strong enough to crush the bones of an ox. His great strength, however, lies in his fore-arms and paws. His mode of attacking his prey is not to seize it with his teeth, but to strike terrific blows with his fore-paws. His weakness is for pork, and to obtain it he will run any risk. When the farmers, after suffering severe losses at his hands, become unusually alert, he retires to the depths of the forest and solaces himself with a young moose, caribou, or deer. He seldom or never attacks a full-grown moose, but traces of desperate encounters, in which the cow-moose has battled for her offspring, are frequently met with in the woods." Dr. Merriam states that the black bears visit the Adirondacks from the wooded districts about twenty miles to the westward in Lewis County during the autumn, crossing a fertile and well-cultivated valley. They are good climbers, but, from their weight, are unable to ascend to the tree-tops or climb far out on the branches, although they will ascend straight stems for a considerable height after honey. They are also excellent swimmers, many being killed while swimming in the lakes. We likewise learn that, as a rule, the black bear hibernates, although its torpor is not deep, and the time of entering upon the winter repose depends upon the severity of the season, and the amount of food-supply. And it appears that the males will remain active in any weather, so long as they can find abundance of food. The female is, however, compelled to seek shelter sooner on account of her prospective family. The winter den of a black bear is generally a partial excavation under the upturned roots of a fallen tree, or beneath a pile of logs, with perhaps a few bushes and leaves scraped together by way of a bed, while to the first snowstorm is left the task of completing the roof and filling the remaining chinks. Not unfrequently

the den is a great hole or cave dug into the side of a knoll, and generally under some standing tree, whose roots serve as side-posts to the entrance. The amount of labour bestowed upon it depends upon the length of time the bear expects to hibernate. If the prospects point towards a severe winter, and there is a scarcity of food, they "den" early, and take pains to make a comfortable nest; but when they stay out late, and then "den" in a hurry, they do not take the trouble to fix up their nests at all. At such times they simply crawl into any convenient shelter without gathering so much as a branch of moss to soften their bed. Snow completes the covering, and as their breath condenses and freezes into it an icy wall begins to form, and increases in thickness and extent day by day till they are soon unable to escape, even if they would, and are obliged to remain in this icy cell till liberated by the sun in April or May.

The young are born about January or February, and are usually two or three in number, although four have been found in a litter. It is believed that the female does not give birth to young oftener than every alternate year.

The black bear was pursued by the early colonists of North America by "still-hunting," or what would be called in England stalking; and it appears that this requires much more care than in the case with other bears, since the American black bear is very acute of hearing. A favourite expedient was to watch a herd of pigs in the cultivated districts, upon which the bears would make a raid, and could then be shot with ease. Mr. C. C. Ward writes that "sometimes the black bear is hunted with dogs trained for the purpose. The dogs are not taught to seize the bear, but to nip his heels, yelp around him, and retard his progress, until the hunters come up and despatch him with their rifles. Common yelping curs possessed of the requisite pluck are best adapted for the purpose. Large dogs with sufficient courage to seize a bear would have but a small chance with him, for he could disable them with one blow of his powerful paw. Another way of hunting is to track Bruin to his winter den, and either smoke or dig him out, when he may be despatched by a blow on the head with the pole of an axe as he struggles out. Various kinds of traps, set-guns, and dead-falls are also employed against him."

THE HIMALAYAN BLACK BEAR (*Ursus torquatus*).

With the black bear of the Himalaya we come to a very different animal, readily recognised by the white chevron or inverted crescent on the chest, from which it takes its scientific title, and which stands out in marked contrast to the jetty black of the remainder of the fur. This species does not attain by any means such large dimensions as the brown or grizzly bear; the length from the tip of the snout to the root of the tail usually averaging in Nipalese examples from about $4\frac{3}{4}$ to $5\frac{1}{2}$ feet, although one specimen has been recorded measuring 6 feet 5 inches. We think, however, that bears of this species from Kashmir would average somewhat larger.

The fur is very different to that of either of the three preceding species, being short and smooth, without any under fur, and becoming very thin in summer. In winter the hair on the shoulders becomes considerably elongated, so as to produce the appearance of a kind of hump. The ears are relatively large, and covered with rather long hair. In addition to the white mark on the chest, the chin is also

white; while the upper lip may be whitish, and the nose reddish-brown. The claws are comparatively short, and black in colour.

Mr. Blanford gives the weight of full-grown males as varying from 200 to 250 lbs.; but these weights are probably exceeded in autumn, when the Himalayan



THE HIMALAYAN BLACK BEAR ($\frac{1}{3}$ nat. size).

black bear becomes enormously fat, the thickness of the fat on the haunches reaching several inches. At such seasons the skin—never very valuable—becomes utterly useless, from being saturated with oil. The skull of this bear has a relatively shorter muzzle and a longer portion behind the eye than that of the brown bear; from which it may also be distinguished by the slight development of the bony ridge along the middle of the brain-case.

The Himalayan black bear is an exclusively forest-dwelling animal, except in Baluchistan, where it inhabits open country. Its range extends from about the eastern portion of Persia through Baluchistan into Afghanistan and Sind; and thence through the forest-clad portions of the Himalaya to Assam, and so on into Burma. The species is also found in the south of China and the islands of Hainan and Formosa, but in Ladak and Tibet it is quite unknown.

Habits. The black bear may be found in the Himalaya, from near the foot to elevations of some ten thousand to twelve thousand feet in summer. It is, perhaps, most abundant in the dense chestnut and oak woods surrounding the valley of Kashmir, whence it issues forth at night to make extensive depredations on the crops and orchards of the natives. Although, according to General Kinloch, the black bear will at times take to killing sheep, cattle, and ponies, it is, as a rule, a vegetable feeder. In the forest the chief food of these bears consists of chestnuts, acorns, roots, berries, ants, and honey. Whenever they raid the cultivated grounds, they consume maize, rice, buckwheat, and a number of fruits, such as mulberries, apples, pears, apricots, and walnuts—the latter being especial favourites. The gourds and melons which are cultivated in many of the gardens in Kashmir are also sometimes eaten by these bears. So numerous are they that it is by no means unfrequent to see two, three, or even more, up a single fruit tree in some of the less frequented districts of Kashmir. They are, indeed, excellent climbers; and their short claws are much better adapted for this purpose than for digging. When in the forests they may be stalked during the day with comparative ease, and will generally be found feeding on roots or wild fruits. This sport, as the writer can state from personal experience, is by no means very exciting, as they are easy of approach. Another method of hunting is by beating small patches of jungle on the hills—from below upwards—when the bears will be driven out. They very frequently go in family parties, comprising the two parents, the two youngest cubs, and one or perhaps two cubs of the preceding litter. When driven from the forest, the whole party emerges in single file, headed by the male, who is followed by the female, after which come the cubs according to seniority. They always break cover with the usual deliberate and sober pace characteristic of all bears, and when the party comprises five or six individuals the sight is ludicrous in the extreme.

The black bear, which is known in Kashmir as the *Siyah Haput* (in contradistinction to the *Kunea Haput*, or brown bear), does not thoroughly hibernate, but, according to General Kinloch, "appears to pass a great deal of his time during the cold months in a state of semi-torpor; occasionally wandering out in search of food, when an unusually mild day thaws his blood and awakens him to the sense of hunger."

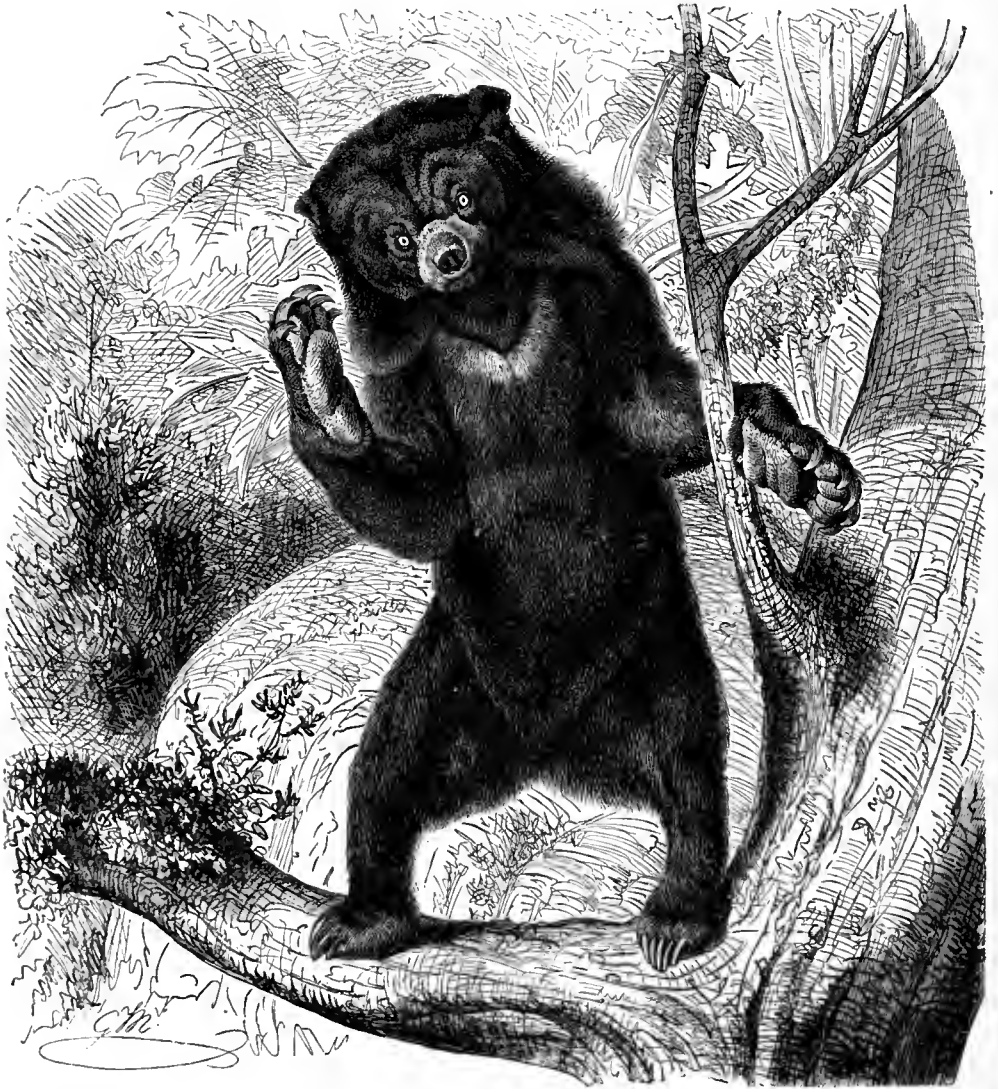
Like its similarly-coloured relative in North America, the black Himalayan bear is sharper in hearing than the brown bear, and it may be that the black coloration has some connection with the greater development of this sense. In disposition the black bear is decidedly more savage and prone to attack man than the brown bear; and in the fruit-season a large number of natives are annually badly mauled in Kashmir by its talons. It must be confessed, however, that these wounds are largely due to the foolhardiness of the natives themselves, who will

not hesitate to drive off the bears from their crops and orchards when armed solely with a stick. In addition to its skill as a climber this bear is a good swimmer. The young, which are nearly always two in number, are born in the spring.

Allied Forms. The small variety from Baluchistan, locally known as the Mam, and originally described as a distinct species, under the name of *U. gedrosianus*, is chiefly interesting as inhabiting a country of such a totally different nature from the typical habitat of the present species. The Japanese black bear (*U. japonicus*) is so nearly allied to the Himalayan species that it is regarded by some writers merely as a local variety, mainly characterised by the white mark on the throat being less distinct. It appears to be very common in Northern Japan, where it is of great importance to the Ainos, who use its skin for clothing, its flesh for food, and the stones in its gall-bladder for medicine. Aino houses are commonly decorated with the skulls of these bears; and, according to Miss Bird, "the Ainos may be distinguished as bear-worshippers, and their great religious festival, or saturnalia, as the Festival of the Bear. . . In all Aino houses, specially near the chief's house, there are several tall poles with the fleshless skull of a bear on the top of each; and in most there is also a large cage, made gridiron fashion of stout timbers, and raised two or three feet from the ground. At the present time such cages contain young but well-grown bears, captured when quite small in the early spring. After the capture the bear cub is introduced into a dwelling-house, generally that of the chief or sub-chief, when it is suckled by a woman, and played with by the children, till it grows too big and rough for domestic life, and is placed in a strong cage, in which it is fed and cared for, as I understand, till the autumn of the following year, when, being strong and well-grown, the Festival of the Bear is celebrated. The customs of this festival vary considerably, and the manner of the bear's death differs among the mountain and coast Ainos; but everywhere there is a general gathering of the people, and it is the occasion of a great feast, accompanied by much *saké*, and a curious dance, in which men alone take part. Yells and shouts are used to excite the bear, and when he becomes much agitated a chief shoots him with an arrow, inflicting a slight wound which maddens him, on which the bars of the cage are raised, and he springs forth, very furious. At this stage the Ainos run upon it with various weapons, each one striving to inflict a wound, as it brings good luck to draw his blood. As soon as he falls down exhausted, his head is cut off, and the weapons with which he has been wounded are offered to it, and he is asked to avenge himself upon them. Afterwards the carcase, amidst a frenzied uproar, is distributed among the people, and amidst feasting and riot the head, placed upon a pole, is worshipped, *i.e.* it receives libations of *saké*, and the festival closes with general intoxication." In another part of the country the neck of the bear is broken by means of a pole placed across it, upon which a number of men bring their weight together. Somewhat similar customs used to take place in Norway when a brown bear was killed.

The Spectacled Bear. The spectacled bear of the Peruvian Andes (*Ursus ornatus*), which is the sole representative of the family inhabiting South America, is a small-sized black species, which derives its name from the tawny

rings or semicircles round the eyes, whereby a most grotesque appearance is communicated to the whole physiognomy. The jaws, cheeks, throat, and chest are white; and the whole length of the animal is only about $3\frac{1}{2}$ feet. It has been generally considered that this bear is nearly related to the next species; but, although specimens have been exhibited in the London Zoological Society's Gardens, little or no information exists as to its habits in the native state.



THE MALAYAN BEAR ($\frac{1}{2}$ nat. size).

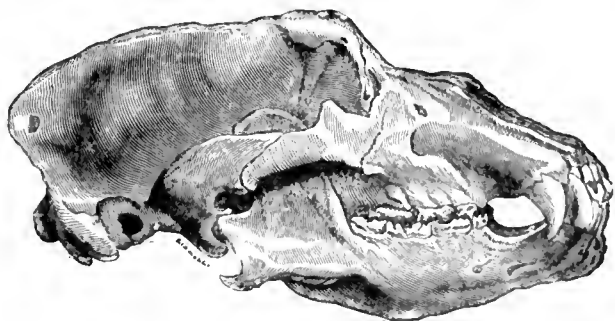
**The Malayan
Bear.**

The small black Malayan bear (*Ursus malayanus*) is a very well-marked species, distinguished by its small and rounded ears, covered with short hair, its much elongated and almost prehensile tongue, its very short and wide molar teeth, and the shortness and breadth of the skull, in which

the nose is but slightly produced. The claws are considerably curved, and pale in colour. The fur of this species is very short and coarse, and is mostly black, although tending to brown in some parts; the whole of the muzzle is paler, or whitish, and the light band on the chest varies from white to orange, and is subject to considerable diversity of form, sometimes extending as a streak on to the under-part of the body. The general length of the head and body is only about 4 feet, and, according to Mr. Blanford, never exceeds $4\frac{1}{2}$ feet. A female mentioned by the same writer, although fully adult, had a length of only $3\frac{1}{2}$ feet, and did not weigh more than 60 lbs. This species is found in the Malay Peninsula, and the islands of Sumatra, Java, and Borneo, and also extends through Burma into the Garo Hills in North-Eastern India. Of its habits, Mr. Blanford states that little is known except in captivity. It is a purely forest animal, and an admirable climber. It is essentially frugivorous, but like other bears occasionally kills and eats mammals and birds. It is said to be very fond of honey, and it probably devours insects and larvæ. When caught young, it is generally easily tamed, and is usually gentle and amusing when in captivity. Its general pace is much quicker than that of other bears, and a specimen kept some years ago in the Zoological Gardens at Calcutta, used to pace up and down its cage with great rapidity, turning very suddenly every time it came to the end of its track. A fragment of the jaw of an extinct bear, obtained from the gravels of the Narbada Valley, in India, appears to indicate a more or less closely allied species.

THE EXTINCT CAVE-BEAR (*Ursus spelæus*).

No account of the typical bears would be complete without some reference to the great extinct cave-bear, of which the remains are found in such profusion in the caverns of Europe, and less commonly in the brick-earths and other superficial deposits. This gigantic species, of which the skull is represented in the annexed figure, was a contemporary of the mammoth and early human inhabitants of Europe. The skull is readily distinguished from that of all other species by the great prominence immediately above the eyes; while the molar teeth are characterised by the extremely fine tuberculation of their crowns, in which, when unworn, the enamel has a kind of wavy pattern.



SIDE-VIEW OF SKULL OF CAVE-BEAR.

The cave-bear, although it had a wide range in Europe, is unknown both in the extreme north and the extreme south of that continent; it is found in the British Isles as far north as Yorkshire, but is not definitely known to occur in Ireland. The number of individuals inhabiting Brixham Cave, near Torquay, and

the celebrated cavern of Gailenreuth in Franconia, must have been prodigious, although it will be obvious that all of these did not exist at one time. From its size, which exceeded that of the largest grizzly, as well as from its numbers, it must have been a formidable foe to the early hunters of Europe, armed only with flint hatchets and spears. In the earlier Pliocene deposits of Europe there occur the remains of the Etruscan bear (*U. arvernensis*), which was considerably inferior in size to the brown bear. The extinct Theobald's bear (*U. theobaldi*) from the Siwalik Hills of Northern India, appears to have been a species closely connecting the typical bears with the one next on our list.

THE SLOTH-BEAR.

Genus *Melursus*.

The well-known Indian sloth-bear (*Melursus ursinus*), commonly known in its native country by the name of Bhalu, but by the Mahrattas termed the Aswal, differs so remarkably from all the other members of the family that it is generally regarded as forming a genus by itself. It differs from all the typical bears by having but two pairs of incisor or front-teeth in the upper jaw, so that the total number of teeth is forty instead of forty-two. Moreover, all the cheek-teeth are much smaller in proportion to the size of the skull than in other bears, while the palate of the skull is deeply concave, instead of being nearly flat. The claws are also unusually large and powerful, and the snout and lower lip are much elongated and very mobile. The sloth-bear is, at best, but an ugly-looking animal, and is generally of smaller size and less bulk than the Himalayan black bear. It is covered with very long and coarse fur, which attains its greatest length on the shoulders. With the exception of the end of the muzzle being dirty grey, and of the white chevron on the chest, the colour of the fur is black, but the long claws are white. As regards size, this species measures from about 4½ feet to 5 feet 8 inches in the length of the head and body, the tail generally measuring from 4 to 5 inches, exclusive of the hair; the height at the shoulder varying from 2 feet 2 inches to about 2 feet 9 inches. Large males may weigh as much as 280 lbs., while there is one instance recorded of a specimen weighing as much as 320 lbs.

The sloth-bear may be regarded as one of the most characteristic, and at the same time one of the commonest of the mammals of India. It is found in Ceylon, and in the peninsula of India from Cape Comorin nearly to the foot of the Himalaya. Mr. Blanford states that it ranges as far west as the province of Katiawar, and is also occasionally found in Cutch, while to the northwards its range is probably limited by the great Indian desert. It occurs in North-Eastern Bengal, but how far its range extends in this direction is not fully ascertained, there being some doubt whether the large black bear found in the plains of Assam is this species or the Himalayan black bear. Within the last thirty or forty years it has been completely exterminated from some parts of Bengal and the Deccan.

Habits. Perhaps the best account of the habits of this bear is one drawn up by Mr. Blanford, partly from the results of his own observations and partly from those of others. It is there stated that these bears "are generally



SLOTH-BEARS IN A FOREST GLADE.

found solitary or in pairs, or three together; in the latter case a female with two cubs, often nearly or quite full-grown. Occasionally four or five are met with in company. They inhabit bush and forest, jungle and hills, and are particularly fond of caves in the hot season and monsoon, and also when they have young. Throughout several parts of the peninsula of India there are numerous hills of a granitoid gneiss that weathers into huge loose rounded masses. These blocks remain piled on each other, and the great cavities beneath them are favourite resorts of bears, as in such places the heat of the sun, and some of the insects that are most troublesome in the monsoon can be avoided. In the cold season, and at other times when no caves are available, this animal passes the day in grass or bushes, or in holes in the banks of ravines. It roams in search of food at night, and near human habitations is hardly seen in the daytime; but, in wild tracts uninhabited by man, it may be found wandering about as late as eight or nine o'clock in the morning, and again an hour or even more before sunset in the afternoon. In wet or cloudy weather, as in the monsoon, it will sometimes keep on the move all day. But the sloth-bear, although, like most other Indian animals, it shuns the midday sun, appears by no means so sensitive to heat as might be expected from its black fur, and it appears far less reluctant to expose itself at noonday than is the tiger. I have seen a family of bears asleep at midday in May on a hillside in the sun. They had lain down in the shade of a small tree, but the shade had shifted without their being disturbed. It is scarcely necessary to observe that this bear does not hibernate. Owing to its long, shaggy, coarse fur, its peculiarly shaped head, its long mobile snout, and its short hind-legs, this is probably the most uncouth in appearance of all the bears, and its antics are as comical as its appearance. Its usual pace is a quick walk, but if alarmed or hurried it breaks into a clumsy gallop, so rough that when the animal is going away it looks almost as if propelled from behind and rolled over and over. It climbs over rocks well, and, like other bears, if alarmed or fired at on a steep hillside, not unfrequently rolls head-over-heels down hill. It climbs trees, but slowly and heavily; the unmistakable scratches left on the bark showing how often its feet have slipped back some inches before a firm hold was obtained."

As might have been predicted from the small size and half-rudimentary condition of its molar teeth, the food of the sloth-bear consists almost exclusively of fruits, flowers, and insects, together with honey. Its favourite fruits appear to be those of the ebony tree, the jujube-plum, several kinds of figs, and the long pods of the cassia. Whether grapes, as shown in our illustration, form also part of the diet of these bears, or whether this is merely a fancy on the part of the artist, we are unaware. During the months of February and March, in many parts of India, the beautiful fleshy scarlet flowers of the mowha tree are nightly shed in great profusion, and form a rich feast for many denizens of the jungle, prominent among which is the sloth-bear, by whom these flowers are greatly relished. In addition to beetles and their larvæ, as well as young bees and honey, the sloth-bear is also passionately fond of white ants or termites. On this point Colonel Tiekell, as abridged by Dr. Jerdon, observes that "the power of suction in this bear, as well as of propelling wind from its mouth, is very great. It is by this means it is enabled to procure its common food of white ants and larvæ with ease. On arriving at an ant-hill,

the bear scrapes away with the fore-feet until he reaches the large combs at the bottom of the galleries. He then with violent puffs dissipates the dust and crumbled particles of the nest, and sucks out the inhabitants of the comb, by such forcible inhalations as to be heard at two hundred yards' distance or more. Large larvæ are in this way sucked out from great depths under the soil. Where bears abound, their vicinity may be readily known by numbers of these uprooted ants' nests and excavations, in which the marks of their claws are plainly visible. They occasionally rob birds' nests and devour the eggs. . . . The sucking of the paw, accompanied by a drumming noise when at rest, and especially after meals, is common to all bears, and during the heat of the day they may often be heard humming and puffing far down in caverns and fissures of rocks."

Like the fox-bats and the palm-civets, the sloth-bear will often visit the vessels hung on the palm-trees for the sake of their juice, and is said frequently to become very drunk in consequence. Sugar-cane is likewise a favourite dainty of these bears, which frequently do a large amount of damage to such crops. Although they generally subsist entirely on vegetable substances and insects, it seems that they will occasionally eat flesh; Sanderson mentioning an instance where one of them devoured the carcase of a recently-killed muntjac deer, the proof that a bear was the devourer being afforded by the imprints of its feet in the wet soil. The same observer also mentions that he has known bears gnaw the dry bones of cattle that have died in the jungle.

With the exception of the puffing and humming noises already mentioned, the Indian sloth-bear is generally a silent animal. Mr. Blanford states, however, that "occasionally they make the most startling noise, whether connected with pairing or not I cannot say. I have only heard it in the beginning of the cold season, which is not their usual pairing-time. They occasionally fight under fruit-trees, but I think the noise then made is rather different."

Like most other members of the family, the sloth-bear has the sense of hearing but poorly developed, and its eyesight is also far from good; and hence it has a peculiarly comical way of peering about when it suspects intruders, as though it were short-sighted. From these deficiencies of sense it can be approached very closely from the leeward side. Its sense of smell, is, however, wonderfully acute, and by its aid it is enabled to detect concealed supplies of honey, and also to scent out ants' nests when situated far below the ground.

The number of cubs produced at a birth is, as in most bears, usually two, but it appears that there may sometimes be three. The young cubs are generally carried on the back of the female when the animals are on the move; and the author last mentioned observes that it is an amusing sight to watch the cubs dismount at the feeding-grounds, and scramble back to their seat at the first alarm. We are informed by Mr. Sanderson that the cubs are carried about in this manner till they are several months old and have attained the dimensions of a sheep-dog, and that when there is room for only one cub on the maternal back the other has perforce to walk by the side.

In regard to their family life, Mr. Sanderson observes that these "bears are exceedingly affectionate animals amongst themselves, and are capable of being most thoroughly tamed when taken young. Either wild or tame they are very amusing

in their ways, being exceedingly demonstrative and ridiculous. Though hard to kill, they are very soft as to their feelings, and make the most hideous outcries when shot at—not only the wounded animal, but also its companions. It has frequently been stated by sportsmen that if a bear be wounded he immediately attacks his companions, thinking that they have caused his injuries. But I think this is not quite correct, at least in the majority of cases. I have observed that a wounded bear's companions generally rush to him to ascertain the cause of his grief, joining the while in his cries, when he, not being in the best of humours, lays hold of them, and a fight ensues, really brought about by the affectionate but ill-timed solicitude of his friends."

In commenting upon the latter portion of this passage, Mr. Blanford supports the old view that the attack is made directly by the wounded animal; and one instance is mentioned where he saw a female when wounded immediately commence an unprovoked attack upon her two half-grown cubs, which were severely cuffed. In another case, when two full-grown bears were both hit, they stood up and fought on their hind-legs, till one fell dead from the effects of the bullet.

Although generally timid in their nature, sloth-bears will on rare occasions attack human beings without provocation, and when they do so, fighting both with teeth and talons, and inflicting terrible wounds, more especially on the head and face. These attacks generally occur when a bear is accidentally stumbled upon by a native wandering in the jungle, and are then due more to timidity than to ferocity. Mr. Sanderson is of opinion that a bear, being a slow-witted animal, is more likely to attack in such a case than is a tiger or a leopard, which more rapidly collect their senses, and are thus less embarrassed by the sudden and unexpected encounter. Mr. Blanford states that when thus surprised a sloth-bear will sometimes merely knock a man over with its paws, although thereby inflicting severe wounds; but on other occasions it seizes and holds in its paws its unfortunate victim, who is not released until bitten and clawed to death. Females with young, and occasionally solitary bears, will at times make unprovoked attacks of great ferocity. The idea that sloth-bears hug their victims is scouted by both writers.

Sloth-bears are usually hunted in India either by driving them from cover with a line of beaters, or by the sportsman going to their caves or lairs among the rocks at daybreak, and shooting them as they return home from their nightly wanderings. Mr. Sanderson says that in the forests of Mysore he was in the habit of shooting bears by following them with trackers; and that, as they seldom left off feeding before nine in the morning, it was generally possible by starting at daybreak to come up with them before they had retired to rest for the day. If, however, the party did not succeed in this, the bears would generally be found lying asleep under the shade of a clump of bamboos, or a rock, as there were no caves in the district into which they could disappear. Elephants, it appears, have a great dislike to bears, and on this account, as well as from the rocky nature of the country generally inhabited by these animals, are but rarely employed in bear-shooting. Mr. Sanderson was also in the habit of hunting bears with large dogs, and despatching them when brought to bay with his hunting-knife; and in this exciting sport was very successful.

Regarding the sport afforded by the sloth-bear, the same hunter observes that

“bear-shooting is one of the most entertaining of sports. Some sportsmen have spoken disparagingly of it, and I daresay sitting up half the night watching for a bear’s return to his cave, and killing him without adventure, may be poor fun. . . . But bear-shooting conducted on proper principles, with two or three bears afoot together, lacks neither excitement nor amusement. It is not very dangerous sport, as the animal can be so easily seen, whilst he is not so active as a tiger or a panther. Still he is very tough, and to anyone who would value him for his demonstrations, he would appear sufficiently formidable. If a bear charges he can generally be killed without more ado by a shot in the head when within two paces. The belief that a bear rises on his hind-legs when near his adversary, and thus offers a shot at the horseshoe mark on his chest, is groundless. I have shot several bears within a few feet, and they were still coming on on all-fours. No doubt when a bear reaches his man he rises to claw and bite him, but not before.”

Jerdon states that in the extreme south of India, among certain hill-tribes known as Polygars, sloth-bears used to be hunted with large dogs, and when brought to bay were attacked by the hunters with long poles smeared at the end with bird-lime. The bird-lime caused the shaggy coat of the bears to become fixed to the end of the pole, so that the animals soon became firmly held. A single fragment of a bone of the fore-limb discovered in a cave in Madras proves that the sloth-bear has been an inhabitant of India since a period when several kinds of extinct mammals flourished there. And the extinct Theobald’s bear from the Siwalik Hills, mentioned on p. 26, serves to indicate that the sloth-bear is a specially-modified form derived from bears belonging to the typical genus, since the skull of that extinct species presents characters intermediate between those of ordinary bears and that of the sloth-bear.

THE PARTI-COLOURED BEAR.

Genus *Eluropus*.

A large number of the mammals from the highlands of Tibet belong to types quite unlike those found in any other part of the world; and in no case is this dissimilarity more marked than in the animal which may be termed the parti-coloured bear (*Eluropus melanoleucus*).

This strange animal, which has been known to European science only since the year 1869, is of the approximate dimensions of a small brown bear, and has a general bear-like aspect, although differing from all the other members of the family in its parti-coloured coat. The fur is long and close, with a thick, woolly under-fur. The general colour is white, but the eyes are surrounded with black rings, the small ears are also black, while the shoulders are marked by a transverse stripe of the same colour gradually increasing in width as it approaches the fore-limbs, which are also entirely black, as are likewise the hind-limbs. This peculiar coloration communicates a most extraordinary appearance to the creature; and without knowing more of its natural surroundings it is difficult to imagine the object of such a staring contrast. The tail is extremely short; and the soles of the feet are hairy.

In addition to these external characteristics, the parti-coloured bear also presents some peculiar features in regard to the skull and teeth. Thus the skull is remarkable for the great width of the zygomatic arches and the enormous development of the longitudinal ridge on the upper-surface of the brain-case, both these features indicating greater power of jaw than has at present been found in any other member of the entire carnivorous order. Then, again, the teeth differ both in number and form from those of all the other Ursidae. Instead of the forty-two teeth, characteristic of the typical bears, the parti-coloured bear has but forty teeth, all told; the diminution in number being due to the absence of the first pair of premolar



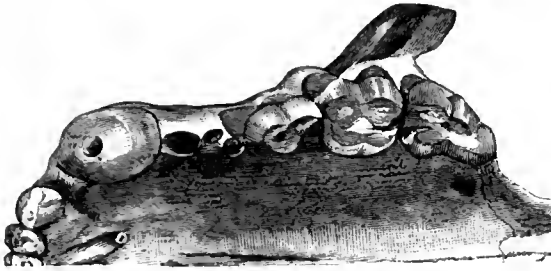
THE PARTI-COLOURED BEAR.

teeth in the lower jaw. As regards form, the molar teeth are distinguished from those of other bears by their shorter and wider crowns; this being most marked in the first molar of the upper jaw, which is broader than it is long. The second upper molar tooth agrees, however, with the corresponding tooth of other bears in being longer than the one in front of it. The pattern formed by the tubercles on the crowns of these teeth is exceedingly complex, and approaches to that obtaining in the panda, among the raccoon family, to be noticed in the next chapter.

The parti-coloured bear is reported to inhabit the most inaccessible districts of Eastern Tibet, and to be of extremely rare occurrence. Unfortunately we are at present quite ignorant of its habits, although it is said to feed chiefly on roots and the young shoots of bamboos, and to be entirely herbivorous.

EXTINCT BEAR-LIKE GENERA.

At the close of the preceding volume it has been mentioned, that, unlike as modern dogs and bears are to each other, yet both families are merely divergent branches from a common stock. In that passage we referred only to those extinct animals most nearly related to the modern dogs, and it was then shown that the so-called amphicyon of the Miocene and upper part of the Eocene period appeared to be a dog with one more pair of upper molar teeth than the true dogs, and approaching the bears in its plantigrade feet. We have now to allude to the extinct genera more nearly allied to the modern bears. The first of these is a bear-like animal from the superficial deposits of South America, known as the arctothere. This animal, of which the left side of



THE LEFT HALF OF THE UPPER JAW OF THE ARCTOTHERE—
AN EXTINCT SOUTH AMERICAN BEAR-LIKE ANIMAL
(much reduced).

the palate is shown on a greatly-reduced scale in the accompanying figure, had the same number of teeth as the true bears. The upper molar teeth (the two on the right side of the figure) are, however, relatively shorter and wider than in the latter, and the second is not greatly larger than the first. Then, again, the upper flesh-tooth (the third from the right in the figure) is much larger than in modern

bears, and is thus more like the corresponding teeth of other Carnivores. Further, the upper arm-bone, or humerus, has a perforation at its lower end, which is not found in any living dog or bear, although occurring in the extinct amphicyon.

Another type is the so-called hyænaretus, of which large species occur in the Siwalik Hills of India and the Pliocene deposits of Europe, while smaller ones are



THE LEFT UPPER MOLAR
TEETH OF A SMALL
SPECIES OF HYÆN-
ARCTUS.—After Koken.

found in the European Miocene strata; the two upper molar teeth of one of the latter being shown in the accompanying woodcut. In these animals the upper molars (as in our

illustration) were sometimes oblong, with the second not longer than the first; while, in other cases, they were more

or less completely triangular, and thus but little different in form from the corresponding teeth of the dogs. The

most important difference from the bears occurs, however, in the form of the flesh-tooth in both jaws; these teeth being

very similar to those of the dogs, and of a thoroughly carnivorous type. Whereas, however, the upper flesh-tooth of the dogs has but two lobes to its cutting blade, that of the hyænaretus had three such lobes. That the hyænaretus was a thoroughly carnivorous animal, there can be no reasonable doubt. Another Miocene Carnivore, known as the hemicyon, has still more dog-like teeth; and the transition from this animal to the plantigrade and dog-like amphicyon is, therefore, scarcely more than a step, so that the passage from the dog-like bears to the bear-like dogs is practically complete.

CHAPTER XVII.

CARNIVORES,—*continued.*

THE RACCOON FAMILY.

Family *PROCYONIDÆ.*

THE raccoons and their allies constitute a very small family of Carnivores, which, with the exception of one outlying and somewhat aberrant genus, are confined to America, and are very characteristic of the central and southern portions of that continent. Their nearest allies are the bears, with which they appear to be connected by the panda, of which the teeth present some resemblance to those of the parti-coloured bear. The skull has the same essential characteristics as in the bears, and the accompanying illustration of the right half of the skull in one of the raccoons is intended to show the position of the tympanic bulla, and its general form and relations in the present family and in the two allied families of the bears and the weasels.

The raccoons agree with the bears in their plantigrade feet (as is well exhibited in our figure of the panda), but differ in that they have only two, in place of three, molar teeth in the lower jaw. The upper molar teeth are, moreover (as shown in the accompanying figure), usually of the same general type as those of the dogs, having squared or triangular crowns, and being generally elongated in the transverse rather than in the antero-posterior direction; while the second of these teeth is smaller, instead of larger, than the first. Moreover, the flesh-tooth in each jaw approaches the ordinary carnivorous type, and is thus very different from the corresponding tooth of the modern bears; it has, however, three lobes to the blade, and a very large inner tubercular portion.

The members of the raccoon family are all animals of comparatively small size; and they differ markedly in general appearance from the bears in having well-developed tails, which may be of great length. Very generally the hair of the tail is marked by alternate dark and light rings. The whole of these animals are good climbers, and they are generally of more or less exclusively nocturnal habits.



THE RIGHT HALF OF THE PALATAL ASPECT OF THE SKULL OF THE RACCOON.

The letters *am.* indicate the entrance to the tympanic bulla, which is the swelling between that and the point indicated by *car.* The other letters indicate the various foramina, etc. (From *Proc. Zool. Soc.*—After Sir W. H. Flower.)

It is noteworthy that, with the exception of the one Old World genus, no remains of this family have ever been discovered beyond the limits of the New World.

THE PANDA.

Genus *Ælurus*.

The curious animal represented in the accompanying illustration, and known as the panda (*Ælurus fulgens*), is one in regard to whose serial position there has been much diversity of opinion. It was at one time placed in the bear family, next to the parti-coloured bear; while it has also been regarded as the representative of a distinct family by itself. Mr. Blanford has, however, come to the conclusion that its true position is in the raccoon family, and it is probable that this view will be pretty generally adopted in the future.

The panda, or, as it is often called, the red cat-bear, is restricted to the South-Eastern Himalaya, and may be compared in size to a large cat. Externally it is characterised by its broad and rounded head, in which the muzzle is extremely short, the small eyes are directed forwards, and the ears are of considerable size. The stout limbs are furnished with large, curved, and sharp claws, which can be partially retracted; and the soles of the large feet are covered with hair. The tail is long and rather thick, its length being nearly equal to that of the body, or rather more than two-thirds of that of the head and body together. The fur is long and thick, with a woolly under-fur.

In colour, a large portion of the fur of the panda is a bright, rusty red, of somewhat variable shade; this colour prevailing on the back, the upper part of the head, and the darker rings on the tail. The forehead is of a lighter tint of red, as are also the paler rings on the tail, its tip being black. The under-parts and the inner-surfaces of the limbs are black, tending to a brownish tint on the abdomen. The face, like the lower lips, is white, except for a vertical stripe of red proceeding from each eye to the angle of the mouth. Occasionally, however, as in the specimen here figured, there is also a red stripe running down the middle of the nose. The inner surface of the ears are also white, as are also the claws. A large male panda measured 24 inches from the tip of the snout to the root of the tail; while the length of the tail was 17 inches without the hair at the end, and 19½ inclusive of the hair. Other specimens measured respectively 20 and 22 inches to the root of the tail.

It is, however, not only externally that the panda is a remarkable creature. In its skull and teeth it is very unlike other Carnivores. Thus the skull is remarkably short, with the profile from the front teeth to the occiput forming a regular curve, which approximates to a semicircle. The lower jaw is also remarkable for its extremely convex and regularly-curved inferior border, and also for the great length of the portion which ascends on the sides of the skull. The total number of teeth in the panda is 38, of which, on each side of the jaws, $\frac{3}{2}$ are incisors, $\frac{1}{2}$ incisors, $\frac{3}{2}$ premolars, and $\frac{2}{2}$ molars. The canines, or tusks, are of no great size, but are remarkably flattened from side to side. The upper molars have very wide crowns, which are nearly square in outline, and carry

four main tubercles and an inner ridge; while the flesh-tooth in each jaw differs from that of all other members of the family in presenting but little approximation to the ordinary carnivorous type; being, indeed, more like that of the parti-coloured bear.

There appears to be some doubt as to the origin of the name panda, by which the animal is very generally known in this country, unless, indeed, it be a corruption of the Nipalese *niyalya-ponga*; the latter name, according to Mr. Blanford, meaning bamboo-eater. It is also known in Nipal as the *wah*. The panda is unknown in the Himalaya to the westward of Nipal; but it there lives at elevations of from seven thousand to twelve thousand feet. Its eastward range



THE PANDA. (From *Proc. Zool. Soc.*—After Selater.)

extends through the mountains to the north of Assam into the Chinese province of Yunnan.

An excellent account of the habits of the panda was published many years ago by Mr. Brian Hodgson, of which the following is a summary:—As we might have supposed from the structure of its teeth, the animal is mainly herbivorous. It is also an excellent climber, although feeding chiefly on the ground, and having its retreat and breeding-place in holes and clefts of the rocks. Its chief food is composed of various fruits, acorns, the young shoots of bamboos, roots, etc. It will, however, also eat eggs, but it is doubtful whether, as asserted, it will touch insects or their larvæ, while recent observers are in accord as to its habitual rejection of all kinds of flesh. Hodgson states that it will sometimes steal down to the villages and feast on milk and butter. These animals feed in the morning and evening, and

sleep much during the day, although they are by no means exclusively nocturnal in their habits. On the ground, their movements are somewhat awkward and ungainly; and they are generally sluggish and stupid in disposition, and allow themselves to be captured without much difficulty. They hiss and spit like cats when angered, and occasionally utter a low deep growl, somewhat like that of a young bear. According to Mr. Hodgson they drink by lapping with the tongue, but, from observations made on specimens in the Zoological Society's Gardens, this is denied by Mr. A. D. Bartlett, who states that they drink by putting their noses to the ground, after the fashion of a bear. They generally sleep curled up sideways, with the head concealed by the thick tail, but will also frequently repose by sitting down on their haunches with the head tucked in between the fore-paws, their habits being very similar to those of some of the raccoons.

In addition to the cries already mentioned, it appears from the account of an observer who watched a pair of these animals high up in the trees near Darjiling, that the panda will at certain times—probably the breeding-season—utter loud and somewhat unearthly cries, which may be heard at a considerable distance. They call one another by a kind of chirping cry. The panda is a quite harmless, and apparently an almost defenceless animal, its sharp and partially retractile claws being evidently adapted for the purpose of climbing, rather than as weapons of offence or defence.

The young, generally two in number, are born in a nest formed in some hollow tree or cavity among rocks. They are produced in the spring, and are helpless for a long period. It is stated that the cubs of one litter remain with the parent, till shortly before the birth of a second brood.

In captivity these animals are gentle and easily tamed, even when not captured until they have attained maturity. In this country they require great care and attention, from their extreme susceptibility to cold; but in the more congenial climate of Calcutta they thrive well in cages placed in the open air.

It is a remarkable circumstance that an extinct species of panda, about half as large again as the living form, once flourished in England. This is proved by the occurrence of teeth and fragments of jaws in the so-called Red Crag of the Suffolk coast, which belongs to the Pliocene period. It is, therefore, probable that the genus was once widely spread over the Old World; while its occurrence in England proves that the country must have been formerly thickly covered with forest, and have enjoyed a climate of a subtropical nature.

THE RACCOONS.

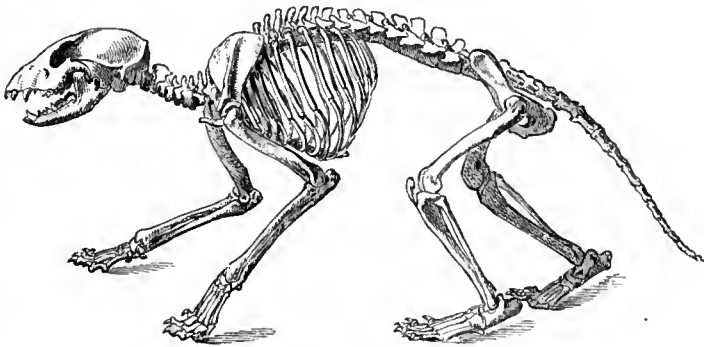
Genus *Procyon*.

The widely-known raccoons, of which there are two or three species, are the typical representatives of the family, and, like all the remaining forms, they are exclusively American. These animals have a total of forty teeth, or two more than in the panda, owing to the presence of the whole of the four typical pairs of premolars in the lower jaw. The cheek-teeth differ from those of the latter in

being more like the ordinary carnivorous type; while the skull has not the short and convex form of the panda's.

Externally, the raccoons are characterised by their thickly-built and stout bodies, their heads broad behind but tapering to a sharp point at the muzzle, and their medium-sized and distinctly-ringed tails. The ears are small and rounded. When walking, the entire sole of the foot is not applied to the ground, as it is when the animal is standing at rest; while the toes themselves, and more especially those of the fore-feet, can be spread out very widely. The compressed and curved nails differ from those of the panda in being entirely non-retractile. The fur is characterised by its length, softness, and thickness, and is greatly developed on the tail, but is very short on the feet, of which the soles are naked.

The best-known species is the common raccoon (*Procyon lotor*), of which a group is represented on the next page. The total length of this animal varies from about 32 to 36 inches, of which some 10 inches are occupied by the tail. The body is covered with thick and rather coarse fur, of a dark brown colour, with the



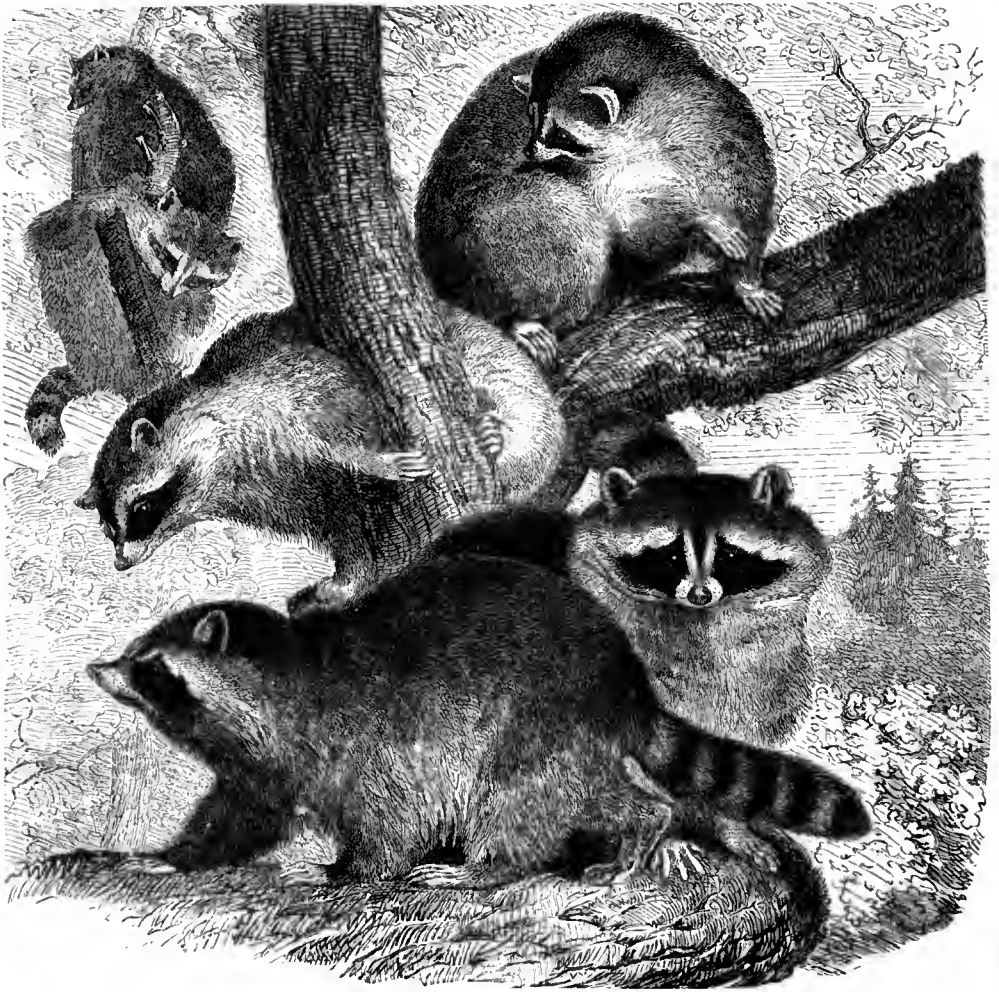
SKELETON OF RACCOON.

tips of the hairs greyish; but there is a distinct black patch on either side of the face, including the eyes, and the muzzle is naked. The tail has five black rings, separated by others of a whitish colour, and its tip is black. When in its best condition, which is usually in the autumn, a raccoon will weigh from 15 to 25 lbs. There is considerable local variation in the colour of this species; the coloration being most brilliant in the southern portion of its range, where its bodily size is also greater than in the north. The common raccoon is confined to Northern and Central America, extending from Alaska in the north to Costa Rica in the south, and occurring over the whole of the United States, where these animals used to be among the commonest.

Habits.

The best of the recent accounts of this raccoon is given by Dr. Hart Merriam, who tells us that raccoons are exceedingly common about the borders of the Adirondaeks, but avoid the dense evergreen forests of the interior. Although, with the exception of bats and flying squirrels, they are the most strictly nocturnal of all North American Mammals, yet they may occasionally be seen abroad on cloudy days. In diet they are thoroughly carnivorous—feeding upon mice, young birds, birds' eggs, fresh-water tortoises and

their eggs, frogs, fish, cray-fish, molluses, insects, nuts and fruits and corn; while they will sometimes kill and eat domestic poultry. They delight to sport in the shallow water on the margins of pools and streams, where they capture the cray-fish lurking beneath the stones, and the fresh-water mussels buried in the mud and sand. They also catch such fish as happen to get stranded or detained in the small pools near the shore, although they are unable to dive in pursuit of their



THE COMMON RACCOON ($\frac{1}{2}$ nat. size).

prey. They are, however, good swimmers. Although first-rate climbers, and making their nests in a hollow high up in some large tree, raccoons cannot be considered by any means thoroughly arboreal animals. Thus they neither hunt their prey among the tree-tops, nor gather nuts and fruits from the branches, nor do they feed upon the young shoots and twigs. Trees form, however, their resting and their breeding-places, and likewise their refuge when pursued by human or other foes. With the falling shades of night they invariably descend to hunt their prey and search for food.

Continuing our account in Dr. Merriam's own words, we find that in the Adirondack region "the raccoon hibernates during the severest part of the winter, retiring to his nest rather early, and appearing again in February or March, according to the earliness or lateness of the season. Disliking to wade through deep snow he does not come out much till the alternate thawing and freezing of the surface, suggestive of coming spring, makes a hard crust upon which he can run with ease. He does not usually walk many miles during a single night, and consequently is soon tracked to the tree, in some hole of which he has retired for the day. It is unusual to find a raccoon alone, for they commonly live and travel in small companies, consisting of the several members of a single family. They do not return to the same nest every morning, but often make little excursions in various directions, being gone several days at a time, and taking refuge, about daylight, in any convenient arboreal shelter. Though preferring a hollow limb high up in some giant elm, ash, or basswood, they will put up with almost any kind of a hollow trunk. I have known them to spend the day in old stubs, in hollow logs, and even in the poor shelter afforded by the angle where a falling tree had lodged in a crutch." Probably, in Central America and the more southern districts of North America, this raccoon remains active throughout the winter, as the climate would not necessitate any hibernation. In the Adirondacks the young are produced in the spring—generally during the month of April; and there are usually from four to six in a litter. They remain with their parent about a twelvemonth. The nest which, as already mentioned, is placed high up in a tree, has but little care bestowed upon its construction.

It has long been known that this raccoon is in the habit of moistening its food with water before eating it; and it doubtless received its distinctive specific name from this habit, which has been of late years verified by Mr. Bartlett's observations on specimens in the Zoological Society's Gardens. The raccoon is one of the most valuable of the fur-bearing animals of North America, and is consequently much persecuted. Raccoon skins were formerly used as a recognised circulating medium in the States of the Mississippi Valley, and were usually valued at 25 cents apiece.

According to Mr. D. Arrowsmith, the raccoon may be easily caught in steel traps; but it is essential that these should be set under water near the margins of swamps or streams. The more sporting method is, however, to hunt these animals at night with specially-trained dogs, which are usually a breed of fox-hounds. It has often been stated that the raccoon leaves a very faint foot-scent; but this opinion is controverted by Mr. Arrowsmith, who states that he has known a hound hunt a raccoon at midday over snow, on a trail which had been made the previous night. The raccoons, after a short run, invariably take to the tree, where they are shot by the hunter, unless they conceal themselves in a hole.

**Crab-Eating
Raccoon.**

The crab-eating raccoon (*P. cancrivorus*) is a nearly-allied South American species, distinguished by its superior dimensions and its much shorter fur, as well as by its proportionately larger teeth. It is found typically from Panama to Colombia and Guiana; but Professor Mivart is of opinion that the raccoons found further to the south, and extending through Brazil to Paraguay, are entitled to rank as a distinct species, on account of their darker

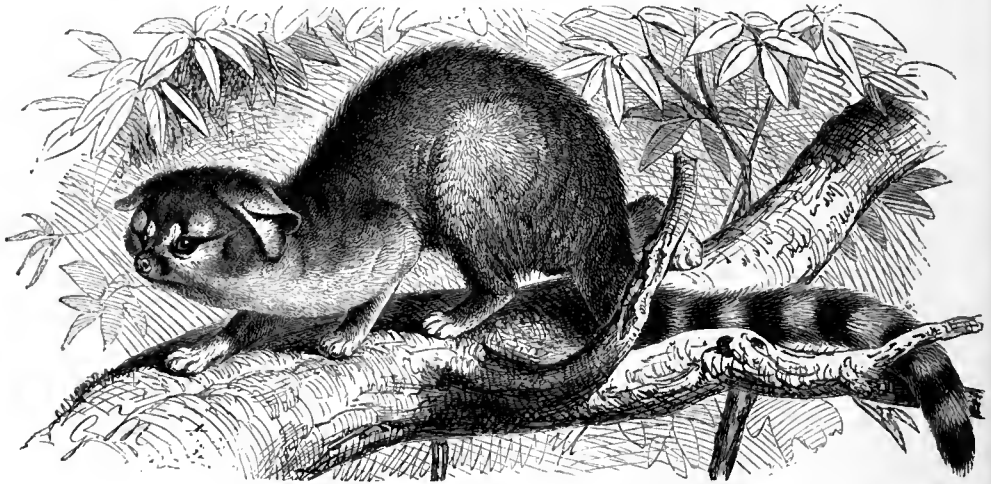
feet. The name of black-footed raccoon has, accordingly, been proposed for this southern form. These raccoons are very common in certain districts, and appear to agree closely in habits with their northern cousin.

THE CACOMISTLES.

Genus *Bassaris*.

The cacomistles, of which the skull is shown on p. 35, are animals nearly allied to the raccoons, but of more slender build, with a sharper muzzle, longer tail, less perfectly plantigrade feet, and teeth of a more typically carnivorous type.

The common cacomistle (*Bassaris astuta*), represented in the accompanying illustration, is an inhabitant of the United States and Mexico. It is covered with



THE CACOMISTLE (½ nat. size).

long and soft fur; and has also well-developed and pointed ears, of which the outer surfaces are nearly naked. The feet have naked pads, but are otherwise hairy; and their short claws are partially retractile. In size this animal may be compared to a cat, the length of the head and body being about $17\frac{1}{2}$ inches, and that of the tail (including the hair at the end) nearly the same. The general colour is brownish-yellow mixed with grey on the upper-parts, and whitish below; but the tips of the ears, and two pieces of spots above and below the eyes, are yellowish-white. The bushy tail, which differs from that of the raccoons in being depressed instead of cylindrical, has a black tip and seven or eight blackish-brown rings, separated by white intervals.

This animal dwells among rocks and trees; and although, on account of its purely nocturnal habits, but seldom seen, is far from uncommon in certain localities. Like the raccoons it is easily tamed, and makes a pretty pet, being sometimes kept for the purpose of killing rats and mice. It is, however, for its size, a bold and ferocious animal, and is reported to be very destructive to poultry. Cacomistles prefer woods well supplied with water, and make their nests in

the holes of trees. The natives are in the habit of finding out whether such a hole is tenanted by a cacomistle, by noting if the bark surrounding the aperture has been removed; this removal of the bark being an invariable custom of the animal. From three to four young are produced at a birth. *B. astuta* is in the habit of carrying its tail bent back over its back. The only other species is Sumichrast's cacomistle (*B. sumichrasti*) from Central America.

Another raccoon-like type of animal has been named *Bassaricyon*, and is at present known to science only by a single skull from Costa Rica, and a skin from Ecuador. These animals, which are probably extremely rare, have the same number of teeth as the raccoons, but approximate so closely in appearance to the under-mentioned kinkajou, that they are probably often mistaken for it by collectors. Mr. O. Thomas considers that the resemblance of the two animals is a case of true mimicry, although he is unable to imagine of what advantage it can be for the *bassaricyon* to be mistaken for a kinkajou.

THE COATIS.

Genus *Nasua*.

The coatis, or, as they are often called, coatimundis, are easily recognised by the great length of their snouts, on which account they are called by the Germans *Rüsselbären* (proboscis-bears). They have the same number of teeth as the raccoons, but the tusks, or canines, are longer and more flattened; while, in conformity with the length of the snout, the skull is relatively longer and narrower.

The snout, which is naked at the tip, is somewhat upturned, and projects far beyond the extremity of the lower jaw, as is well shown in our coloured Plate; it is capable of a considerable amount of motion. The body is long, and rather flattened, and the tapering tail is also elongated and of considerable depth. The toes are more closely connected together than the raccoons, and are provided with longer and stouter claws. There are two species of coatis. One of these, the white-nosed coati (*Nasua nasica*), which is the species represented in the coloured Plate, inhabits Mexico and Central America. It is characterised by the white nose and upper lip, the dark brown face and cheeks, and the length and softness of its fur. In colour the long hairs of the back are tipped with either rufous, fulvous, or whitish; and the tail is frequently of the same colour as the back, though it may have dark and light rings on the under-side of the basal half, or, as in our illustration, complete rings.

The second species is the red coati (*N. rufa*), inhabiting South America from Surinam to Paraguay. In this species the fur is generally short and harsh, with the longer hairs on the back tipped with black. The ears are relatively larger and more hairy; and the tail is invariably marked with from seven to nine broad fulvous or rufous rings alternating with black ones; its tip being black. Both species are subject, however, to considerable individual variations of colour, and the distinction between them is sometimes difficult to make out.

Habits.

These animals usually go about in small troops, comprising from about eight to twenty individuals; and are mainly arboreal. Their

food includes fruits, young birds, eggs, lizards, and insects. In Costa Rica they are found in the mountains at elevations of from six thousand to seven thousand feet. In Nicaragua Mr. Belt observed them hunting the large lizards known as iguanas. When, however, an iguana was surprised by a coati, it immediately fell from the bough on which it was reposing to the ground, and thence escaped to another. Nothing daunted, the coati would renew the pursuit again and again. Frequently the coatis would divide their troop into two sections, one of which made its way through the branches above, while the other hunted on the ground below, so that any prey which might fall from the trees had but a poor chance of escape. In Guatemala coatis are among the most common of all mammals, and may be found at all elevations in the mountain-forests, from the level of the sea up to nine thousand feet. They are very readily tamed, and are often kept by the Spaniards in South America chained to one of the pillars of the corridor surrounding the courtyards of their houses.

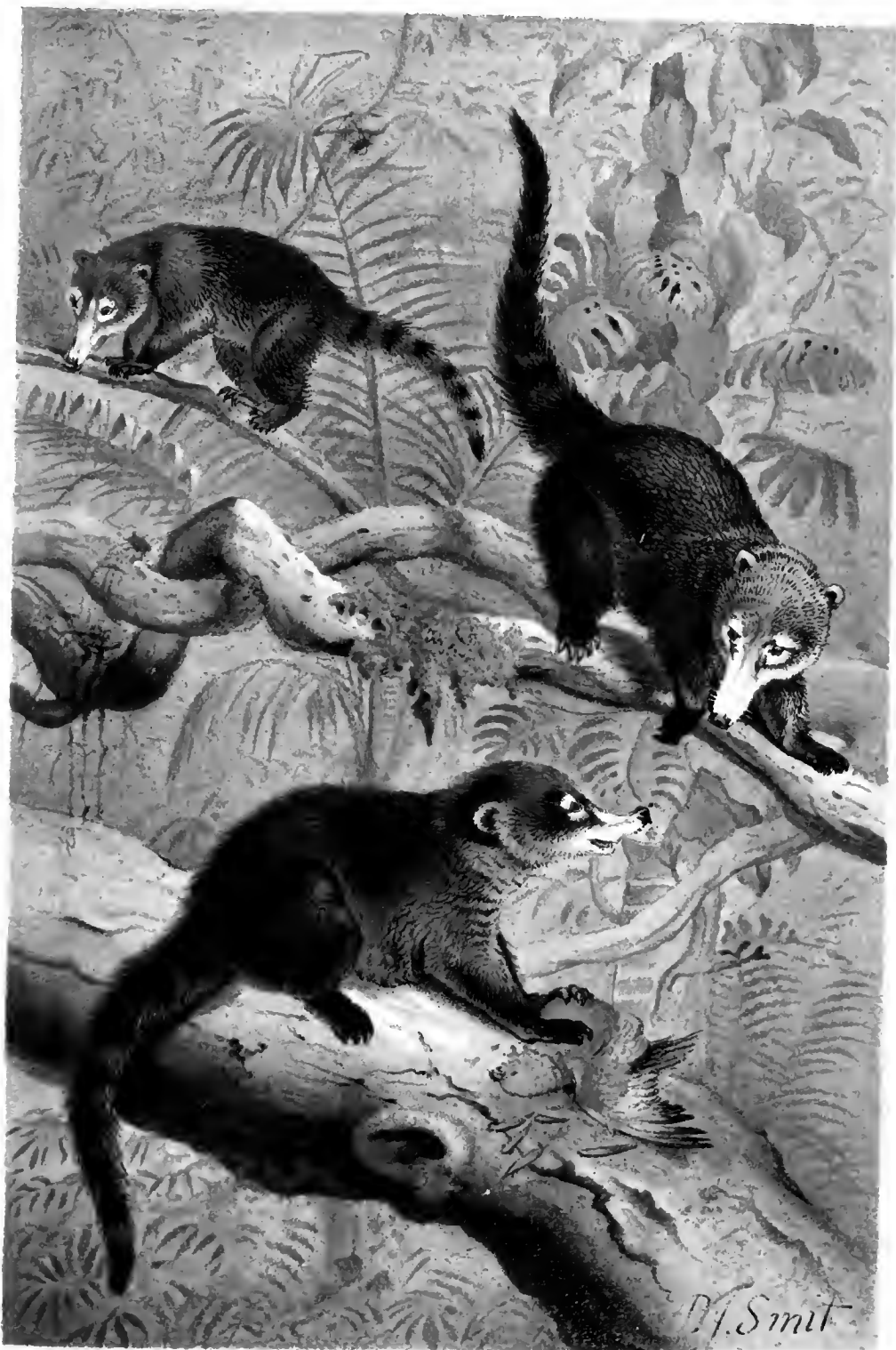
That coatis are aboriginal inhabitants of South America is proved by the occurrence of their fossilised remains side by side with those of many extinct mammals in the caverns of Lagoa Santa, in Brazil. They are also represented in deposits of still earlier age in Argentina, where the species have been referred to a distinct genus (*Cynonassua*).

THE KINKAJOU.

Genus *Cercoleptes*.

THE last representative of the Raccoon family is the kinkajou, or jupura (*C. caudivolvulus*), which is the most arboreal form of all, and is distinguished by its prehensile tail—a character possessed by it in common with the Indian binturong. The kinkajou is distinguished from the other American members of the family by having but thirty-six teeth, owing to the disappearance of a pair of premolars in each jaw. It is a long and rather low-bodied animal, with a rounded and broad head, in which the muzzle is short, and the front of the nose marked by a median vertical groove. The ears are small and rounded. The limbs are short, with naked soles to the feet, and long, powerful, and much curved claws. The tail, which, as we have said, is prehensile, is cylindrical, of moderate thickness, and of great relative length, being fully as long as the head and body together. The animal is further distinguished by the great length of its tongue, which can be protruded a considerable distance in front of the mouth. The fur is soft, short, and of an almost woolly nature, with nearly the same length over the whole body and tail, and is of a pale yellowish-brown colour throughout. In size the kinkajou may be compared to a cat. It is found in wooded districts from Central Mexico to the Rio Negro in Brazil. In Guatemala, where it is far from rare, it ranges to elevations of four thousand and five thousand feet above the sea. It conceals itself in the holes of trees,—in which it probably also breeds,—issuing forth only at night in search of food. A specimen which fell, when wounded, from a tree into a river below swam well. It feeds on small mammals, birds and their eggs, honey and fruits, and appears to be specially partial to oranges and bananas.

The expression of the kinkajou reminded Bates strongly of that of some of the



WHITE-NOSED COATI.



lemurs; and he was also struck with the extreme brightness of its dark eyes. "I once saw it," he writes, "in considerable numbers when on an excursion with an Indian companion along the low Ygapo shores of the Teffé, about twenty miles above Ega [on the upper Amazon]. We slept one night at the house of a native family living in the thiek of the forest, where a festival was going on, and there being no room to hang our hammocks under shelter, on account of the number of visitors, we lay down on a mat in the open air, near a shed which stood in the midst of a grove of forest trees and pupunha palms. Past midnight, when all became still after the uproar of the holiday-making, as I was listening to the dull, fanning sound made by the wings of impish hosts of vampire-bats crowding



THE KINKAJOU ($\frac{1}{4}$ nat. size).

round the eajer trees, a rustle commenced from the side of the woods, and a troop of slender, long-tailed animals were seen against the clear moonlit sky, taking flying leaps from branch to branch through the grove. Many of them stopped at the pupunha trees, and the hustling, twittering, and screaming, with the sounds of falling fruits, showed how they were employed. I thought at first they were *Nyctipitheci*, but they proved to be jupuras, for the owner of the house early next morning caught a young one, and gave it to me. I kept this as a pet animal for several weeks, feeding it on bananas and mandioca-meal mixed with treacle. It became tame in a very short time, allowing itself to be caressed, but making a distinction in the degree of confidence it showed between myself and strangers. My pet was unfortunately killed by a neighbour's dog, which entered the room where it was kept."

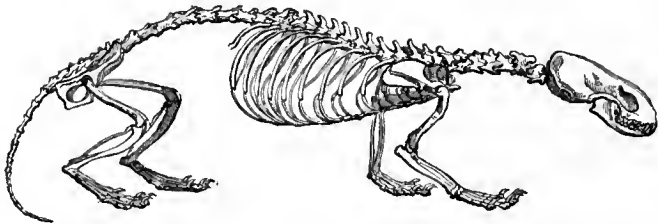
CHAPTER XVIII.

CARNIVORES,—*continued.*

THE WEASEL FAMILY.

Family *MUSTELIDÆ.*

WITH the Weasel family, in which are included not only the weasels and their immediate allies, but likewise the badgers and otters, we come to the last group of terrestrial Carnivores. The family is thus a very extensive one, and also one in which many of the various members differ very widely from one another in external appearances, as well as in the structure of their teeth. A large number of the species—and among them the typical forms—are, however, characterised by



SKELETON OF WEASEL.

their long and slender bodies and short limbs; while the great majority are of medium or small size, and none are very large.

In the general characters of the base of the skull the members of the Weasel family agree with the Bears and Raccoons. They are, however, distinguished from these by having but a single pair of molar teeth in the upper jaw, while they agree with the raccoons in generally having but two pairs of these teeth in the lower jaw. The ratels have, however, only a single pair of lower molar teeth. The skull of any member of the family may always be distinguished from that of any other Carnivore by the inner portion of the upper molar tooth being wider in the antero-posterior direction than its outer portion, this character being exhibited in the figure of the palate of an otter given later on, although in this case the whole tooth is relatively wider than usual. The skull is further characterised by the great development of the curved ridges of bone by which the lower jaw is held in place, which grip the condyle of the latter so tightly that it is sometimes difficult or impossible to detach it from the skull proper. As in the two preceding families, the feet are in all cases provided with five toes.

From the structure of the skull, as well as from certain features in the

anatomy of the soft parts, it has been generally considered that the weasels are most nearly allied to the bears and raccoons; and, as a matter of convenience, it is found best to continue to place them in this position, as it somewhat simplifies classification. The evidence furnished by the numerous forms of extinct Carnivores, which have been discovered of late years in the middle and lower Tertiary rocks of Europe and North America, points, however, very strongly to the conclusion that the nearest allies of the weasels are in reality the civets, and that the former group is the direct descendant of the latter. If this view be true,—and the evidence in its favour is very strong indeed,—it follows that the structural resemblance of the weasels to the bears and raccoons is an instance of what is termed parallel development, and indicates no near genetic connection between the two groups.

The family is a very widely distributed one, having representatives on all the great continents, with the exception of Australia. It attains, however, its maximum development in the temperate regions of the Northern Hemisphere; and it may be noted that none of its members inhabit Madagascar. In regard to coloration there is an enormous amount of variation. Several of the northern forms have a dark summer and a light winter dress, and thereby differ from all other Carnivores except the Arctic fox. Then a large number of the martens and weasels and all the otters are clothed with fur of a nearly uniform dark tint, while one of the martens and some of the badgers are remarkable for their extreme brilliancy. Moreover, the American skunks and the Cape polecat (*Ictonyx*) are remarkable for their contrasting bands of black or dark brown and white, and thus form some of the most conspicuously-coloured of all mammals. It is also noteworthy that in the parti-coloured examples there is a great tendency for the under-parts of the body to be darker than the upper; whereas, it is scarcely necessary to observe, the reverse is the case in the great majority of mammals. Again, there is a tendency for the different colours to arrange themselves in longitudinal lines or patches, or so as to make the whole of the upper-surface of the body light, and its under-surface dark; and in no case are there either spots or transverse bands of colour, while equally noteworthy is the entire absence of alternating dark and light rings of colour on the tail. Many of the members of this family yield furs of great commercial value.

The various members of the family are generally divided into three main groups, distinguished from one another by the characters of their teeth and claws. These groups are the weasels, the badgers, and the otters, which we proceed to consider in the order named.

THE TAYRA AND GRISON.

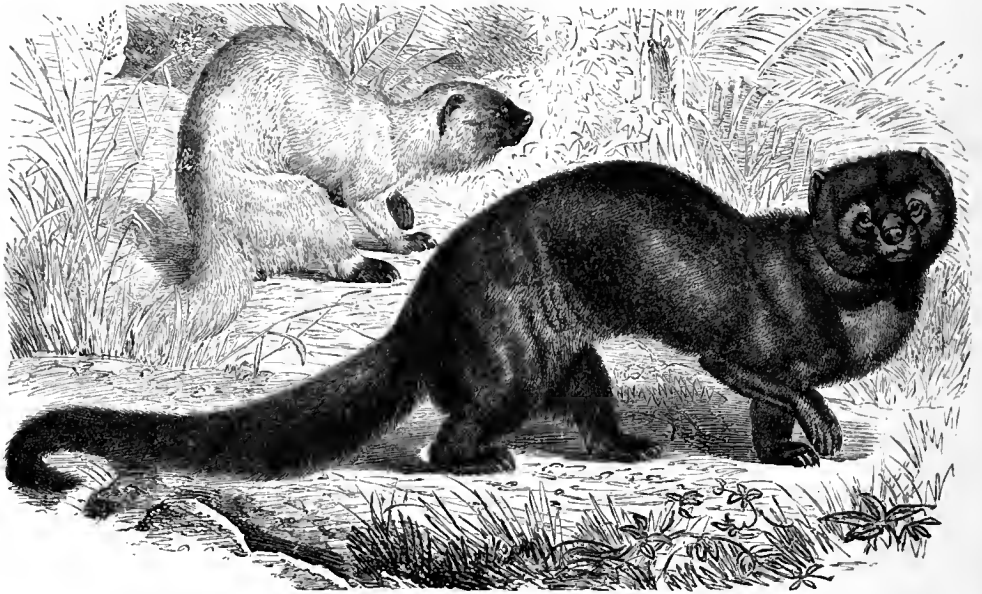
Genus *Galictis*.

The first representatives of the weasel group are the peculiar South and Tropical American species, which are respectively known as the tayra and the grison. The principal distinctive features of the group to which these belong are briefly as follows.

In the whole group the toes are short and only partially webbed, with short,

sharp, and curved claws, which may be partially retractile. The single upper molar tooth on each side is characterised by its narrowness from front to back, and its moderate dimensions. With the exception of the wolverene, all the members of the group are distinguished by their long and weasel-like bodies and short legs, while all are terrestrial and arboreal in their habits. Exclusive of the members of the present genus and one South-African species, the group is mainly confined to the northern parts of Europe, Asia, and North America, only a single representative occurring in Peninsular India, Burma; and the Malayan region, and one in South America.

The tayra and grison are characterised by having a total of 34 teeth, of which $\frac{2}{3}$ are incisors, $\frac{1}{4}$ canines, $\frac{3}{8}$ premolars, and $\frac{1}{2}$ molars. Their skulls may be readily



THE TAYRA ($\frac{1}{8}$ nat. size).

distinguished from those of the martens and weasels by the tubercle on the inner side of the upper flesh-tooth being placed near the middle of the tooth, instead of close up to its front edge. They walk to a great extent on the soles of their feet, which are completely naked, so that their feet are almost, but not quite, plantigrade. The claws cannot be retracted. The head is characterised by its breadth and flatness, and is furnished with very small and rounded ears. The tail varies in length from about one-half to three-quarters the length of the head and body.

Tayra.

The tayra (*Galictis barbara*) is the largest species, and may be compared in size to the common otter, its total length being a little over a yard, of which rather less than half is occupied by the tail. The body and limbs are usually of a uniform dark brown colour, becoming almost black in some individuals, while in others it is lighter. There is always a lighter spot on the chest. The head and neck are generally grey, but in two immature individuals in

the British Museum they are nearly white, with the exception of the muzzle, which is dark. Occasionally, individuals are met with in which the whole of the fur, except that on the muzzle, ears, and feet, is entirely white; one such example being shown in the upper figure of our illustration. The nose has a vertical groove at its extremity, the teeth are relatively large and protruding, and the aspect of the animal is ugly and forbidding.

The range of the tayra is generally stated to extend from Mexico in the north to the Rio de la Plata in the south, but it also includes some of the more southerly portions of the Argentine pampas. In British Honduras tayras were observed by Moore hunting in companies of from fifteen to twenty, and although some writers have doubted the correctness of this statement, it is fully confirmed by Mr. Hudson in Argentina. Rengger states that the tayra lives both in open grass-clad country, and likewise in forest. Writing of this and the next species, Mr. Hudson says that, on the pampas of Argentina, "there are two quaint-looking weasels, intensely black in colour, and grey on the back and flat crown. One is a large bold animal (*G. barbara*) that hunts in companies; and when these long-bodied creatures sit up erect, glaring with beady eyes, grinning and chattering at the passer-by, they look like little friars in black robes and grey cowls; but the expression on their round faces is malignant and bloodthirsty beyond anything in nature, and it would, perhaps, be more decent to liken them to devils rather than to humans."

Although largely nocturnal in its habits, the tayra will frequently hunt till midday, when it seeks its lair and reposes till evening. This lair is generally either the deserted burrow of an armadillo, or some hole in a tree. The food of the animal consists of such mammals as it is able to kill, such as agutis and other rodents, but it also eats birds and their eggs. In inhabited districts the tayra frequently raids on poultry-houses, among the inmates of which it commits much havoc. Honey it also readily eats. The nest, which is sometimes made in the cavities of rocks, instead of in a hollow tree or deserted burrow, is constructed with much care. In one nest, examined by Hensel, two young were found, which were then quite blind, and had much the appearance of young foxes.

Grison. This (*G. vittata*) is a smaller animal than the tayra, and may be compared in size to a marten or an Indian mungoose. It is also readily distinguished by its relatively shorter tail, of which the length does not exceed half that of the head and body, and likewise by its coloration. The latter is of that peculiar type to which we have already referred, in which the under-parts are much darker than the upper. The snout, the under-surface of the neck, and the under-parts of the body are very dark brown, whereas the whole of the upper-surface, from the forehead nearly to the tip of the tail, is of a uniform bluish-grey tint, the individual hairs being ringed with black and white. From the forehead to the shoulder the grey and brown areas are divided by a lighter band with a yellowish tinge, while the tip of the tail and the ears are distinctly yellow. There is no groove on the nose. The grison is found over the greater part of South America, as well as in Central America and Mexico; and there is also Allemand's grison (*G. allemandi*), which is of larger size, but has the same general coloration, although presenting some approximation to the tayra.

The general habits of the grison appear to be very similar to those of the tayra. It is described as being the Carnivore most commonly encountered on the coasts of South America; but in Brazil it is stated to be less frequent than its cousin. By preference it appears to select the open country, although it may also be found in forests. It frequents plantations, and commits great depredations upon domestic poultry. Hollow trees, clefts in rocks, and deserted burrows, are its favourite retreats; but it is said that, when hunted with dogs, the grison will never attempt to climb, and invariably takes shelter under rocks, or beneath the roots of trees. Fossil remains of various species of this genus have been found in the caverns of Lagoa Santa, in Brazil; while, what is more noteworthy, others have been obtained from the superficial deposits of the United States, thus indicating that the genus formerly extended far to the northwards of its present limits in Mexico.

THE MARTENS, POLECATS, AND WEASELS.

Genus *Mustela*.

The martens and their near allies the polecats, stoats, and weasels, constitute the typical group of this subdivision. By many writers the large martens are separated as a genus from the smaller polecats, stoats, and weasels, the three latter being grouped together under the title of *Putorius*, but in this we are not disposed to concur. It is true that the martens have one more pair of premolar teeth in each jaw than their smaller relatives; but we cannot in any case attach much importance to such a difference, and its triviality is proved by extinct species, which exhibit a considerable amount of diversity in this respect.

Regarding, then, all the animals above mentioned as constituting but a single genus, we have to indicate the features by which the group is distinguished.

In the first place, the number of teeth may either be the same as in the tayra, or there may be an additional premolar tooth on each side of both the upper and the lower jaw, thus raising the number of teeth to forty. The upper flesh-tooth, as already mentioned, differs from that of the tayra by having the lobe on its inner side placed close up to its front edge. With regard to external characters, the martens and weasels are distinguished from the members of the preceding genus by their habit of walking almost entirely on their toes (digitigrade), and also by their short and compressed claws being capable of partial retraction. Their tails are either long or of medium length, and more or less bushy. It may be added that the lower flesh-tooth of the martens and weasels is characterised by the small size or total absence of the cusp on the inner side of the second lobe of the blade; and as the heel at the hinder end is also rather small and furnished with a cutting edge, the whole tooth consists of three main cusps, of which the two end ones are similar. Such a tooth is, therefore, totally unlike the lower flesh-tooth of a civet.

Pine-Marten. The well-known European pine-marten, or yellow-breasted marten (*M. martes*), may be regarded as the typical representative of the martens, all of which possess the following features in common. First of all, they have four pairs of premolar teeth in each jaw; while the flesh-tooth of the lower

jaw has a distinct cusp on the inner side of the second lobe of the blade. Moreover, they are of comparatively large size, and may be compared in this respect to the domestic cat. In all of them the body is much elongated, although to a less degree than is the case with the polecats and weasels. The martens are found only in the Northern Hemisphere, and range far to the northwards; one species, however, occurring as far south as India and the Malayan region.

The pine-marten has a total length of from 25 to 30 inches, of which from 16 to 18 inches are occupied by the head and body, and from 9 to 12 inches by the tail, inclusive of the hair at its extremity. As in the other members of this group, the muzzle is sharply pointed, with the nose extending a little beyond the lips:



THE PINE-MARTEN ($\frac{1}{2}$ nat. size).

and the ears are thickly covered with hairs on both sides. Beneath the glossy outer fur there is a thick coat of under-fur; and the soles of the feet have a thick coat of fur between the bare pads.

The pine-marten is characterised by the rich brown colour of the fur, and the reddish grey tint and yellow tips of the under-fur; the light-coloured fur on the throat and chest varying in tint from yellowish white to a bright orange. The range of this species includes a large portion of Northern Europe and Asia; and in former years the animal was common in the British Isles, where it is now restricted to the wilder districts. From the specific designation of this marten, it would naturally be supposed that it exhibits an especial predilection for pine-forests. This, however, does not appear to be the case, and it would seem that the name was given merely from the circumstance that pine forests are abundant in many of the districts which it inhabits.

Habits. Like the other members of the group, it is chiefly arboreal in its habits, and thereby differs markedly from the weasels, which are more terrestrial. "Creeping from branch to branch in silent and stealthy pursuit of birds, squirrels, and other small animals," writes Bell, "their sharp and long claws afford them a firm and secure hold of the bark, whilst the long and somewhat bushy tail must considerably aid them in maintaining their balance on the boughs; the ears, too, are large and open, a circumstance which is of great advantage to them in discovering and pursuing their prey, amidst the dense foliage in which they love to conceal themselves." Martens will, however, frequently descend to the ground, when they will destroy mice, rats, and moles, as well as rabbits and hares, and, it is said, even lambs. They are also deadly enemies to domestic poultry of all kinds; while in the neighbourhood of the sea-coast they are also reported to feed on mussels. When domesticated, it is said on good authority that they will eat fruit.

Although it was long considered that the beech-marten was also found in the British Islands, it is now ascertained that the present species is the only member of the group that has ever occurred here. Regarding its present distribution here, the late Mr. Alston, to whom we are indebted for the clearing up of this confusion, writing in 1879, states that in the wilder districts of Scotland, as well as in the north of England, Wales, and Ireland, the marten still holds its own; while specimens are occasionally captured in districts where it is now practically extinct. Thus one was shot in Norfolk in the year 1878, while another was killed in Hertfordshire in 1872. In Ireland the animal was, when Mr. Alston wrote, occasionally seen even in County Dublin.

Beech-Marten. The beech or white-breasted marten (*M. foina*), formerly supposed to be an inhabitant of the British Islands, is generally of a greyish brown colour, although the tint may vary from a whitish brown to deep blackish brown, with the tail and limbs generally darker than the body. The light area on the throat and chest, which may vary considerably in extent in different individuals, is invariably white; while the colour of the under-fur varies from ashy to pure white. The skull is also proportionately wider than in the last species, and there are also certain characters in the teeth by means of which the one species can be distinguished from the other. The length of the head and body is about 18 inches, and that of the tail, with the hair at the end, 13 inches.

Distribution. This species is a more southern form than the last, being widely distributed in Europe, but not reaching either the British Islands or Scandinavia: while to the eastward it extends into Asia as far as Turkestan and the Eastern Himalaya. In the latter districts examples have been procured from Afghanistan in the west to Sikhim in the east, and also from Kumaun and Ladak; further eastwards it appears to be unknown. Throughout the Himalaya it is generally found at considerable elevations, although descending as low as five thousand feet in the Gilgit district. It inhabits the whole of Central Europe and Italy, the warmer parts of European Russia as far as the Urals, as well as the Crimea: the western and northern slopes of the Caucasus, Palestine, Syria, and Asia Minor. It appears, however, to be unknown in Persia.

Habits. Over the greater part of Europe this marten is a commoner animal than the preceding, which it also exceeds in the greater boldness of its disposition. Although it is a frequenter of woods and trees, it is also found not uncommonly among rocks and stones, and hence receives its German name of *steinmarder*. In barren districts like Ladak this marten must, of course, nearly always dwell among rocks. From its bold disposition it is frequently found in the neighbourhood of human habitations, where it inflicts much damage on poultry.

In its general mode of life the species closely resembles *M. martes*. The nest is carefully formed of hay and straw, and situated in a hole in a tree, in the crannies between rocks, or in an old barn or granary. The young, generally from four to five in number, are born about the month of April, and are blind for the first fortnight of their existence. Its wanderings at night during the summer are



THE BEECH-MARTEN ($\frac{1}{2}$ nat. size).

extensive; and no dove-cot—however lofty it may be—is safe when there is a marten anywhere in the neighbourhood. The food of this species is much the same as that of the last, although in inhabited districts including more domesticated animals. It feeds on mice, rats, rabbits, and all kinds of birds; and, when dwelling in woods, hunts and kills squirrels, lizards, and frogs. It likewise eats fruits of various kinds, such as cherries and plums; and in some parts of the Continent is considered to do so much harm to orchards that the stems of the trees are washed with tobacco-juice or petroleum in order to prevent the marten from ascending them. Like all its kindred, the beech-marten is, for its size, an exceedingly bloodthirsty creature, and will often kill more than it can devour.

Although generally silent, in the pairing-season, which takes place towards the end of February (or about three weeks later than that of the pine-marten), these animals utter a kind of mewing sound not unlike that of a cat; and a pair of them in a tree may be heard for a considerable distance.

In general the fur of this species is less valued than that of the pine-marten; but some skins from Afghanistan and Turkestan have beautiful fur, with long, glossy, nearly black piles, and very soft white or pale ashy under-fur. These Turkestan martens were at one time regarded as belonging to a distinct species. The inferiority of the fur of the ordinary beech-marten, as compared with that of the sable, is due not only to its colour and actual length, but likewise to the relative length of the long piles as compared with that of the under-fur, which is scarcely concealed by them. The more northern skins are always superior to those from Southern Europe; and a large number are imported into this country and sold as an inferior kind of sable. As already mentioned, it was considered by the late Professor Rolleston that the domesticated animal employed by the ancient Greeks for the purposes for which we now use the cat, and called by them the *Ailouros*, was this marten, which is often spoken of as the white-breasted marten. Fossil remains of martens occur in the cavern deposits of the Continent; but only those of the pine-marten have as yet been found in England.

Sable. The sable (*M. zibellina*) is so nearly allied to the pine-marten that some writers have considered that it should be regarded merely as a variety distinguished by the greater length and fineness of the fur. Brehm states, however, that it has a much more distinctly cone-shaped head, larger ears, longer and stouter limbs, and proportionately larger feet. In the most highly-esteemed specimens the fur should be thick, soft, and nearly uniformly coloured. Such skins are blackish above, having a mixture of black and grey on the snout, grey on the cheeks, chestnut-brown on the neck and flanks, and orange-yellow, or sometimes reddish orange on the throat. The margins of the ears are either greyish white or light brown in colour. In a number of cases there is a larger or smaller admixture of white hairs among the dark fur of the back, while the muzzle, cheeks, breast, and under-parts are white. In other specimens the fur on the back is yellowish brown, while that of the under-parts is nearly white, and only the legs black. Good skins should exhibit a kind of "watering," owing to the reddish tint of the woolly under-fur showing through the long outer hairs. An average sable will measure about 20 inches from the snout to the root of the tail; the length of the tail being 7 inches. The skins are valued only when they have their winter fur, the summer coat being much shorter. In spring, although the winter fur may still be retained, the skins are quite useless, as the hair will drop off even after the skins have been dressed.

Distribution. The range of the sable originally extended from the Ural Mountains to Behring Sea, and from the mountains on the southern borders of Siberia to the 68th parallel of north latitude. It is, however, now much curtailed, owing to the incessant persecution to which the animal has been so long subject; and the chief haunts are now the mountain forests of North Asia, more especially Eastern Siberia and Kamtschatka.

Habits. According to reports furnished to Dr. Guillenard by a native hunter, it appears that sables are for the most part of nocturnal habits, and, though they occasionally feed by day, generally spend that period of the twenty-four hours in holes at the roots or in the trunks of trees. They dislike the presence of man, and are rarely to be found in the neighbourhood of the

villages; their favourite resort being the depths of the forest least frequented by the natives. It is considered that the most inaccessible and least known parts of the country are the best hunting-grounds. They live on hares, birds of all kinds, and, in short, almost every living thing they can kill, but they are also said to eat berries, and even fish. There are, indeed, but few animals, apparently, which do not live on fish in Kamschatka. They have only one litter during the year, generally in the month of April, and bring forth four or five young at a birth in a nest in the holes of trees. The same writer tells us that whereas formerly a large number of sables were caught in traps in Kamschatka, they are now more generally hunted there with dogs; these dogs being specially trained for the purpose, and either running down their quarry on the deep snow, driving them into trees, or smelling them out when lying asleep in holes. The great object in



THE SABLE ($\frac{1}{2}$ nat. size).

such hunts is to "tree" the sable, when the tree is surrounded with nets, and the animal either shaken from the boughs or knocked off them by means of poles. If the sable does not fall into the nets, it is again pursued by the expectant dogs, by whom it is either run down, or once more "treed." When the tree is too high to allow of the sable being dislodged by the usual methods, it is either felled, or the animal is shot: but recourse to guns is if possible avoided, as the shot does damage to the skins. If the distance they have to travel be a long one, the Kamschatkan hunters start on their winter expeditions after the sable towards the end of September: but, if the district is nearer, they wait until the first fall of snow or about six weeks afterwards. If a single hunter takes twenty sable skins in a season, he considers himself fortunate; but Dr. Guillemard mentions that in a little-known district one party bagged upwards of 140 skins. The total number annually taken in Kamschatka must be very large: the number exported in the year 1882 from Petropavlovsky (which receives the majority) being over

two thousand. The price of a single sable skin in St. Petersburg ranges from £2 to £25, according to its quality and condition. The Kamschatkan peasant receives an average of sixteen roubles for each skin; and this he has to take out in kind.

American Marten. This species (*M. americana*) is so nearly related to the pine-marten and the sable that there may be a question whether it should be regarded as anything more than a variety. The long hair is very like that of the pine-marten, to which it is most nearly allied; its general colour being more or less uniformly brown, the breast-spot yellow, and the head and ears grey or whitish.

It is found in the Hudson's Bay district, Labrador, Alaska, and other parts of North America, descending on the eastern side as far south as the Adirondack Mountains, near New York.

In habits it appears to be similar to the pine-marten. In the Adirondacks it inhabits the evergreen forests, and is chiefly, although not exclusively, nocturnal. Its food consists of partridges, rabbits, and other smaller rodents, birds' eggs, young birds, frogs and toads, and large insects. It is said to display a distinct preference for forests of conifers, and is thoroughly arboreal, never venturing into the neighbourhood of human dwellings. Although generally gentle-looking in appearance it is related that when attacking animals larger than itself, such as hares, it becomes as fierce in demeanour, in proportion to its size, as a tiger. When one is seen among the tree-tops, the hunter has but to whistle and thus attract its attention, when it will afford a ready shot.

The fur is of great commercial value; the best skins selling at about £3, 15s. each. Of recent years the annual imports into this country have exceeded 100,000. Curiously enough, at certain periods this species becomes exceedingly scarce; the periods of scarcity recurring with great regularity at intervals of about ten years. How the animals disappear is, however, unknown, since there is no region into which they can migrate without the knowledge of the hunter, and none are found dead. The best season for obtaining the skins is in November; the animals being generally caught in wooden traps, which are set in lines for miles across the country. In spite of the incessant persecution to which it is subject, it does not appear that this species has appreciably diminished in number in the wilder regions of its habitat.

Fisher Marten. The largest of all the martens is the so-called fisher marten (*M. pennanti*), an animal rejoicing in a number of names—both popular and scientific—being variously designated as the "pekan," "Pennant's marten," "black fox," and "black cat." The two latter titles are due to the large size, stout build, and dark colour of the animal, which in point of form may be more aptly compared to a fox than to a weasel. It measures from 24 to 30 inches from the tip of the snout to the root of the tail. Its general colour is blackish brown, becoming grey on the head and neck; while the throat is distinguished by the absence of the light-coloured patch distinctive of all the other species. It ranges over the greater part of North America, as far northwards as Alaska and the Great Slave Lake, while to the southwards it is found in the upper part of Texas and about latitude 35°. Continual hunting has, however, exterminated the animal from the more settled districts of the United States east of the Mississippi.

Dr. Hart Merriam observes that "the name of fisher is somewhat

Habits. of a misnomer, for these animals commonly frequent deep swamps and wooded mountain sides, away from the immediate vicinage of water, and are not known to catch fish for themselves as do the mink and otter. However, they are fond of fish, and never neglect to devour those that chance to fall in their way. They prey chiefly upon hares, squirrels, mice, grouse, small birds, and frogs, and are said to eat snakes. They also catch and feed upon their own congener, the marten, and make a practice of devouring all that they discover in dead-falls and steel-traps." It also appears that porcupines compose a considerable proportion of their food in some districts; specimens being sometimes killed with numbers of porcupine-quills in their skin and flesh. Curiously enough, these needle-like quills, which often exceed $2\frac{1}{2}$ inches in length, seem to cause it but little or no inconvenience. Instances are recorded where the fisher marten has attacked and routed such a comparatively large animal as the raccoon.

In its chiefly nocturnal and largely arboreal habits the fisher marten resembles most of the other members of the group; its agility in the forests is, however, very remarkable, and when much frightened, or in pursuit of prey, it has been known to leap from tree to tree. The nest is usually built in the hole of a tree at a great height above the ground; the young being generally from two to four in number, and produced at the end of April or beginning of May.

The fisher marten is trapped for its skins in the northern parts of America from October till May, those captured in the early part of the season being in the best condition. The fur is not nearly so valuable as that of the American marten; the usual price being about a dollar and a half per skin. In the European markets the fur is generally known as Virginian polecat.

Indian Marten. Readily distinguished from all the other species by its more brilliant coloration, and the greater relative length of the tail, which is fully equal to two-thirds that of the head and body, the Indian marten (*M. flavigula*) is the handsomest member of the group. The soles of the feet are, moreover, at least partially naked, although this character is less marked in Himalayan specimens than in those from more easterly regions.

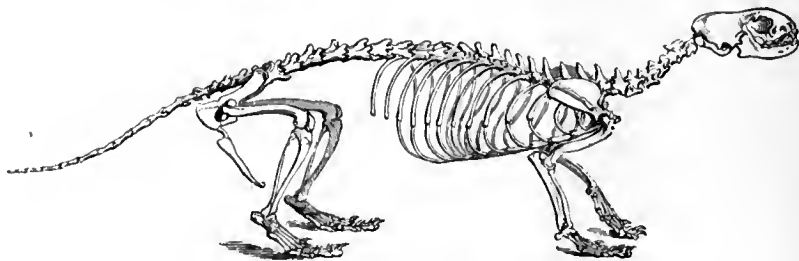
The fur is generally short, although longer in the Himalayan than in other examples, and has a thick, woolly under-fur during the winter. There are two varieties of this animal, one of which is more brightly coloured than the other. In the former, or common Indian type, the upper part of the head and neck, the rump, the tail, and the limbs, are either glossy blackish brown or black; while the middle of the back is of a paler brown, sometimes with a whitish tinge. The chin and upper part of the throat are white, while the lower throat and chest are either of a brilliant orange, brownish yellow, or pure yellow tint. In the second variety, with the exception of the white chin and throat and the pale yellow chest, the whole of the fur is dark brown. The length of the head and body varies from 20 to 22 inches, and that of the tail, inclusive of the hair at the tip, from 17 to 20 inches. According to Mr. Blanford, the Indian marten is found throughout the Himalaya, from the regions to the westward of Kashmir to Eastern Assam, and thence through the hilly districts of Burma to the Malay Peninsula and Sumatra. In Peninsular India it occurs on the Nilgiri and Travancore Hills; whilst to the

eastward its range extends as far as South China and Amurland. It is always found at a considerable elevation above the sea-level, ranging in the Himalaya up to seven thousand or eight thousand feet; and its occurrence in ranges so remote from one another as the Himalaya and Nilgiri would seem to indicate a former colder condition of climate in order to have enabled the animal to have traversed the intervening hot districts.

Habits. This marten is only found where the hills are thickly clothed with forest, and is by no means exclusively nocturnal. Although apparently far from uncommon in the Himalaya, it is, according to the writer's personal experience, but seldom seen. He had, however, once the good fortune to see a pair of these handsome animals descend from the trees, and gambol in a forest-glade at a short distance from his position. Other observers state that it may sometimes be seen in parties of five or six, hunting for prey either among brushwood or on the branches of trees. The late Prof. L. Adams states that, when on the move, it is continually uttering a kind of low chuckle, prolonged into a harsh cry when it becomes excited. Its food, which includes large insects, appears to be very similar to that of the other martens, but it is reported to kill young deer. It is noteworthy that a fossil marten, probably nearly allied to this species, occurs in the Pliocene strata of the Siwalik Hills of Northern India, and is thus the oldest representative of the group yet known.

Polecat. With the well-known European polecat (*M. putorius*), we come to the first representative of the second great group of the genus *Mustela*, or that which includes the polecats, weasels, stoats, and minks.

As already mentioned, the chief characters by which these animals are distinguished from the martens are the absence of the first pair of premolar teeth

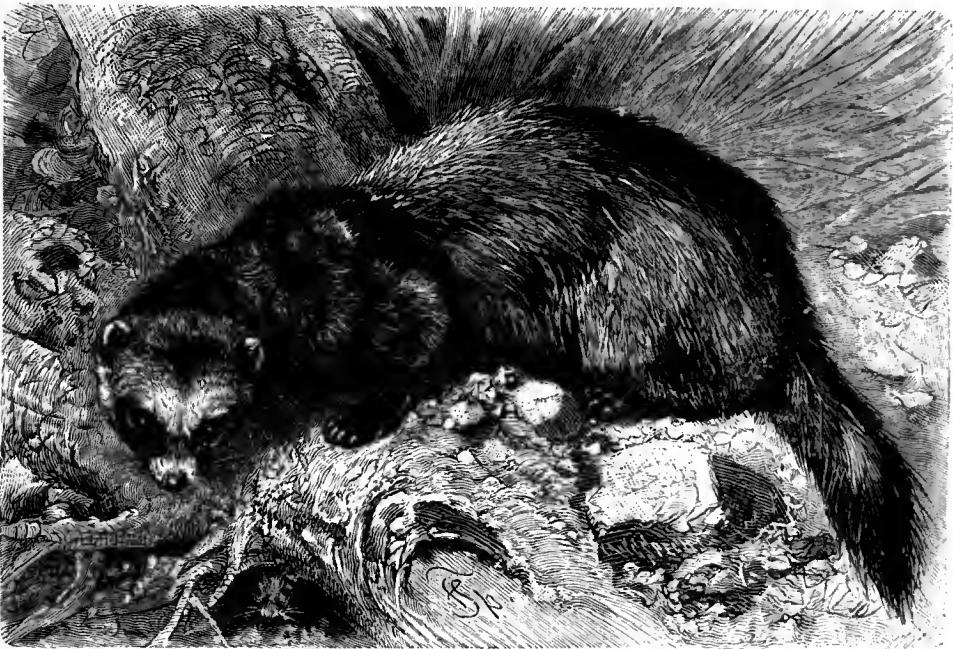


SKELETON OF THE POLECAT.

in both jaws, the sharper cusps on the crowns of all the cheek-teeth, and the absence of a cusp on the inner side of the blade of the flesh-tooth in the lower jaw. The members of this group are, moreover, of smaller size than the martens, and have, as a rule, longer bodies and proportionately shorter legs; and, whereas the martens give but little smell, the animals remaining for consideration are of ill reputation in this respect—as testified by the old name of fougart (foul-marten) applied to the polecat.

The common polecat is the best known representative of a small group of five species, distinguished from the stoats and weasels by their larger size and more powerful build. In length the head and body usually measure about 17 inches, while that of the tail is 6 inches. The nose is rather sharp, the small

ears are rounded, the neck is relatively long, and the tail is bushy. In colour the long hair of the body and limbs is brownish black or black, darkest on the head, tail, feet, and under-parts; while the ears are white, and there are some brown and white markings on the face and mouth. The woolly under-fur is a pale yellow, or fulvous, and by showing through the long hair communicates a general brown tinge, mingled with yellow, to the whole pelage; the tint varying considerably in different individuals. The fur is very long and loose on most parts of the body, and is commercially known as "fitch," from the name Fitchet, or Fiteher, applied in many parts of the country to this animal. The range of the polecat includes the greater part of Europe, extending as far northwards as the southerly districts of Sweden and the White Sea, but not including the Mediterranean countries.



THE POLECAT ($\frac{1}{3}$ nat. size).

In Western and Northern Asia it is replaced by the closely-allied Siberian polecat (*M. eversmanni*), which appears to be distinguished mainly by the head and back being nearly white, and by certain differences in the form of the skull. A third nearly-allied kind is the Tibetan polecat (*M. larvata*), inhabiting Ladak and Tibet, which differs only from the last by certain features in the base of the skull.

Sarmatian Polecat. The Sarmatian polecat (*P. sarmaticus*) is, however, a very distinct species, of rather smaller size than the common kind, and well distinguished by the fur of the under-parts being of a glossy black, while that of the upper parts is a mixture of brown and yellowish white. This species, often known as the mottled polecat, presents, therefore, another instance of that peculiar distribution of dark and light colours which we have already alluded to as characteristic of several members of the family. It is found in South-East Europe.

northwards from Poland, whence it extends into Western Asia, where it is common in the neighbourhood of Kandahar.

Black-Footed Polecat. Lastly, we have the American, or black-footed polecat (*M. nigripes*), which is generally of a brownish-white colour, with the feet, the tip of the tail, and a broad stripe across the forehead, black. It is larger than the common species; the length of the head and body measuring 19 inches, and that of the tail, with the hair at the end, $5\frac{1}{2}$ inches. It inhabits the central plateau of the United States, ranging as far south as Texas.

Habits. The habits of all these five species of polecat appear to be very similar, and the whole of them are characterised by their extremely fetid odour. From the barren nature of the country which it inhabits, the Tibetan polecat probably, however, dwells among rocks and stones; while the Sarmatian species generally resides in the deserted burrows of other animals.

The common polecat, whose habits will in the main serve to illustrate those of the other species, is chiefly a nocturnal animal, lying concealed during the day in woods, in fox or rabbit holes, woodstacks, or among rocks, and issuing forth at evening for its devastations. In winter it frequently seeks shelter in old farm-buildings or outhouses. It is far less arboreal in its habits than the martens, and is also less active in its ways. The polecat is a deadly enemy to hares, rabbits, and partridges, and equally destructive to all kinds of domestic poultry, from the pigeon to the turkey; while in addition to the smaller mammals and birds, it will consume eggs, lizards, snakes, and frogs. It is stated on good authority that it always carries away its food to its lair; this would be obviously impossible with such large birds as geese and turkeys, which are, perhaps, merely killed for that insatiable thirst for blood, which is its characteristic. Indeed, wherever a polecat gains access to a poultry-house, the owner will be pretty sure to find the majority of the occupants lying dead in the morning. The polecat is, moreover, a no less deadly enemy to the game preserver; the authors of Bell's *British Quadrupeds* remarking that "the destruction which it occasions among the eggs and young of pheasants and partridges, young hares and rabbits, is incalculable; and, in the latter case particularly, it follows these animals into their burrows with such facility that a single family of polecats would shortly produce a sensible diminution in numbers amongst the denizens of a whole warren."

Fortunately, however, of late years its numbers have been vastly diminished, and it is now chiefly confined to regions with thick woods affording it comparatively inaccessible retreats. In the Alps it wanders in summer far above the limit of trees, although retreating to lower elevations in winter. The nest of the polecat is made in a deserted rabbit-hole, in the crevices of rocks, or amongst heaps of stones overgrown with brushwood or weeds; and here the young are born in the months of April and May, or, more rarely, the beginning of June. The number in a litter may vary from three to eight, although it is more usual to find four, five, or six. When captured early, the young may be easily trained for the purpose of rabbit-catching. Fossil remains of the polecat, like those of the weasel and the stoat, have been obtained from the cavern-deposits of this country and the continent, in association with the bones of extinct mammals.

Ferret.

After much discussion and difference of opinion, zoologists are agreed that the ferret is merely a variety of the polecat, somewhat modified by the effects of long-continued captivity. It is usually smaller and more slender than the polecat, and is generally of a yellowish white colour, with pink eyes, but there is also a brown variety known as the "polecat-ferret." Ferrets are bred chiefly for rabbit and rat-hunting, both in Europe and the United States. Although they learn to know their masters to a certain extent, they are untrustworthy animals, and should be handled with caution. The ferret has no strong local attachments, and, therefore, requires to be strictly secured. It is also very susceptible to cold. As is the case with many domesticated animals, ferrets are more prolific than their wild allies, the number in a litter usually varying



THE FERRET ($\frac{1}{3}$ natural size).

from five to ten. The young are born in the spring; but it is said that there may sometimes be two litters in the year.

In rabbit-catching the ferret is usually sent into the hole either muzzled or attached to a coil of string, by which it can be withdrawn. If allowed to enter a rabbit-hole unmuzzled, or without a string, ferrets are very likely to remain in such good quarters, and to slaughter the occupants one after another. The usual plan is to stop all the entrances to the burrows by means of small bag-like nets, in which the rabbits are caught when they bolt; but sometimes they are allowed to bolt freely, and are either shot or coursed with dogs. In ferreting it is essential that those who are present should be perfectly silent, as otherwise the rabbits will prefer to be eaten alive by the ferret in their holes rather than attempt to escape. It is also important that no one should stand immediately in front of the entrance to the hole. When a ferret enters a burrow in which there are several rabbits, a

prodigious scuffling and scurrying immediately takes place in the interior; and after a few minutes, if not frightened by sounds above, the occupants soon begin to bolt in rapid succession at the various exits. Like the other members of its tribe, a ferret almost invariably seizes a rabbit immediately behind the ear.

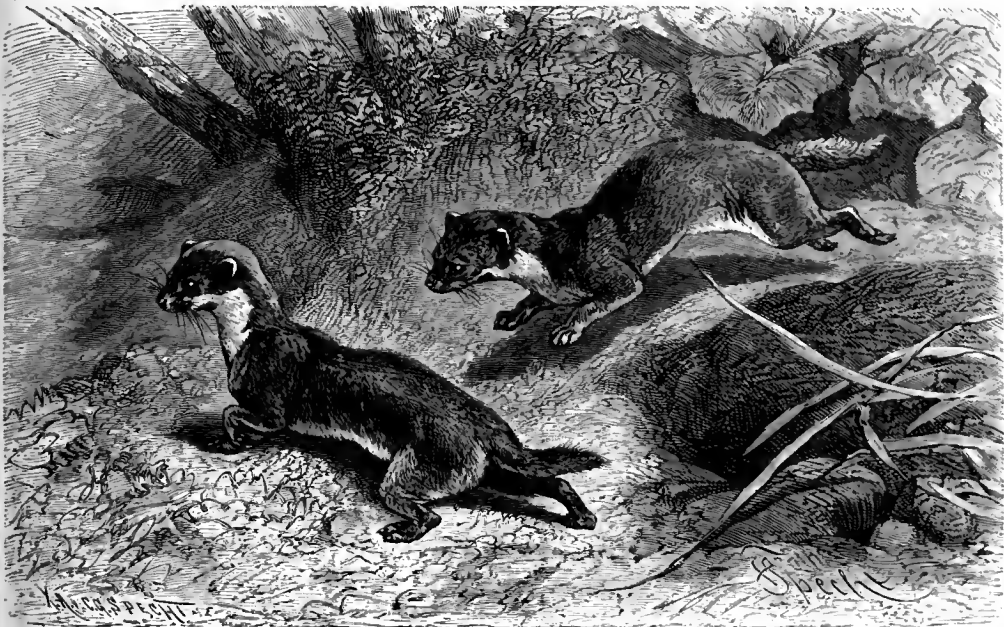
The common weasel of Europe (*M. vulgaris*) is the first of several species, distinguished from the polecats by their smaller size, longer bodies, and the much slighter development of the ridges and crests on their skulls. The difference in the proportionate length of the weasel and the polecat will be made evident by comparing the figure of the skeleton of the former given on p. 46 with that of the latter on p. 58. Moreover, whereas none of the martens or polecats have a winter coat markedly different in colour from that which they wear in summer, the weasels and stoats in northern regions generally or invariably change their summer dress of brown for a white winter garb.

The common weasel, which ranges over the whole of Europe, Northern and Central Asia, and a large portion of the northern part of America, usually varies from 6 to 8 inches in length from the tip of the snout to the root of the tail; the tail itself, with the hair at the end, varying from 2 to 2½ inches. In colour the upper-parts are usually some shade of mahogany brown in the summer dress, while the throat and under-parts are white, without any tinge of yellow. The outer sides of the limbs are coloured like the back, but it appears that the feet may be either of the same tint as the back or as the under-parts. There is considerable individual variation in the shade of the brown, as there is with regard to the limits of demarcation between the brown and the white areas. The tail is cylindrical and pointed, with its tip of nearly or exactly the same tint as the back. The female weasel is considerably smaller than the male, and appears to be the animal locally known as the cane.

In the northern parts of the whole extent of its range the weasel assumes a white dress in winter, although it appears that this change of dress is less regular than in its cousin the stoat, and requires a greater intensity of cold for its production. This change occurs but rarely in the British Islands. Even in the winter dress, the tip of the tail, although paler than ordinary, retains the reddish brown colour. In North America the weasel turns white in the northern parts of New England and the Adirondack Mountains near New York, but in the latitude of Massachusetts it retains the dark colour throughout the year.

Habits. The weasel, in suitable localities, may be found almost everywhere,—in hedgerows, woods, among stones, in water-courses, and along the edges of swamps. Its general food consists of small creatures, such as mice, rats, small birds, moles, shrews, insects, etc.; but there is no doubt but that it will occasionally make inroads on poultry, and sometimes attack rabbits and sleeping partridges. The accusations of killing rabbits and hares habitually, which are so frequently levelled against the weasel, should, however, in most cases be transferred to the stoat. Indeed, from the war incessantly waged by the weasel against rats, mice, and voles of all kinds, it ought to be protected by the farmer, if not also by the gamekeeper, rather than ruthlessly destroyed whenever encountered. In spite, however, of these services, there is no doubt that the weasel does sometimes take to rabbit-hunting in good earnest: and several will combine together in

companies the better to effect their object. Thus the late Richard Jefferies mentions that he has seen five, and heard of eight weasels together. "The five I saw," writes this observer, "were working a sandy bank drilled with holes, from which the rabbits in wild alarm were darting in all directions. The weasels raced from hole to hole, and along the sides of the bank exactly like a pack of hounds, and seemed intensely excited. Their manner of hunting resembles the motions of ants; these insects run a little way very swiftly, then stop, turn to the right or left, make a short *détour*, and afterwards on again in a straight line. So the pack of weasels darted forward, stopped, went from side to side, and then on a yard or two, and repeated the process. To see their reddish heads thrust for a moment from the holes, then withdrawn to reappear at another, would have been amusing had it not



THE WEASEL ($\frac{1}{3}$ nat. size).

been for the reflection that their frisky tricks would assuredly end in death." In another passage the same author graphically describes the chase of an unfortunate rabbit by a weasel—the timid fear and almost complete paralysis of the pursued through sheer terror, and the bold confidence of the bloodthirsty pursuer.

In all cases the weasel is a bold and inquisitive animal, exhibiting but little fear of man, and poking out its nose from some hole or cranny to survey his proceedings with the greatest indifference and self-possession. In spite, however, of this curiosity, the weasel is ever on the alert to withdraw its head at the slightest symptom of attack. When on the ground, weasels generally proceed in a series of small leaps, stopping at intervals to take a careful survey of their surroundings, and not unfrequently raising themselves on their haunches in order to obtain a better view. From its elongated, almost snake-like, body the weasel can follow most of the small mammals on which it preys to their holes or hiding-places. As Bell

observes: "It follows the mole and the field-mouse to their runs; it threads the mazes formed in the wheat-riek by the colonies of mice which infest it, and its long flexible body, its extraordinary length of neck, the closeness of its fur, and its extreme agility and quickness of movement, combine to adapt it to such habits, in which it is also much aided by its power of hunting by scent." The weasel is likewise an expert climber, seizing hen-birds while sitting in their nests, and thus gaining both parent and offspring, or eggs, at a single stroke. Although probably more prone to wander by night than by day, it can scarcely be regarded as a nocturnal creature, and may, indeed, as in the instance above recorded, be frequently observed hunting by day. Professor Bell states that the weasel brings forth four or more frequently five young, and is said to have two or three litters in a year. The nest is composed of dry leaves and herbage, and is warm and dry, being usually placed in a hole in a bank, in a dry ditch, or in a hollow tree. As is well known, the female weasel will defend her helpless young with great fury and desperation, risking her own life freely rather than leave them. Occasionally, too, the male will join in endeavouring to protect or carry off the young from danger.

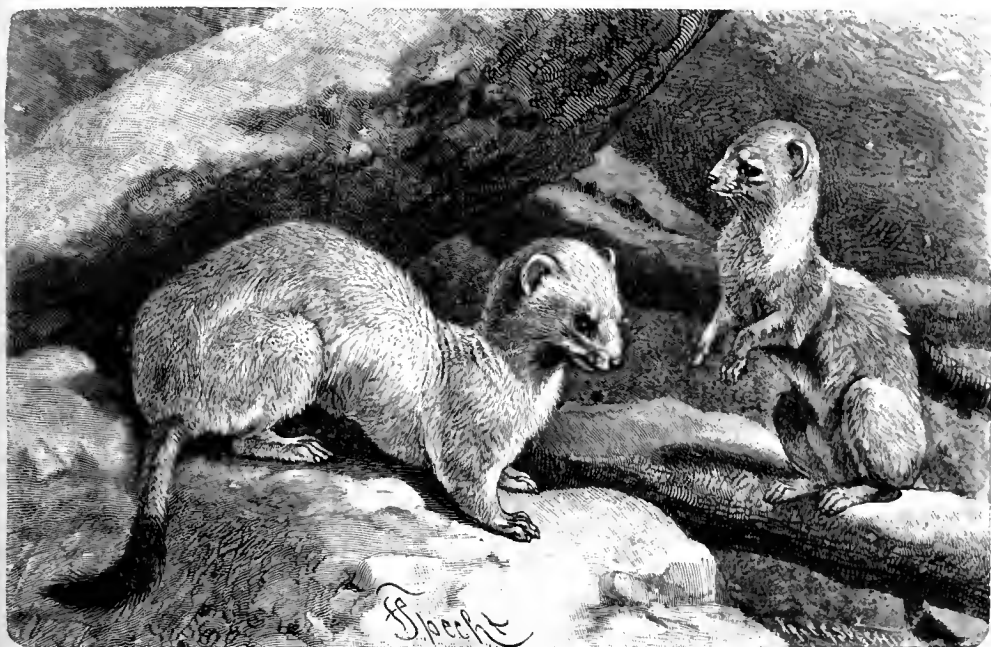
Stoat. The stoat or, as it is generally called when in winter dress, the ermine (*M. erminea*), is closely allied to the weasel, from which it is chiefly distinguished by its superior size, and the black tip to the tail, which retains its colour when the rest of the fur turns white. On account of its superior size the stoat is frequently known as the greater weasel.

In summer the colour of the fur of the upper-parts of the stoat is dull mahogany brown, while the under-parts are of a pale sulphur yellow, and are thus easily distinguished from the pure white of the weasel. The length of the head and body is usually from 9 to 10 inches, but it may occasionally fall as low as 8 inches, or reach to 11; the length of the tail, with the hair, varying from about 3 to 5 inches.

Distribution. The distribution of the stoat is nearly the same as that of the weasel; the animal being widely spread over the northern regions of both hemispheres; it is, however, not improbable that the stoat extends into portions of the Western Himalaya, where its cousin is unknown. In all the more northern parts of its habitat the stoat invariably assumes the well-known white winter dress which constitutes the valuable ermine of commerce. In the British Islands this change always takes place in the Highlands of Scotland; while in the northern English counties, like Northumberland and Durham, it is frequent but by no means universal. Proceeding further south, the change of colour becomes more and more rare, taking place only occasionally in counties like Cambridgeshire and Lincolnshire, while in Cornwall and Hampshire it is almost unknown. In North America the change takes place in the more northerly of the United States and all the regions to the northward; specimens captured during the winter in Massachusetts, New York, and Pennsylvania being almost invariably white. Some of those from Virginia turn partially white, while in South Carolina there is no change at all.

Change of Coat. The nature of the change from the dark summer to the white winter dress in the stoat and other animals has given rise to much

discussion. It was originally considered that the animal sheds its coat in the autumn and spring; the dark summer coat being gradually replaced by the advent of the white hairs of the winter one. Doubts then arose whether the change in colour was always coincident with the development of the winter and summer coat, and whether the hairs themselves might not actually change colour. Dr. Elliott Coues succeeded, however, in proving that the change might take place in either way, some specimens taken in spring showing the long, woolly white winter coat on some parts of the body, while on other parts they had the short, coarse, brown hair of summer; and he observes that "we may safely conclude that if the requisite temperature be experienced, at the periods of renewal of the coat, the new hairs will come out of the opposite colour; if not, they will appear



THE STOAT OR ERMINE IN WINTER DRESS ($\frac{1}{3}$ nat. size).

of the same colour, and afterwards change; that is, the change may or may not be coincident with the shedding."

Dr. Coues attributed the reason of the colour-change entirely to the effects of temperature; but strong objection is taken to this view by Dr. Hart Merriam, who observes that it occurs in captive specimens kept continually in warm rooms. Dr. Merriam relies, however, chiefly upon the circumstance observed by himself and others that among the stoats of the Adirondack Mountains the winter change never takes place till after the first fall of snow, which generally occurs towards the end of October or the beginning of November. Although the temperature of the air may be much lower before than subsequent to this first snowfall, yet it is true "that ermine caught up to the very day of the first appearance of snow bear no evidence of the impending change. Within forty-eight hours, however, after the occurrence of the snowstorm the coat of the ermine has already commenced to

assume a pied and mottled appearance, and the change now commenced progresses to its termination with great rapidity. In early spring, the period for the reversal of this process, the changing back from the white coat of winter to the brown summer coat is determined by the same cause—the presence or absence of snow.” These arguments appear conclusive that the change is really due to the necessity of the colour of the animal being adapted to its external surroundings; the change in captivity being owing to the influence of hereditary habits, which cannot be overcome in the short period during which the animals are under observation.

Habits. In habits the stoat is in general very similar to the weasel, although from its larger size and greater strength it more commonly attacks larger animals, such as hares, rabbits, and poultry, than its smaller relatives. In America it is very fond of the ruffed grouse, and will often overcome the large northern hare; while its destruction of poultry is proved by a statement of Audubon to the effect that one has been known in a single night to slay upwards of forty well-grown fowls. When food is abundant, it is stated that the stoat only sucks the blood or eats the brains of its victims, leaving the flesh untouched. The late Richard Jefferies states that these animals usually hunt in couples, although occasionally three may be seen together; and that their range of destruction seems only to be limited by their strength.

The stoat hunts its prey both by day and by night, and is fully as good a climber as the weasel. Although it cannot in any way be considered an aquatic animal, there is good evidence to show that it is an excellent swimmer, and will, when occasion arises, take readily to the water. Its favourite haunts appear to be stony places and thickets, which secure it a safe refuge from its foes; and it is also very partial to patches of impenetrable gorse, while it will sometimes take up its abode in a deserted rabbit burrow. In spite of its destructiveness to poultry and game of all kinds there can be no doubt that from the number of rats, mice, and voles it consumes, the stoat is a benefactor to the farmer; and it is a remarkable fact that, whenever unusual numbers of any of the rodents above mentioned have appeared in any district, they have almost invariably been followed by a large assemblage of stoats and weasels who wage war upon them. It is almost superfluous to add that the stoat, when angered, emits a most noisome and penetrating smell.

The young in England are generally produced during the months of April and May, in a nest constructed in a hole in some dry bank. Prof. Bell states that the usual number of young in a litter is five; Dr. Coues states that the number may vary from a pair to as many as a dozen, although five or six may be taken as the average. In America the stoat has occasionally been employed in the same manner as the ferret for rabbit-catching, and appears to take to the work readily. In most parts of England stoats seem to be far less common than weasels, although the reverse is stated to be the case in Scotland.

The fur of such individuals as assume in Britain the white winter dress is always far inferior in quality to that of skins obtained from more northerly regions; the inferiority consisting in the shorter and thinner hairs, and the less pure and bright tint of the whole pelage. The importation of ermine skins into England was formerly very large, more than 105,000 having been landed in the

year 1833; but at a later period, owing to depreciation in value, the Hudson's Bay Company found that ermine skins were not worth the trouble of collection. At the present day the ermine is much more abundant in British North America and Alaska than it is in the United States; the largest number of skins being obtained from Alaska.

Other Species. In addition to the weasel and stoat, there are a number of more or less closely-allied species inhabiting the Northern Hemisphere, while a few descend below the Equator. In North America, inhabiting the region of the Upper Missouri, we have the long-tailed stoat (*M. longicauda*), distinguished from the ordinary stoat by its longer tail. The Brazilian, or bridled weasel (*M. frenata*), is a more southerly species, ranging from Texas to Brazil, and distinguished by the head being darker than the body and blotched with white, and also by the retention of the dark colour throughout the year. A weasel from Patagonia may be only a variety of this species.

Asia also possesses a number of representatives of the group, such as the Himalayan weasel (*M. hemachelana*), in which the under-parts are brown and the tip of the tail dark; the striped weasel (*M. strigidorsus*), of Sikhim, in which there is a pale stripe down the back; the yellow-bellied weasel (*M. cathia*), from the Central and Eastern Himalaya; the pale weasel (*M. alpina*), ranging from the Altai to Gilgit; as well as several others, some of which are confined to Tibet.

Extinct Forms. Weasels were also well represented in past epochs of the earth's history, the remains of numerous species having been described from the Miocene or Middle Tertiaries of Europe. Of those referred to the existing genus *Mustela*, some differ from living weasels, and thereby agree with the larger martens, in having four pairs of premolar teeth in both jaws; while others have four pairs of these teeth in the upper jaw, and only three in the lower jaw; and others, again, have the reverse of this arrangement. Another extinct weasel-like animal from the same deposits, for which the name *Plesictis* has been proposed, is one of the forms already alluded to as apparently connecting the weasels so intimately with the civets.

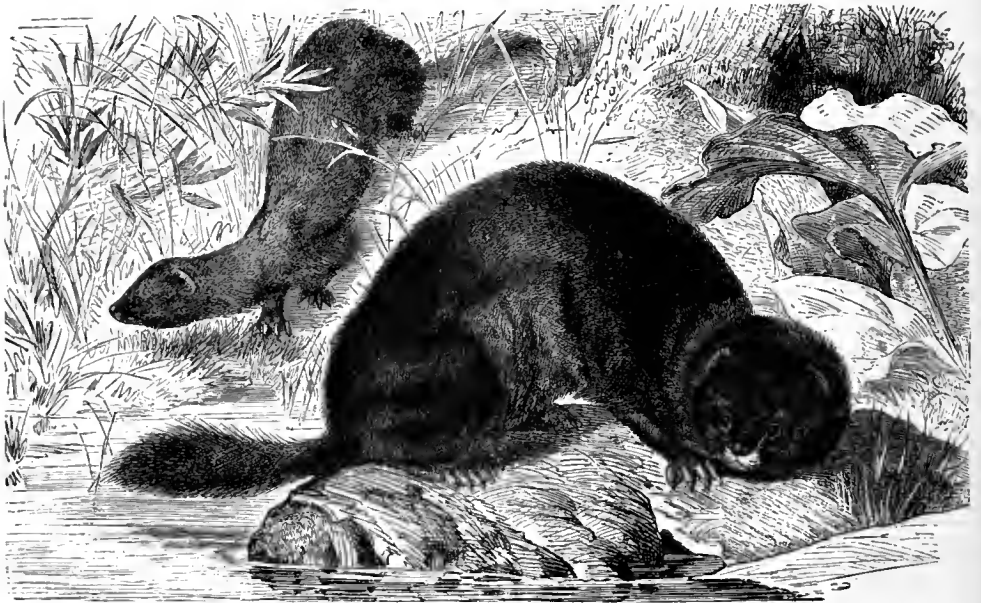
Mink. The animal represented in the illustration on the next page forms one of a group of three species of comparatively large size, whose nearest allies are the polecats. The European representative of this group (*M. lutreola*), is generally known on the Continent as the nertz, or sumpf-otter (marsh-otter), and has no recognised English title, although the name of European mink has been suggested for it, and is adopted in this work. The second species is the true mink (*M. vison*) of North America; while the third is the Siberian mink (*M. sibirica*), which is stated to connect the other two with the polecats.

These three are distinguished from the other members of the genus, not only by their semi-aquatic habits, but by certain structural peculiarities. While agreeing with the polecats in the number of their teeth, the minks differ from them, as well as from the weasels, by the narrower muzzle to their skulls, being thus more like the martens. The premolar teeth are relatively larger than in their nearest allies; while a more important point of distinction is

afforded by the partial webbing of the toes, which are also peculiar in possessing no long hair between their naked pads.

The European and North-American minks are such closely-allied animals that they cannot be even distinguished from one another externally; and in our own opinion it would be better to regard them as mere local varieties of a single species. The European mink has, however, very generally a white upper lip, which is but rarely exhibited in its American relative. When the skulls of the two forms are compared together it will be found that in the American form the upper molar tooth is invariably decidedly larger than in the European; and it is on account of this difference that the two are regarded as specifically distinct from one another.

Like the martens, the minks have a uniformly long and somewhat bushy



THE EUROPEAN MINK ($\frac{1}{3}$ nat. size).

tail, differing markedly from that of the weasels; its whole length being approximately equal to half that of the head and body. The ears are smaller than in any of the allied forms, and scarcely appear above the general level of the fur. The pelage consists of a dense, soft, and matted under-fur, mixed with long, stiff, and glossy hairs; the gloss being most marked in the fur of the upper-parts, while the hairs of the tail are more bristly than elsewhere. In colour the mink, according to Dr. Coues, varies from a light dull yellowish brown to a rich black chocolate-brown; the ordinary tint being a rich dark brown, scarcely, if at all, paler below than above. The tail is always decidedly blackish. Our illustration exhibits the white upper lip usually distinctive of the European mink. In both the eastern and western forms the chin is always white, although the extent of the white area is subject to individual variation. In addition to the white on the chin, there may also be small irregular patches of the same colour on the under-parts, while, as a rare abnormality, the tail may also be tipped with white.

As a rule, the American mink is somewhat larger than the European; and in both the male is always larger than the female. The American form may vary in length from the tip of the snout to the root of the tail from 15 to 18 inches; while the length of the tail, inclusive of the hair, ranges from about 8 to 9 inches. The European mink is an inhabitant of Eastern Europe, occurring at the present day in Poland, Finland, and the greater part of Russia, although unknown to the eastward of the Ural Mountains. The American species ranges over the greater part of North America, although not found in the extreme north of that continent.

Habits. In its general habits the mink, in both hemispheres, is thoroughly amphibious, and is therefore only found in districts where water is abundant. Indeed, these animals may in this respect be regarded as presenting precisely the same relationship to the polecat as is held by the water-vole to the land-vole. The mink, writes Dr. Hart Merriam, "not only swims and dives with facility, but can remain long under water, and pursues and captures fish by following them under logs or other places from which there is no free escape. It has thus been known to catch as swift and agile a fish as the brook-trout, and Audubon says that he has seen a mink catch a trout of upwards of a foot in length. It is remarkably strong for so small an animal, and a single one has been known to drag a mallard duck more than a mile, in order to get to its hole, where its mate joined in the feast." Generally, the food of the mink consists of various aquatic creatures, such as frogs, crayfish, and molluses; but it will also eat various small aquatic mammals, such as voles, as well as mice and rats, while in America it is reported to prey at times upon the comparatively large musquash. Marsh-frequenting birds also fall victims to the mink, and their eggs are probably also consumed. Other wild birds are, however, comparatively safe from the attacks of this animal, as its climbing powers are of the feeblest. Poultry are not unfrequently attacked; but in these and other attacks the mink does not exhibit that wholesale destructiveness characteristic of the stoat. In hunting, the mink has been often observed to pursue its prey entirely by scent; and it may be observed on its hunting expeditions both by night and by day.

As a rule, minks appear to be comparatively solitary animals, but Dr. Merriam mentions having once seen three in company. The abode of the mink is usually a hole in the bank of a stream or lake; and a well-trodden path always leads from the entrance of the burrow down to the water. From such abiding places it appears that the animal will not only make daily excursions for the sake of procuring food, but also wander into neighbouring districts, from which it sometimes does not return till after the lapse of a week or two.

The nests of the mink are situated either in the above-mentioned holes, or in hollow logs, and are generally well lined with feathers and other soft substances. The usual number of young in a litter is from four to six; and in the Adirondaek region of New York these are born early in May, and remain with the female until the following autumn. In America minks have been extensively bred in a semi-domesticated state, for the purpose of being used as ferrets; and in this condition it appears that the number of young in a litter may vary from three to as many as ten. The scent characteristic of all the members of the weasel-group is extraordinarily developed in the mink, Dr. Coues observing that in America no

animal, with the exception of the skunk, possesses such a powerful, penetrating, and lasting effluviium.

All who have hunted the mink bear witness to its extraordinary tenacity of life, the writer last quoted stating that he has known several instances of these animals being found alive after having lain for fully four-and-twenty hours with their bodies crushed flat beneath a heavy log. The countenance of the mink is described as at all times far from prepossessing; but when caught alive in a steel-trap these animals are said to have an expression almost diabolical.

Fur. Some years ago the fur of the mink was but little esteemed, and the price was at one time said to be so low as not to repay the cost of transport. Recently mink fur has, however, been more appreciated, and the animal has consequently been more vigorously trapped, with the result that in some districts there has been a considerable reduction in its numbers. In 1865 the value of a good mink skin was reported to have reached five dollars; and at that date upwards of 6000 of these skins were annually exported from Nova Scotia alone. It is stated that while for two decades the total number of European mink skins averaged 55,000, the exports of American mink reached 160,000; but in the year 1888 the number of American was upwards of 370,000. At the latter date the value of Russian mink varied from about one to four shillings per skin, while American skins fetched from four to ten shillings. Much higher prices were, however, current a few years previously. American mink always obtains higher prices than Russian, the best skins coming from Alaska and New England.

Siberian Mink. The Siberian mink is a little-known species inhabiting the districts to the eastwards of the Yenesei River, but unknown in Siberia. It is more like a polecat in general appearance, having similar dark and light markings on the head and face. The colour is a clear rich tawny or fulvous brown, as dark below as above.

THE SOUTH-AFRICAN WEASEL.

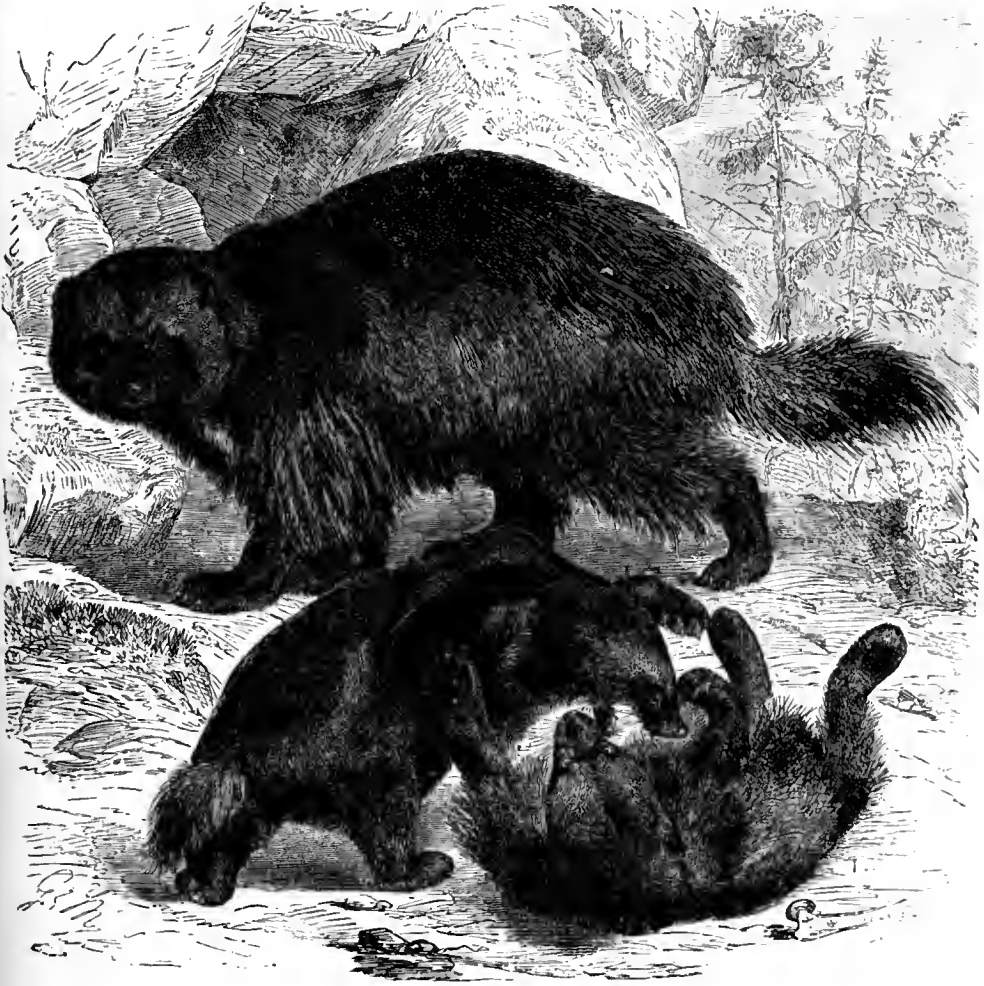
Genus *Pæcilogale*.

The pretty little South-African weasel (*Pæcilogale albinucha*) is worthy of a separate heading, not only on account of its remarkable coloration, but also as being, with the exception of one species belonging to the typical genus *Mustela*, the sole representative of the weasels in Africa south of the Sahara. This species is distinguished from all the other weasels by having the ground-colour of the fur black, with the upper part of the head and neck white, and four pale brownish white stripes running along the back; the tapering tail being white. This peculiar coloration is almost precisely similar to that of the so-called Cape polecat, to be mentioned later on; and it may be that we have here another instance of true mimicry among mammals. In addition to its coloration, the species is also distinguished by having but two pairs of premolar teeth in each jaw, while very generally there is but a single pair of molar teeth in the lower jaw; and it is on these differences in the number of teeth that zoologists chiefly rely in referring this weasel to a distinct genus.

THE GLUTTON, OR WOLVERENE.

Genus *Gulo*.

The glutton (*Gulo luscus*), which is the only representative of the genus to which it belongs, is a very different-looking animal to any of the foregoing, from

THE GLUTTON, OR WOLVERENE ($\frac{1}{3}$ nat. size).

which it is likewise distinguished by its superior dimensions. In spite, however, of these differences, naturalists are in accord in regarding the glutton (or, as it is called in America, wolverene) as a member of the typical or weasel-like section of the family.

The glutton, which is an inhabitant of the northern regions of both the Western and Eastern Hemispheres, has the same number of teeth as in the martens; but these are unusually large and powerful, and distantly recall those of the

hyænas. The whole animal is heavily and rather clumsily built, and walks with the greater part of the soles of the feet applied to the ground. The limbs are thick and rather short; the feet are provided with long, curved, and compressed claws, and have their soles thickly haired. The back is much arched, and both the head and tail are carried low. Dr. Coues compares the whole appearance of the animal to that of a bear cub, with a superadded tail. The head is broad and rounded, with a rather short and pointed muzzle, small and widely-separated eyes, and small rounded ears, projecting but little above the general level of the fur. The tail is comparatively short, thick, and bushy, with hairs varying from 6 to 8 inches in length; and it has somewhat the appearance of having been truncated at the end. The fur of the body and limbs is rather coarse, long, and thick; and there is also a thick woolly under-fur. The general colour is dusky or blackish brown; but there is a distinct band of chestnut, or some lighter tint, commencing behind the shoulders, then running along the flanks, and meeting its fellow at the root of the tail. The front and sides of the head are light grey, while upon the throat and chest there may be one or more light spots. The limbs and under-parts, together with most of the tail, are very dark. The claws are nearly white. There is considerable individual variation in the size of the glutton, the length of the head and body in seven examples measured by Dr. Coues varying from $26\frac{1}{2}$ to 36 inches; and that of the tail, with the hairs at the end, from $12\frac{1}{2}$ to 15 inches. About 29 inches may, however, be set down as the length of the head and body in average-sized specimens.

In Europe the glutton appears to have been long regarded as a kind of fabulous creature; and it is remarkable that it is known by the same name—*vielfrass*—in almost all the continental countries. What may be the meaning of this name is uncertain; some writers considering that it is compounded of two Swedish words signifying rock-cat, while others refuse to admit its Scandinavian origin. By the French Canadians the animal is termed *Carcajou*, and by the English residents of British North America, *Quickhatch*; the latter, and probably also the former, being derived from some almost unpronounceable native name.

Distribution. The glutton is a forest-haunting animal, and in America is to be found in all suitable districts to the north of the United States as far as the Arctic coast, traces of its presence having been observed on Melville Island, in about latitude 75° . Its southern limits on the eastern side of the continent may be set down as about latitude 42° or 43° , or, roughly speaking, that of Lake Erie; but on the western side it descends lower, having been definitely recorded from Salt Lake, while in the mountains it may extend as far as Arizona and New Mexico. The animal is, however, now virtually exterminated throughout the United States. In Europe the glutton is found at the present day in Norway, Sweden, Lapland, the north of Russia, namely, in the neighbourhood of the White Sea, in the Government of Perm, and the whole of Siberia, and Kamschatka. In the time of Eichwald it was still to be found in Lithuania, but is now extinct there. Solitary specimens have, indeed, been killed in Saxony and Brunswick; but these must be regarded merely as stragglers, and not as indicating that the range of the species extended so far south within historic times. At an earlier period of the earth's history the glutton ranged, however, to the British Isles, its fossilised remains

having been discovered in the caverns of Derbyshire, Glamorganshire, and the Vale of Clwyd, while they also occur in the older "forest-bed" of the Norfolk coast. Evidence of the former existence of the glutton on the continent has also been obtained in the caves of the Dordogne in the south of France.

Habits.

In habits the glutton is almost exclusively nocturnal, there being but few instances of its having been seen abroad during the day; and in two of these cases the animal was seen to sit up and shade its eyes with its paws, as if suffering from the unaccustomed light. The glutton does not hibernate, and there is no marked difference in the colour of the winter and summer coat. In spite of its clumsy-looking appearance the animal when disturbed can make off at a very rapid pace, and hunters who have occasionally seen a glutton in the shades of evening speak of the hopelessness of pursuing it. It likewise ascends rough-barked trees with facility, although it is said that its climbing powers are only exerted when it scents food. In the pursuit of prey the glutton will readily swim rivers. As a rule it is silent, although when attacked it will give vent to angry growls.

Gluttons are found either solitary or in pairs, but generally solitary. During the day they live concealed in subterranean holes, which are usually their breeding-places, and which are frequently the deserted lairs of bears. In North America the young are born in June or July, the number of individuals in a litter being, according to Coues, generally four or five, but it is stated that there are sometimes only a pair. The young remain with their mother till the following winter, when they have to shift for themselves. The Cree Indians state that the mother is exceedingly fierce when defending her offspring, and at such times will not hesitate to attack human beings.

In regard to food, it appears that the glutton will devour any animal that it can catch and overmaster, and that it is by no means averse to carrion. The activity of the animal is such that it can at times, according to Dr. Coues, capture such nimble prey as hares and grouse, while disabled or weakly deer are always successfully attacked. The stories of its attacking healthy full-grown reindeer are, however, improbable. Foxes, rabbits, marmots, etc., are dug out from their burrows and eaten.

Although much exaggerated by the older writers, the voracity of the glutton is extreme. It is stated by North American hunters that a freshly-killed animal may be safely left out in the woods for the first night, as the glutton will not touch it; but the second night the animal will return and gorge itself on the flesh, burying such portions as it is unable to consume. So pertinacious, indeed, are these animals in quest of slaughtered carcasses, that they have even been known to gnaw through a thick log of wood and to dig a hole several feet deep in frozen ground, in order to gain access to the body of a deer concealed by hunters.

Gluttons are in the habit of robbing the traps set for other animals, and when one of them has discovered a line of marten traps the trapper may as well relinquish his trade until he has destroyed the marauder. Every trap along the line will be pulled to pieces and the bait or captured marten removed; and after the hunger of the glutton is satisfied the remainder of the booty will be buried. Another curious propensity of the glutton is its habit of stealing and hiding articles which can be

of no possible use to it; and one instance is recorded where these animals removed and concealed the whole paraphernalia of an unoccupied hunter's lodge, including such articles as guns, axes, knives, cooking vessels, and blankets.

Capture. Dr. Coues states that the glutton "may be captured in wooden traps similar to those used for martens, but of course made on a much larger scale, as the animal's strength is enormous, even for its size. The traps are sometimes built with two doors; but so great is the cunning and sagacity of the beast, that the contrivance for its destruction must be very perfect. The traps should be covered up with pine-brush, and made to resemble a *câche* as much as possible, as the wolverene is then likely to break in and get caught. The bait, ordinarily the conspicuous feature of a trap, must in this instance be concealed, or the animal will either break in from behind or, failing in this, will pass on his way. It is sometimes also taken in steel traps, or by means of a set gun, but both these methods are uncertain."

THE SKUNKS.

Genera *Mephitis* and *Conepatus*.

The handsome but ill-savoured skunks introduce us to the second great group of the present family, which includes the skunks, badgers, and their allies, and is characterised as follows. The feet are long, with straight toes, and the claws are blunt, but slightly curved and compressed, and quite incapable of retraction; those of the fore-feet being remarkable for their large size. The form of the molar tooth of the upper jaw is somewhat variable. Most of the members of this group are terrestrial and fossorial in their habits.

The skunks, of which there are several species, are an exclusively American group, of which all but one are referred to the genus *Mephitis*; our example on page 76 being the exception, and forming the genus *Conepatus*.

The typical forms have 34 teeth, of which $\frac{3}{8}$ are incisors, $\frac{1}{2}$ canines, $\frac{3}{8}$ premolars, and $\frac{1}{2}$ molars; and the whole of them are easily recognised by their large bushy tails, usually carried over the back, and their general black colour variegated with white stripes on the back; this coloration being another instance of the tendency of the upper part of the body to be lighter than the lower among many members of the family.

Common Skunk. The common skunk (*Mephitis mephitis*) is an inhabitant of Northern and Central America, ranging from Hudson's Bay in the north to Guatemala in the south, and it may be compared in size to a rather small cat, the length of the head and body always exceeding a foot, although there is considerable local variation in this respect. It is a stoutly-built animal, with a small head, short and rounded ears, a moderately-elongated body, and legs of medium length; the mode of walking being partially plantigrade. The long and bushy tail is thickly clothed with very long and fine hair, and is, as already mentioned, generally carried curled over the back when the animal is walking. Its length, inclusive of the hair, is somewhat less than that of the head and body. The general colour of the moderately long hair of the body is black or blackish;

and, although there is a great amount of individual variation, the white markings usually take the form of a streak on the forehead, a spot on the neck, and two stripes running down the back. The tail is black, more or less mixed with white, or merely tipped with the same. In some cases the white stripes do not extend beyond the neck, so that the back is entirely black.

Long-Tailed Skunk. The nearly-allied long-tailed skunk (*M. macrura*) from Mexico differs by its longer and more bushy tail, of which the whole length is not less than that of the head and body.

Lesser Skunk. More distinct is the lesser skunk (*M. putorius*), ranging from the southern United States to Yucatan and Guatemala. This species never exceeds a foot in length from the snout to the root of the tail, the whole tail being distinctly shorter than the head and body. It has four interrupted white stripes on the body, together with some spots, and the tail is tipped with white. There are also certain differences in the characters of the skull.

White-Backed Skunk. In South America the group is represented by a very distinct species known as the white-backed skunk (*Conepatus mapurito*), which is the one figured in our illustration. This skunk differs from all the others by its heavier build and more pig-like head and snout, in which the nostrils are directed downwards and forwards, instead of laterally. There are, moreover, important differences in the form of the skull and teeth, the latter being usually only thirty-two in number, owing to the absence of the first pair of premolar teeth in the lower jaw. Then, again, the ears are extremely small, and the tail is shorter and less bushy than in the other skunks. In size this species is the largest of the group, some specimens attaining a length of about 24 inches, exclusive of the tail, although the more usual dimension is about 18 inches. The colour is even more variable than in the common skunk, but in general the two white stripes on the back are very wide, and may either completely unite, or, as in our illustration, be separated merely by a narrow dark band, the tail being either pure white or black and white. The coloration of this species shows, therefore, very markedly the general light colour of the upper, as compared with the lower surface of the body.

The range of this species extends northwards from Patagonia and Chili through Central America to Texas.

Habits. Subject to certain modifications, engendered by their surroundings, the habits of all the species of skunks are very similar, and they will accordingly be treated of collectively.

Skunks are good climbers, but appear to prefer clearings and open glades rather than dense forests, and they may be frequently found in the neighbourhood of human dwellings; although in Patagonia and the Argentine pampas they inhabit perfectly open country. In common with other members of the family they are largely nocturnal, but may be met with walking abroad in the evenings in North America, while Darwin states that in Patagonia the white-backed species, "conscious of its power, roams by day about the open plains, and fears neither dog nor man."

This indifference to the presence of other creatures is, indeed, one of the most striking characteristics of the group, and is, as suggested in the passage cited, doubtless due to the immunity of attack which these creatures possess, owing to their nauseous secretion. Thus Mr. Belt states that in Nicaragua "the skunk goes

leisurely along at night, holding up his white tail as a danger-signal for none to come within range of his nauseous artillery." And Dr. Merriam relates that so indifferent is the common skunk to the presence of man, that in many parts of the United States these creatures are not unfrequently run over in the evenings on the roads by passing vehicles. The peculiar and conspicuous coloration of the skunks is generally regarded by naturalists as belonging to the class of so-called "warning colours." Such warning colours would seem, observes Mr. Poulton, "to benefit the would-be enemies rather than the conspicuous forms themselves. . . . But the conspicuous animal is greatly benefited by its warning colours. If it resembled its



THE WHITE-BACKED SKUNK ($\frac{1}{3}$ nat. size).

surroundings, like the members of the other class, it would be liable to a great deal of accidental or experimental tasting, and there would be nothing about it to impress the memory of an enemy, and thus to prevent the continual destruction of individuals. The object of warning colours is to assist the education of enemies, enabling them to easily learn and remember the animals which are to be avoided."

In the Adirondaek region the chief food of the common skunk consists of mice, salamanders, frogs, and the eggs of birds that nest on or near the ground, while such hens' nests as are met with are sure to be robbed, and an occasional raid is made on the poultry-yard. A large number of beetles, grasshoppers, and other insects are likewise consumed by these animals.

Owing to its fearless and unsuspecting nature, the North-American skunk may be taken in almost any kind of trap; and these animals are often a considerable annoyance to the trapper owing to their habit of frequently entering the snares set for more valuable quarry. The skunk, observes Dr. Merriam, is slow in movement and deliberate in action, and does not often hurry himself in whatever he does. His ordinary gait is a measured walk, but when pressed for time he breaks into a slow, shuffling gallop. It is hard to intimidate a skunk, but when once really frightened he manages to get over the ground at a very fair pace.

The same writer further observes that in the Adirondack region skunks remain active during the greater part of the year, and hibernate only during the severest part of the winter. "They differ from most of our hibernating mammals in that the inactive period is, apparently, dependent solely upon the temperature. That the amount of snow has no influence upon their movements is evident from the fact that they are frequently out, in numbers, when its average depth exceeds five feet on the level. Neither can it be a difference in food-supply that affects them, for at this season they subsist almost entirely upon mice and shrews, and I have repeatedly noticed these little beasts scampering about on the crisp snow when the thermometer indicated a temperature below 20° F." In the more southern districts of North America skunks doubtless remain active throughout the year, and the same is probably the case with those inhabiting Central and South America.

The nests of these animals are formed either in holes in the ground, in hollow trunks of trees, or among rocks; and in the North-American species the number in a litter is usually from six to ten. The young are born in the spring, and generally remain with their parents as inhabitants of the same hole till the following spring, when they have to make way for a fresh family. Dr. Merriam states that if a trap be set at the entrance of one of these holes the whole family may commonly be captured, at the rate of one per night. Surprising as it may at first sight appear, the common skunk, especially when captured young, is said to make a pretty and agreeable pet, gentle in manners, and cleanly in habits; while the beauty of its fur makes its personal appearance highly attractive. Moreover, the flesh of these animals is said to be white, delicate, and highly palatable.

The secretion that has given the skunk such an ill name is contained in a pair of glands situated beneath the tail, and can be ejected at the will of the animal; such ejection taking place only when the creature is attacked or irritated. So forcibly can the fluid (which is of an amber colour) be ejected, that it will carry from a distance of 13 feet to a little over 16 feet. It appears that there is a marked difference in the intensity of the odour of the secretion in different individuals of the common skunk, which is probably in part due to the age of the animal, and in part to the length of time which has elapsed since the preceding discharge took place. When freshly ejected, the fumes from the secretion are pungent and acrid in the extreme, and are probably capable of producing extensive swelling of the respiratory passages. Dr. Merriam states that "when inhaled without the admixture of a large amount of atmospheric air the unhappy victim loses consciousness and breathes stertorously, the temperature falls, and the pulse slackens, and if the inhalation were prolonged the results would doubtless prove

fatal." It has been stated that the secretion is not only used as a means of defence but also as a means of attracting these animals towards one another. This, however, is strenuously denied by Dr. Merriam.

Of the lasting and pernicious effects of even a drop of skunk secretion, no more striking instance exists than one recently published by Mr. W. H. Hudson, who writes of the South-American species. This observer relates, as a not uncommon event on the Argentine pampas, that a settler starts one evening to ride to a dance at a neighbour's house. "It is a dark windy evening, but there is a convenient bridle-path through the dense thicket of giant thistles, and striking it he puts his horse into a swinging gallop. Unhappily the path is already occupied by a skunk, invisible in the darkness, that, in obedience to the promptings of its insane instinct, refuses to get out of it, until the flying hoofs hit it and send it like a well-kicked football into the thistles. But the fore-feet of the horse, up as high as his knees perhaps, have been sprinkled, and the rider, after coming out into the open, dismounts and walks away twenty yards from his animal, and literally smells himself all over, and with a feeling of profound relief pronounces himself clean. Not the minutest drop of the diabolical spray has touched his dancing-shoes. Springing into the saddle he proceeds to his journey's end, and is warmly welcomed by his host. In a little while people begin exchanging whispers and significant glances; . . . ladies cough and put their handkerchiefs to their noses, and presently begin to feel faint and retire from the room. Our hero begins to notice that there is something wrong, and presently discovers its cause; he, unhappily, has been the last person to remark that familiar but most abominable odour, rising like a deadly exhalation from the floor, conquering all other odours, and every moment becoming more powerful. A drop has touched his shoe after all."

Fossil Skunks. Fossil remains of skunks belonging to the same genus as the species still inhabiting the country are met with in the caverns of Lagoa Santa in Brazil, where they are accompanied by those of a number of other animals of totally extinct types.

THE CAPE POLECAT.

Genus *Ictonyx*.

As will be apparent at a glance from our illustration, the South-African animal, commonly known as the Cape polecat (*Ictonyx zorilla*), is so like a small skunk in coloration and general appearance that it might well be taken for a member of the same group. Although the number of the teeth in the present animal is the same as in the skunks, the teeth themselves are relatively smaller than in the latter, with smaller cusps, and are thus more like those of the polecat, between which and the skunks the Cape polecat appears to form a kind of connecting link. A skull of the present animal may be readily distinguished from that of a skunk by the upper molar tooth being smaller, instead of larger, than the flesh-tooth.

In size the Cape polecat agrees approximately with the true polecat, and has a somewhat similarly-shaped body, and proportionately short limbs. The head is

broad, and the muzzle long and sharp, while the ears are very small and rounded. The tail is comparatively long and bushy, and about three-quarters the length of the head and body; and the whole of the fur is relatively long and thick. The ground-colour of the fur is a glossy-black, marked with a variable number of white stripes and spots. Frequently, as in our illustration, there is a white spot between the eyes, and another over each of the latter; but sometimes all the three



THE CAPE POLECAT ($\frac{1}{3}$ nat. size).

are united. The hinder-part of the head is frequently white, and from this white area there are given off pure white stripes (separated by three narrow black ones), which unite near the tail; the upper part of the latter being also mostly white. In other cases, however, the whole of the hinder-parts of the head, the neck, and the anterior portion of the back are white.

Distribution.

The Cape polecat ranges from the Cape to Senegal; but in Sennaar and Egypt it is replaced by another nearly-allied species (*I. frenata*).

It is probably the latter which, according to Brehm, ranges across the Isthmus of Suez into Asia Minor, and the neighbourhood of Constantinople.

Habits. These animals frequent rocky districts, hiding either in the clefts of rocks, or among bushes and trees, and are purely nocturnal. They feed on mice and other small mammals, birds and their eggs, and lizards and frogs; and in inhabited districts they destroy poultry. In their general habits they are unlike the martens and polecats, being unable to climb, and only taking to the water under compunction, although, when the necessity arises, they can swim well. Their great protection against their foes is their intolerable odour, which is described as being almost, if not quite, as offensive as that of the skunks. In many houses of the Dutch boers of South America tame individuals of the Cape polecat may be found, which are kept for the purpose of catching rats and mice.

THE FERRET-BADGERS.

Genus *Helictis*.

The ferret-badgers form a small group of four species from Eastern Asia, which in some respects serve to connect the preceding forms with the true badgers, having relatively longer bodies, shorter limbs, and longer tails than the latter. They are all of comparatively small size, and are distinguished from the other members of the badger-like group by having the under-surface of the body lighter coloured than the back. One species is further remarkable for the brilliant orange tint of the under-parts and portions of the head.

All these animals have the same number of teeth as the martens; the upper molar and flesh-tooth being remarkable for their broad and squared crowns. The head is elongated, and terminates in a prolonged and naked muzzle, with obliquely truncated nostrils; and the ears are small but distinct. The claws are very narrow, and about twice as long in the fore as in the hind-feet; the soles of the feet being naked. The tail, which is more or less bushy, may be either rather more or rather less than half the length of the head and body.

Of the four species, the brown ferret-badger (*Helictis orientalis*), in which the length of the head and body is 16 inches, and that of the tail, with the hair, 9 inches, inhabits the Nipal Himalaya and Java, and is characterised by its brown or yellowish brown colour, and its relatively long tail. The Burmese ferret-badger (*H. personata*), which differs in the greyish tint of the upper-parts, inhabits Lower Burma and Manipur, and probably some neighbouring districts. The two remaining species, viz. *H. moschata* and *H. sabaurantiaca* are from China. The latter is characterised by its relatively short tail, and the brilliant orange colour of the snout and the sides and the under-parts of the head and throat; the ears, a stripe down the neck, and the under-parts and feet being yellow. The upper-part of the head and face is chocolate-brown, forming a most marked contrast with the orange; while the back and tail are olive-colour.

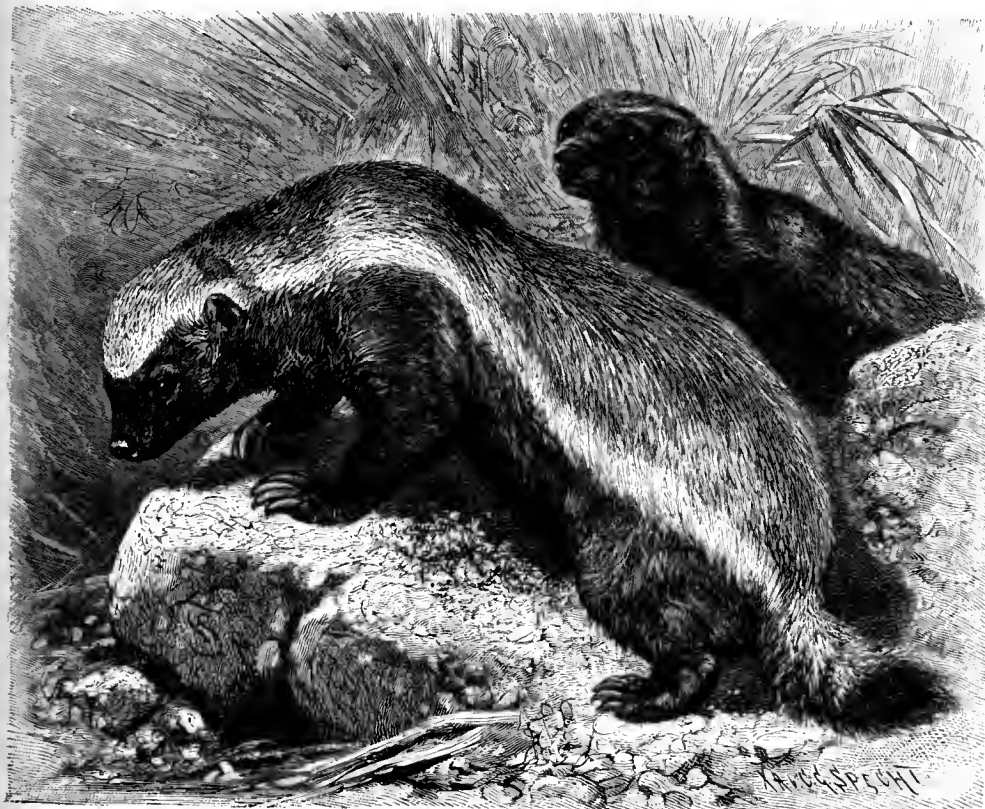
Habits. The ferret-badgers are purely nocturnal, and differ from the other members of the present group in being able to climb with facility. The Indian species are almost omnivorous in their food, eating both

small mammals and birds as well as fruits and insects. All the species live in forests as a rule.

THE RATELS.

Genus *Mellivora*.

The ratels or, as they are frequently called, honey-badgers, are distinguished from all the members of the family hitherto noticed by their more badger-like shape, very short tails, and the absence of any external ears. They are aptly



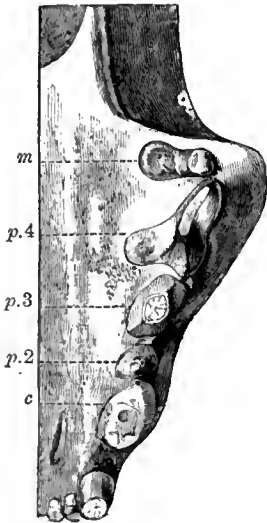
THE CAPE RATEL ($\frac{1}{3}$ nat. size).

compared in gait and appearance by Mr. Blanford to small bears. There are but two living species, of which one is confined to India, and the other to Africa.

In addition to their short tails and the absence of external ears, the ratels are characterised by their stoutly-built bodies, and short, powerful limbs, of which the front pair are provided with enormous claws. They walk with the greater part of the naked soles of the feet applied to the ground. As regards coloration, they show in a most marked degree the peculiarity to which we have already referred as characterising many members of the family; that is to say, the under-parts are dark, and the upper-parts lighter. In the present instance, the whole of the

muzzle, together with the under-parts of the head, body, and tail, and the entire limbs, are black; while the upper portion of the head, body, and fore-half of the tail are whitish grey.

The skulls of the ratels may be distinguished by the small number of the large and powerful teeth. The total number is only 32, there being but three pairs of premolar teeth in each jaw, and no tubercular molar in the lower jaw behind the flesh-tooth. The upper teeth, as shown in the figure of the palate of a fossil species, are characterised by the molar (*m*) being very narrow from front to back, and of the characteristic musteline dumb-bell-shape; and also by the flesh-tooth, or fourth premolar (*p.4*), being larger than the molar, with the tubercle on the inner side placed near the front edge. Moreover, in the lower jaw, the flesh-tooth has a very minute heel at its hinder end. The ratels may be compared in size to a badger, the length of the head and body of the Indian species varying from about 26 to 32 inches, and that of the tail, inclusive of the hair, from 6 to 6½ inches.



THE RIGHT HALF OF THE PALATE OF THE FOSSIL INDIAN RATEL.

m. molar tooth; *p.4*, fourth premolar, or flesh-tooth; *c.* canine tooth, or tusk (broken).

Distribution. The Indian ratel (*Mellivora indica*) is

found from the Himalaya to Cape Comorin, but is unknown in Ceylon or to the eastwards of the Bay of Bengal. The African species (*M. ratel*) occurs throughout Africa, but more especially in the southern and western parts of the continent. Mr. Blanford has some doubts as to whether the African and Indian ratels are really entitled to be regarded as distinct species; but the former, as shown in our illustration on page 81, is distinguished by the

presence of a well-marked white line dividing the dark area of the under-parts from the grey of the back.

Habits.

Both species are strictly nocturnal in their habits, and reside during the day in burrows, which are probably excavated by themselves. The Indian species is most commonly met with in hilly regions, or along the high-scarped banks of the great rivers, which afford good situations in which to construct its burrows. Ratels generally go about in pairs, and feed on rats, birds, frogs, insects, and honey; while in cultivated districts they commit frequent raids on poultry. The accusation of digging up corpses from graveyards, which has earned for the Indian species the name of "Gravedigger" among Anglo-Indians, is, according to Mr. Blanford, probably unfounded. The African species exhibits a very strongly-marked taste for honey, together with the larvæ of bees in the combs; digging out the latter from hollow trees by the aid of its powerful front claws. The account given by Sparrmann of the ratel's mode of operations when about to attack a bees' nest is not, however, to be wholly relied upon, since it is largely drawn from native sources of information.

In captivity ratels are easily tamed, and frequently exhibit a peculiar habit of turning complete somersaults each time they walk up and down the cages in which they are confined.

Fossil Ratels. From the rocks of the Siwalik Hills of North-Eastern India, belonging to the Pliocene period, and likewise from formations of corresponding age in the Punjab, there have been obtained the remains of ratels closely allied to the living species; so that it may be concluded that India was the original home of these animals, and that thence they migrated into Africa.

THE AMERICAN BADGER.

Genus *Taxidea*.

The American badger (*Taxidea americana*) brings us to the first of four genera which may be collectively called badgers, and the whole of which are confined to the Northern Hemisphere. They all have the same number of teeth as in the martens, that is to say, 38, of which $\frac{3}{4}$ are incisors, $\frac{1}{2}$ canines, $\frac{1}{4}$ premolars, and $\frac{1}{2}$ molars on each side of the jaws. All of them have stoutly built bodies, and short limbs adapted for digging; while, with one exception, the tail is very short. They are further characterised by the unusually large size of the molar tooth of the upper jaw, and likewise by the elongation of the posterior heel of the flesh-tooth of the lower jaw.

In the American badger the skull is very wide posteriorly, the body depressed, and the tail very short. The skull may be at once distinguished from that of the true badgers by the proportionately larger size of the upper flesh-tooth, and the smaller upper molar, which is triangular in form, with the apex directed outwards. The fore-claws are enormous, the eyes are very small, and the muzzle is hairy right up to the obliquely truncated nostrils. The low, rounded, and broad ears are remarkable for the large size of their apertures. In length the animal, from the snout to the root of the tail, measures about 24 inches, and the tail 6 inches. The general colour of the coarse fur of the body is a blackish grizzle, mingled with either white, grey, or tawny, or the whole of these together, on the upper-parts, while below it is uniformly whitish, sometimes shaded with grey or tawny. The head is darker than the body, with a white stripe down the middle, and the limbs are blackish brown.

Distribution. The ordinary form of the American badger extends from British North America, from at least latitude 58°, over the greater portion of the United States. Near the Mexican border of the States, as in Eastern and Central Mexico itself, it is, however, replaced by a variety distinguished by a white stripe, sometimes interrupted, running down the back from the nose to the tail.

Habits. In habits the American badger appears to closely resemble the common European species, being strictly nocturnal, and living in burrows constructed by itself. In the colder portion of its habitat it hibernates. Although but very seldom seen, Dr. Coues states that these animals live in countless numbers in the region of the upper Missouri River and its tributaries; tracts of sandy soil being so full of their burrows as to render travelling on horseback dangerous. These badger-holes can be distinguished from those of the prairie-marmot by their larger size and the absence of a circular mound of earth at their entrance; though many such holes are merely burrows of the prairie-marmot,

which have been enlarged by the badger in order to capture the original excavator. This abundance of the American badger is doubtless largely due to its immunity from foes and the plentiful supply of food.

In addition to the various species of Rodents, which form its principal food, the American badger will also eat smaller animals,—even insects and snails,—while it is also partial to birds' eggs and to bees' nests with their honey and larvæ. In disposition it is shy and retiring, always seeking to avoid rather than to court danger. If brought to bay, it will fight with all the fierceness and stubbornness characteristic of its European cousin, and it also exhibits the same tenacity of life. In some parts of the Western States badger-baiting used to be as favourite a sport as it once was in our own country, but it is now discontinued.

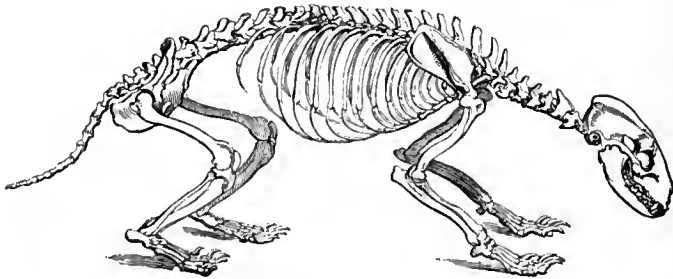
But little appears to have been ascertained as to the breeding habits of the American badger, but it seems that three or four is the usual number in a litter. In British North America the period of hibernation lasts from October till April, and the animals are said to come forth after their long fast in good condition.

Fur. American badger fur is of some value, and is at times largely used for robes, muffs, tippets, and trimmings; while a considerable quantity of the long hairs are employed in the manufacture of shaving and other brushes, although in many cases the hairs are too soft for this purpose. In 1873 the prices of American badger skins varied from one to seven shillings each in London; while three years later the price per skin for the best samples in New York was one dollar. At the present time, according to Mr. Poland, the price in London varies from six to twenty-two shillings.

THE COMMON BADGER.

Genus *Meles*.

The common badger (*Meles taxus*) is the best known member of a group of five closely-allied species distributed over a considerable portion of Europe and Asia, although unknown in the Indian and Malayan regions. All these



SKELETON OF THE COMMON BADGER.

animals are readily distinguished from the American badger by the characters of the skull and teeth. The skull itself is characterised by the great height of the bony ridge running along the middle of the brain-case, and affording attachment for the powerful muscles which render the badger's bite so

severe. Then, again, the upper molar tooth, instead of being triangular and of nearly the same size as the flesh-tooth, is oblong in form, and very much larger than the latter, recalling in this respect the corresponding tooth of the bears; a further analogy with that group being presented by the small size of the first three premolar teeth. Another feature in which the true badgers differ from the American badger is to be found in the great development of the posterior heel of the lower flesh-tooth, which exceeds in length the whole of the remainder of the



THE COMMON BADGER (1 nat. size).

tooth, this expanded heel having to bite against the enlarged upper molar tooth. The skull of the badger is also peculiar on account of the close interlocking of the lower jaw with the skull proper, the articulation being so perfect that it is impracticable to detach the one from the other without fracture. Needless to say, it is, therefore, impossible for one of these animals to dislocate its lower jaw.

In general bodily conformation the Old World badgers very closely resemble their transatlantic ally; and their hairs are similarly banded with different colours, producing the well-known grizzled hue of the fur so characteristic of all these animals. The skin of the common badger is remarkably large and loose, enabling

the animal, when seized by almost any part, to turn and bite its aggressor; and the fur is long and loose. With the exception of a black stripe on each side, starting between the nose and the eye and running backwards to include the ear (of which the tip is white), the head of the badger is white. The lower jaw, throat, and all the under-parts, as well as the limbs, are black; while the upper-parts are reddish grey, and the flanks and tail light grey. The length of a full-grown badger from the snout to the root of the tail, will vary from about 25 to 29 inches, that of the tail being about $7\frac{1}{2}$ inches; and the weight has been estimated at from 25 to 30 lbs.

Distribution. The common badger or, as it used to be called in England, the brock, is distributed over the whole of Europe, with the exception of the north of Scandinavia and the island of Sardinia; and it is also widely spread over Northern Asia, where it ranges in Siberia as far as the river Lena. It is probably also this species which inhabits Syria; but it is at present uncertain where the range of the common badger in Western Asia terminates, and where that of the smaller and paler coloured Persian badger (*M. canescens*) of Eastern Persia commences. In China and other parts of continental Asia the group is represented by the white-tailed badger (*M. leucurus*) and the Chinese badger (*M. chinensis*); while a fifth species (*M. anacuma*) inhabits Japan.

Habits. On the continent, especially in many parts of Germany (where it is known as *dachs*), the badger is very common, and does much damage to the vineyards. In the British Islands, as we may judge both from the frequency with which its remains are met with in the cavern and other superficial deposits, as well as from the number of places in England, such as Brockenhurst and Brockley, which derive their names from this animal, the badger must once have been very commonly distributed. At the present day, writes Mr. J. E. Harting, "many people seem to be under the impression that the badger, if not actually extinct in the British Islands, is at all events a very scarce animal. This is far from being the case. In many parts of the country the badger is still not at all uncommon, and in certain districts which might be named it is even on the increase, owing to the protection afforded it. The reason for its supposed scarcity arises from two causes, firstly, the nature of its haunts, which are generally in the deep recesses of large woods, fox-covers, and quarries; and, secondly, the nature of its habits, which are shy and retiring, and chiefly nocturnal."

The favourite haunts of the badger are the deepest and thickest woods, or coppice-clad cliffs and quarries; and in such situations it digs a large and roomy burrow. Here it sleeps during the day, issuing forth at evening in search of food, and sometimes joining with its fellows in this quest; Mr. Harting having observed three badgers together in Gloucestershire, while the late Mr. C. St. John on one occasion saw no less than seven in company on the shore of Loch Ness. In the colder portions of its habitat the badger hibernates during the winter, the length of the hibernation depending upon the latitude and the degree of severity of the season. In England the hibernation appears to be always interrupted. Mr. Ellis, of Loughborough, who has a number of badgers on his estate, recently wrote that he has known one of the burrows covered with snow for a fortnight or more, during which time the animals remained below, and only ventured out when a thaw came. In Sweden it is stated that badgers generally retire about the middle of

November, and do not reappear till the middle of the following March, unless there should be a protracted thaw, during which they will sally forth in search of food. In order to afford additional security, the mouth of the burrow is blocked from the inside by its occupant. The burrow is always kept scrupulously clean, and is lined with fern and other vegetable substances; and Mr. Ellis states that "as the winter approaches, the old bedding is replaced by dry fern and grass raked together by the badger's powerful claws. This is often left to wither in little heaps till dry enough for the purpose. Partially concealed, I have watched a badger gathering fern, and using a force in its collection quite surprising."

The peculiar conformation of the upper molar teeth of the badger at once proclaims that the diet of the animal is by no means exclusively carnivorous; and Professor T. Bell states that its food "consists indifferently of various roots, earth-nuts, beech-mast, fruits, the eggs of birds, some of the smaller mammals, frogs, and insects." It is also ascertained that the badger is in the habit of digging up wasps' nests for the purpose of feeding upon the larvæ in the combs; and it has an equal partiality for the contents of the nests of wild bees.

It has been very generally asserted that badgers and foxes do not get on well together, and that the former kill the cubs of the latter. Mr. Ellis states, however, that, on his estate at least, "the badgers and the foxes are not unfriendly, and last spring a litter of cubs was brought forth very near the badgers; but their mother removed them after they had grown familiar, as she probably thought they were showing themselves more than was prudent." Mr. Harting also mentions more than one instance where these two animals have lived amicably together in the same burrow; in one of these cases a fox having annually given birth to cubs in the badger's den.

Within the deep recesses of its burrow, which often terminates in a fork-like manner, are born the young of the badger; the number in a litter being usually three or four. The young are produced during the summer; and are at first blind, not acquiring the power of sight till the tenth day. It is a curious, but apparently well-ascertained circumstance, that the female badger, like the roe-deer, has the power of extending the time of gestation considerably beyond the usual period.

Quoting once more from Mr. Ellis, that gentleman, writing in the autumn of 1877, states that on his estate "in June the first young badger appeared at the mouth of the earth, and was soon followed by three others, and then by their mother. After this, they continued to show every evening, and soon learnt to take the food prepared for them. The young are now almost full grown, and, forgetting their natural timidity, will feed so near that I have placed my hand on the back of one of them. The old ones are more wary, but often feed with their family, although at a more cautious distance. Their hearing and sense of smell are most acute, and it is curious to see them watch, with lifted head and ears erect, then, if all is quiet, search the ground for a raisin or a date. But the least strange sight or sound alarms them, and they rush headlong to earth with amazing speed." When taken young, badgers may be easily and perfectly tamed.

Hunting.

The difficulty of "drawing a badger" when in a tub is well known, and tries the pluck of the best bred terriers to the utmost. It appears, however, that in Germany dachshunds usually bolt the badger from its

burrow, unless they are foiled by the creature digging deeper down and burying himself beneath the upturned soil. Other methods employed in Germany are either digging the animal out by following the course of the burrow, or by boring directly down upon it by means of a kind of gigantic corkscrew. Digging out is also sometimes resorted to in England, but the more common plan is to tie an empty sack, with a running noose round the mouth, in the entrance of the badger's burrow while the occupant is abroad, and then drive him in with dogs.

Fur. The fur and hairs of the common badger are used for the same purposes as those of its American cousin; but the hairs, being stiffer, are better adapted for brushes.

Fossil Badgers. It has already been mentioned that fossil remains of the common badger are met with in the cavern and other superficial deposits of this country; and it may be added that they also occur in those of the Continent. Beyond these, however, no fossil badgers have hitherto been met with, except in strata of the Pliocene period in Persia. When our comparatively full acquaintance with the extinct Tertiary Mammals of Europe and Northern India is taken into account, this remarkable absence of the remains of badgers is strongly suggestive that Persia or the adjacent regions must have been the original ancestral home of these animals, from whence they migrated westwards.

THE MALAYAN BADGER.

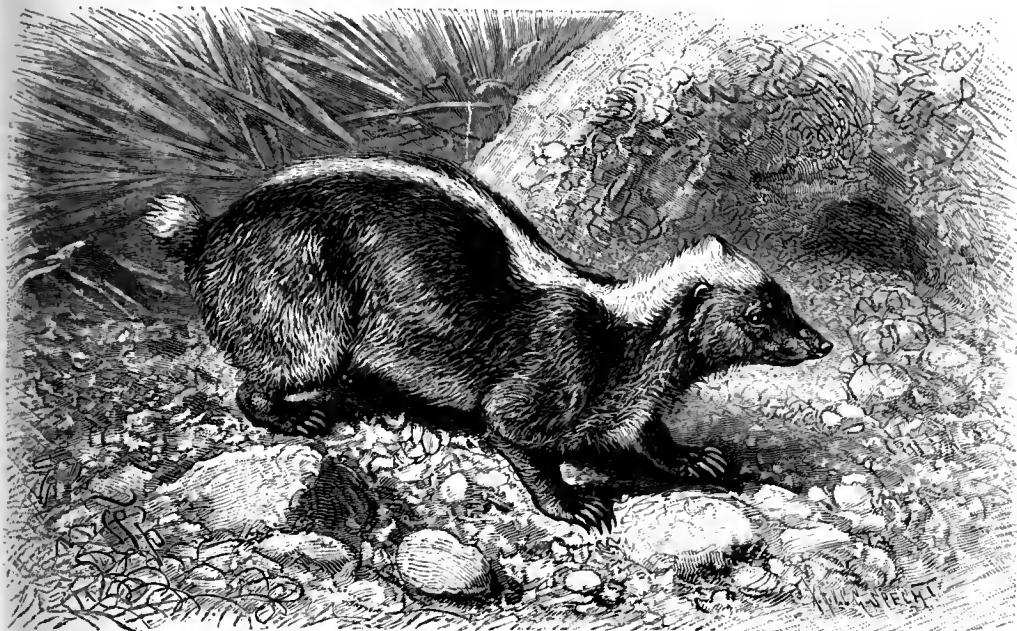
Genus *Mydaus*.

As being the sole representative of the badgers inhabiting the islands of the Malayan region, the curious looking animal depicted in the accompanying illustration may be appropriately designated the Malayan badger. It is known to the natives of Java as the Teledu, while by the Germans it is termed, on account of its evil odour, Stinkdachs; its technical name being *Mydaus meliceps*.

The Malayan badger forms a kind of connecting link between the true badgers and the under-mentioned sand-badgers, having a tail shorter than in the former, while its cheek-teeth are much more like those of the latter. It is a comparatively small animal, the length of the head and body being about 15 inches, and that of the stumpy tail only some $\frac{3}{4}$ of an inch. With the exception of the back of the head, the top of the neck, a stripe down the back, and the tip of the tail, which are whitish, the general colour of the long and thick fur is dark brown, but lighter below than above. There is a kind of crest of long hair on the back of the head and neck. The muzzle is long and pointed, and almost entirely naked in front of the eyes, with the flesh-coloured nostrils obliquely truncated and mobile. The Malayan badger appears to be confined to the mountains of Java, Sumatra, and Borneo, ranging in the former island from an elevation of about five hundred to upwards of seven thousand feet above the level of the sea. In Borneo it is found at elevations of not more than eighty or one hundred feet, and in Sumatra does not ascend above one thousand feet. It is a nocturnal and burrowing animal, not uncommon in some districts.

Horsfield, the original describer of this animal, says that when killed carefully,

and the scent-glands immediately removed, the flesh of the Malayan badger is quite free from odour, and far from unpalatable. The secretion of the glands is, however, foetid in the extreme, and has been compared to that of the skunks. As in the latter, it can be ejected by the animal to a considerable distance. We have but little information as to the habits of this animal in a wild state: but it is stated to be gentle and easily tamed when in captivity.



THE MALAYAN BADGER ($\frac{1}{2}$ nat. size).

THE SAND-BADGER.

Genus *Arctonyx*.

With the sand-badger or, as it is often termed, the hog-badger (*Arctonyx collaris*), we come to our last representative of the badgers, and at the same time of the present section of the Weasel family. The ordinary sand-badger is an Indian species, ranging from the Eastern Himalaya through Assam and the neighbouring regions to Tenasserim and Lower Burma. There is, however, also a smaller species (*A. taxoides*), inhabiting Assam and Arakan, and possibly China; while there is probably a third in Eastern Tibet.

The sand-badgers are easily distinguished from the other members of the group by their proportionately longer tails; that of the Indian species being from a quarter to a third the length of the head and body. The long and naked snout is very like that of the Malayan badger; the eyes are small, and the ears also small and rounded. The body is rather flattened from side to side; and only a portion of the naked soles of the feet are applied to the ground in walking, so that these animals may be described as digitigrade rather than plantigrade when in motion.

The pelage consists of a full soft under-fur, mingled with long stiff hairs. In colour the Indian sand-badger is dirty grey both above and below, with a more or less marked blackish tinge on the back, most of the individual hairs being dirty white throughout their length, but the longer ones on the back and sides having black tips. The head is white, with some variable black bands, while the lower parts and limbs are dusky, the limbs being sometimes black. Here, then, we have another instance of the tendency in the present family for the under-parts to be lighter than the upper regions. In length the Indian sand-badger measures about 30 inches from the snout to the root of the tail; the length of the latter, inclusive of the hair at the tip, being about 11 inches.

The most marked peculiarities of these animals are, however, to be found in the structure of their skulls. Thus the skull differs from that of any other mammals, except some of the edentates and dolphins, in having the bony palate prolonged as far back as the level of the cavity for the reception of the condyle of the lower jaw. The teeth are numerically the same as in the true badgers, but the upper molar tooth, instead of forming a regular oblong, has its hindmost outer angle excavated, so that the inner border of the tooth is much longer than the outer one. The first premolar tooth in the upper jaw is very minute, and is often soon shed.

Habits.

Writing of the habits of the Indian sand-badger, from notes supplied by Colonel Tickell, Mr. Blanford states that it "frequents undulating stony ground or small hills among jungle, and lives in fissures of the rocks or holes dug by itself. It is thoroughly nocturnal. In captivity it is dull and uninteresting, feeding voraciously on meats, fish, reptiles, or fruits, and it is particularly fond of earth-worms. One individual used to pass the day sleeping in a hole that it had dug, and was very savage if disturbed. When angry it made a loud grunting noise and bit fiercely. It was dull of sight, and its only acute sense appeared to be that of smell. It was in the habit of raising its snout in the air in order to scent any one who approached, much as a pig does. This animal had no disagreeable smell."

THE OTTERS.

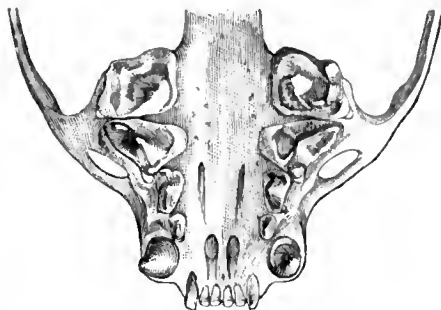
Genus *Lutra*.

The otters, which, with the sole exception of the sea-otter, are included in a single genus, constitute the third and last main group into which the members of the Weasel family are divided. They are characterised generally by their short and rounded feet,—although the hind-feet of the sea-otter are an exception in this respect,—their webbed toes, and their small, curved, and blunt claws. They all have very broad and flattened heads, furnished with small external ears, and joined to the long flattened body by a thick neck, which passes imperceptibly from the head in front into the trunk behind. The tail is moderately long, while the limbs are extremely short. The fur is soft, thick, and of a uniformly brownish colour over the whole body, except on the under-parts, where it is generally of a more greyish hue. The teeth of the otters are characterised by the nearly square form of the molar in the upper jaw, which, as shown in the accompanying figure, has its inner

portion much expanded. All the species of these animals are thoroughly aquatic in their habits.

The typical otters, which include all the species except the sea-otter, are characterised by their hind-feet being of normal form, and by the number and structure of their teeth. As a rule, the total number of teeth is 36, of which, on each side of the jaws, $\frac{3}{4}$ are incisors, $\frac{1}{4}$ canines, $\frac{3}{4}$ premolars, and $\frac{1}{2}$ molars. The first premolar tooth in the upper jaw is, however, always very small, and in some species (as in the case of the palate here figured) may be totally wanting, thus reducing the number of the teeth to 34.

The general characteristics of the teeth of the upper jaw will be apparent from the figure, and it will be seen that the hinder teeth are furnished with a number of sharp cusps, admirably adapted to assist in retaining the slippery prey of these animals. In addition to the peculiar characters of the teeth, the skull of an otter may always be recognised at a glance by its extreme constriction immediately behind the sockets of the eyes, and the equally marked expansion of the flattened brain-case; the portion of the skull forming the face being also very short in proportion to the remainder. The tail is thick at the base, and somewhat flattened from above downwards. In most cases there are short claws on all the feet, but in a few species they may be either rudimentary or absent.



PALATE OF THE CLAWLESS OTTER.

The uppermost tooth on each side is the molar, immediately below which is the flesh-tooth.

In all parts of their organisation otters are admirably adapted for their particular mode of life; their elongated forms, with but slight constriction at the neck, being perfectly suited to glide through the water with the greatest ease and speed; their thick, dense fur forming a perfect protection against chill, and their teeth, as we have mentioned, being specially modified in order both to hold such slippery prey as fishes, and at the same time to pierce with facility their hard scales. Probably, in consequence of their precisely similar habits and mode of life, all the otters are so like one another that it is extremely difficult to determine the exact number of species, and scarcely any group has proved more puzzling in this respect to the systematic zoologist. It appears, however, that there are about ten species of true otters, of which one is European and Oriental, three are exclusively Oriental, two are African, and four American. The largest of all is the Brazilian otter, while the two smallest species are the feline otter of South America and the Indian clawless otter. The geographical distribution of the genus is wider than that of any other single Mammalian genus, with the exception of certain bats; otters having been obtained from all parts of the world except the Antarctic and Arctic regions, Australasia, and Madagascar. We shall allude to the various species of the genus according to their geographical distribution.

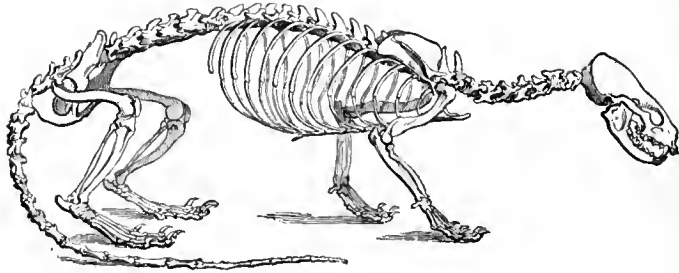
The European otter (*L. vulgaris*), which is the one represented in our coloured Plate, is taken first, as being not only the type of the

European Otter.

genus, but likewise the best known; and many of our remarks on its habits will also apply equally well to the others.

In size this species occupies a kind of central position in the group, the average length from the snout to the root of the tail being about 26 to 28 inches, and that of the tail 15 to 16 inches, while the weight is from 16 to 18, up to as much as 24 lbs. The fur consists of a soft under-fur, in which the hairs are whitish grey, with brown tips, and of longer stiff hairs, which are greyish at the base, and rich brown at their tips on the upper-parts of the body and the outer surfaces of the limbs; the cheeks, throat, the under-parts of the body, and the inner surfaces of the limbs being brownish grey. The upper margin of the naked nose terminates behind in an angle, while, as in the other species, the muzzle is provided with long "whiskers." In the Indian variety, which was formerly regarded as a distinct species, the fur of the back is generally grizzled, while the size of the animal is slightly less than in the ordinary European form. The claws on all the feet are well developed, and there are four premolar teeth in the upper jaw.

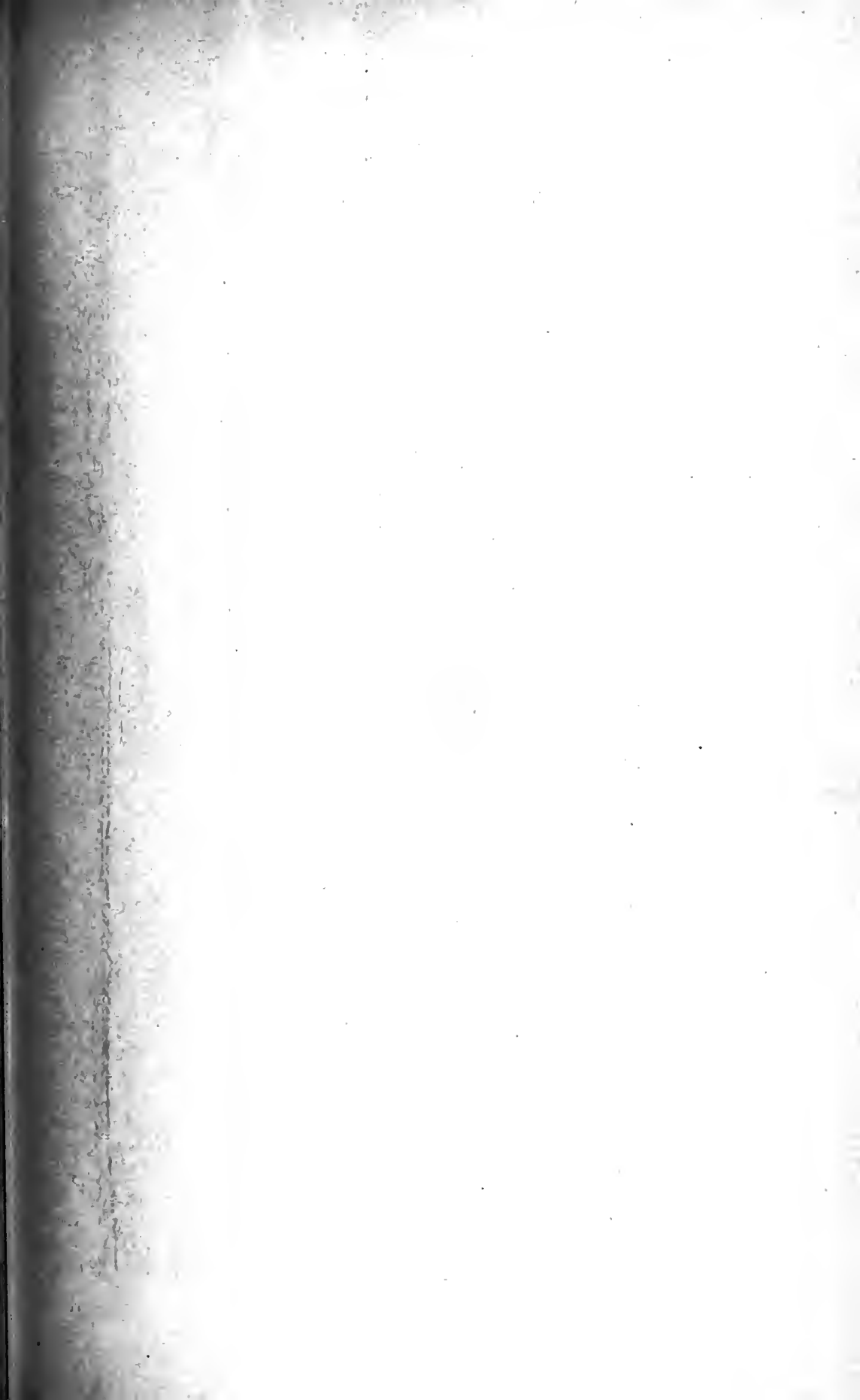
Distribution. The common otter is found all over Europe in suitable localities, and also extends over a large portion of Asia northwards of the Himalaya. It is likewise represented by the ordinary form in the North-Western



SKELETON OF THE COMMON OTTER.

Himalaya, and by the above-mentioned smaller and greyer variety in India and Ceylon, as well as in some of the districts to the eastwards of the Bay of Bengal.

Habits. Writing of the habits of the common otter, Bell observes that "it swims and dives with great readiness, and with peculiar ease and elegance of movements; and although its action on land is far from being awkward and difficult, yet it is certainly in the water that the beautiful adaptation of its structure to its habits is most strikingly exhibited. It swims in nearly a horizontal position, and dives instantaneously after the fish that may glide beneath it, or pursues it under water, changing its course as the fish darts in various directions to escape from it, and, when the prey is secured, brings it on shore to its retreat to feed. As the otter lives exclusively on fish, when it can procure them, it frequents lakes, rivers, smaller streams, or ponds, and not unfrequently descends to the sea; and the havoc which it makes among the finny inhabitants is almost incredible. In feeding, it holds the fish between its fore-paws, eating first the head, and then downwards to the vent, leaving the tail." The fish actually eaten by the otter form, however, but a small proportion of those captured; this animal being one of those which appears to delight in killing for killing's sake. In India the





EUROPEAN OTTER.

common otter is occasionally found in the large tanks so common throughout the country, and it is stated by Mr. Blanford to be common in the great backwaters off the Western Coast, and in the Chilka Lake of Orissa.

Otters are generally found either in pairs or in family parties of five or six individuals, the latter comprising the parents and their partially or full-grown progeny. Their habitations are usually made in or near the banks of the waters they frequent, the hollows beneath the roots of trees growing on a river's margin being especial favourites, while in hilly districts the clefts between rocks are selected, and where the soil is of an alluvial nature deep burrows, with several entrances, one of which usually opens beneath the water, are excavated in the banks. A large pile of loose stones, forming one of the piers of a timber bridge over the Indus above the town of Leh has long been the favourite resort of a colony of otters. The presence of numerous bones and scales of fish, as well as the peculiar web-footed tracks of the animals themselves, will always indicate whether or not an otter's den or "holt" is inhabited.

Otters apparently never hibernate, and in consequence must be hard pressed to supply themselves with food during the winter in the colder portions of their habitat. At such times they are asserted in inhabited districts to make occasional raids on the farmyard, where they have been known to kill poultry and, it is said, even young lambs and pigs. Water-fowl are probably also attacked at such periods, while it is stated that eggs are always acceptable to these animals. In addition to fish, otters are in the habit of eating frogs and such fresh-water or marine crustaceans as are found in the waters they frequent.

Although chiefly nocturnal,—more especially in districts where they are much harassed,—otters may not unfrequently be seen hunting in the morning and evening, Mr. Blanford stating that he has frequently observed them in India at work up to nine or ten o'clock in the morning. When fishing, it appears that all the members of a party of otters are in the habit of combining their efforts to surround or drive a shoal of fish. General M'Master had on one occasion the good fortune to observe a party comprising at least six individuals thus engaged in the Chilka Lake of Orissa. "They worked," writes the narrator of the incident, "most systematically in a semicircle, with intervals of about fifty yards between each, having, I suppose, a large shoal of fish in the centre, for every now and then an otter would disappear, and generally, when it was again seen, it was well within the semicircle, with a fish in its jaws, caught more for pleasure than for profit, as the fish, so far as I could see, were always left untouched beyond a single bite."

The large size of the aperture in the skull below the socket of the eye for the transmission of the nerves supplying the muzzle, indicates that the "whiskers" of the otter must be extremely sensitive. With regard to their powers of hearing, smell, and sight, Mr. Blanford believes that, while the two former are well developed, otters are somewhat deficient in the latter. Their general intelligence is decidedly high, and they likewise often display much cunning and forethought, more especially in avoiding the traps set for their capture. When excited they utter a kind of yelping bark, and they are stated to give a sort of whistle as an alarm-note to their fellows. There is still a dearth of information as to the breeding-habits of the otter. It appears, however, that the young may be produced at any season of

the year, although the winter is the more usual time. The number of young in a litter generally varies from two to five, the cubs themselves being born blind.

Tame Otters. The otter is readily tamed if captured at a sufficiently early age, and then becomes much attached to its owner, whom it will follow about after the manner of a dog. The natural instincts of these animals are taken advantage of by the native fishermen of some oriental countries to aid them in their avocations. The late Bishop Heber, when voyaging up one of the rivers of Bengal, states that his vessel passed "a row of no less than nine or ten large and very beautiful otters tethered with straw collars and long strings to the bamboo stakes on the banks. Some were swimming about at the full extent of their strings, or lying half in and half out of the water; others were rolling themselves in the sun on the sandy bank, uttering a shrill whistling noise, as if in play. I was told that most of the fishermen in the neighbourhood kept one or more of these animals, who were almost as tame as dogs and of great use in fishing, sometimes driving the shoals into the nets, sometimes bringing out the larger fish with their teeth." According to later authorities it appears, however, that the bishop was misinformed as to the otters being employed to catch fish with their teeth, their sole use in India being to drive the latter into the nets. In China, on the other hand, otters are actually employed in the former operation.

Hunting. Otter-hunting in England has been already alluded to briefly under the head of the otter-hound; and from the facts there mentioned it will be gathered that these animals are still fairly numerous in many of the wilder parts of the country.

Pelage. Otter fur, from its close texture, fine gloss, and rich colour, is much esteemed as a trimming, and commands a rather high price in the market. A large number of the otter skins imported into this country belong, however, to the North American species. Skins of the European species vary from five to thirty shillings in price.

Fossil Remains. Fossil remains of the common otter have been obtained from the superficial deposits and caverns of this country and the Continent, and likewise from the so-called "forest-bed" of the Eastern Coast, which is somewhat older. A fossil otter from the still more ancient Norwich Crag, belonging to the upper portion of the Pliocene period has, moreover, been identified with the present species.

North American Otter. This otter (*L. canadensis*) is distinguished from the preceding by the much larger size of the naked area at the tip of the muzzle, which extends far above and to the sides of the nostrils, instead of being entirely confined to the space between them, as in the latter. According to Dr. Coues, it is very variable in point of size and colour. It may, however, attain a total length of 4 feet or more, while the general colour of the fur is liver-brown with a purplish gloss, the chin, throat, and under-parts being paler. This species occurs over the whole of North America in suitable regions, although apparently nowhere very numerous; its northern range extending along the Mackenzie and other rivers nearly to the Arctic Ocean.

Habits. There does not appear much that is especially noteworthy or peculiar in the habits of this species. Dr. Hart Merriam states that in

the Adirondack region the number of fresh-water cray-fish consumed by these otters is enormous, this crustacean apparently forming as important a portion of their food as fish. The same writer also bears testimony as to the long journeys undertaken by the North American otter from river to river across country; these journeys mostly taking place during the winter. On such occasions they "go so fast that a man has great difficulty in overtaking them. On the ice they proceed by a series of what boys call 'a run and a slide,' that is, they make several jumps and then slide ahead flat on their bellies, as far as their impetus and the smoothness of the ice permit, and then do the same thing over again, and so on." A curious habit of this otter is its propensity for sliding down smooth and steep banks, either of snow or of mud. Such gambols have been watched by several observers, from whose accounts it appears that in winter the animals select the highest ridge of snow, on to the top of which they scramble, whence, as Dr. J. D. Godman writes, they give themselves an impulse with their hind-legs, and swiftly glide head-foremost down the declivity, sometimes for a distance of twenty yards. This sport they continue apparently with the greatest enjoyment until fatigue or hunger induces them to desist. A pair on a mud-bank made upwards of twenty-two slides before they were disturbed. The number of young in a litter is said to be usually two, although there may occasionally be either one or three. They are born about the middle of April, and during the summer and autumn the female is generally to be seen accompanied by her two young.

Pelage.

The fur of the otter is more valuable than that of any other North American animal, and is in good condition from November till the spring, but is at its best period during the latter season. It is stated by Dr. Coues that the number of skins of the American otter exported by the Hudson's Bay Company to London in the year 1873 exceeded 11,000, while in 1891 the same company sold 8171 skins. The ordinary price varies from thirty to fifty shillings per skin.

Trapping.

These otters are usually caught in steel traps, which are set beneath the water where one of the "slides" or tracks of the animals leads to the margin. Sometimes the trap is, however, placed at the top of the slide and covered with snow. In neither case is any bait used; but in all methods the greatest care is necessary that no traces of the trapper's presence should remain, as the otter has very acute smell and sight, and is exceedingly wary and cunning.

South America possesses at least three species of otters, of which the most noteworthy are the Brazilian otter and the feline otter. The Brazilian otter (*L. brasiliensis*) is much the largest of all the living species, and is distinguished by the presence of a distinct ridge running along each side of the tail, whence it is often termed the margined-tailed otter. It inhabits the rivers of Brazil and Guiana, where it is known as the Ariranha. The length of the head and body is over 40 inches, while that of the tail is about 23 inches. The nose is completely covered with hair, and the general colour of the pelage is chocolate-brown, becoming lighter on the under-parts. The chin, as well as a large irregular patch on the throat, and some spots on the under-surface of the body are, however, whitish or yellow.

Brazilian Otter.

Habits. In some of the South American rivers these otters may be met with in large companies, and they differ from most other species in being purely diurnal, commencing their hunting with the dawn of day and continuing till nightfall. When in such companies, the otters utter a kind of whistling sound, which is said to have some resemblance to the mewling of cats. Hensel states that, when travelling on the Brazilian rivers in a canoe, the voyager, when shooting out from beneath the overhanging branches of a tree, may often see a number of black objects in the water, which at his approach tend to collect together. Careful observation will show that these are otters, but by the time the canoe has reached the spot where they were first seen all will have disappeared. Soon, however, the traveller's ears are struck by a peculiar snorting sound, and, as he looks around, he sees the water on all sides dotted with the dark heads of the giant otters, which, with a second snort, disappear again as quick as lightning beneath the surface.

Feline Otter. The feline otter (*L. felina*) is, on the other hand, one of the smallest members of the group, agreeing approximately in size with the Indian clawless otter. It is characterised by its relatively short face and its light and delicate teeth, the inner tubercle of the upper flesh-tooth being much smaller than in the other species from the same regions. This species also differs from other otters in being almost exclusively marine in its habits. In regard to its distribution, Mr. O. Thomas states that "in the Southern Hemisphere it extends to the Straits of Magellan, where its range meets that of the larger Brazilian otter. Thence northward it is exceedingly common along the coasts of Patagonia and Chili, where the complex labyrinths of gulfs and channels are highly favourable to its manner of life." It has been found in Peru and Ecuador.

In regard to the naked-nosed and flat-headed South American otters, intermediate in size between the two last species, there is still much uncertainty, but they are all provisionally included under the name of *L. paranensis*.

Smooth Indian Otter. In addition to the common European otter, which, as we have already seen, is represented by a variety in India, there are three Indian and Malayan representatives of the group. The first of these species is the smooth Indian otter (*L. macrodus*), readily distinguished from the common otter by the upper border of the naked portion of the muzzle forming a straight line, while the fur is very smooth and short. Then, again, the skull is less depressed and flattened, and the molar and flesh-tooth in the upper jaw are very large, the latter differing from the corresponding tooth of the common species by the larger proportionate size of the tubercular portion on the inner side of the blade. This otter is found all over India, and also extends to Burma, the Malay Peninsula, and Sumatra. Its habits appear to be very similar to those of the common otter, and, like the latter, it is trained for fishing.

Hairy-Nosed Otter. The hairy-nosed otter (*L. sumatrana*) is a very well-marked species from the Malayan region, distinguished, as its name implies, by the muzzle being completely covered with hair; the inner tubercle of the upper flesh-tooth being relatively small. A closely-allied extinct species (*L. palawindica*) occurs in the Siwalik Hills of Northern India.

Clawless Otter. There is also the much smaller Indian clawless otter (*L. cinerea*), differing from the others not only by its inferior dimensions, but also by the rudimentary condition, or even total absence, of the claws. The upper teeth (shown in the figure on p. 91) are distinguished by the absence of the first premolar, and the great length from front to back of the molar tooth. Moreover, the whole skull is much shorter than in the other species. The length of the head and body of this otter varies from 22 to 24 inches, and that of the tail from 10½ to 13 inches. The clawless otter ranges from India through Burma and the Malay Peninsula and islands to China. In India it occurs in the Himalaya at low elevations, in Lower Bengal and the Nilgiri Hills of Madras, and perhaps also in Ceylon. It appears to be the only otter found in Java. According to Mr. Blanford, the habits of this otter are similar to those of the other oriental species.

African Otters. The whole African continent possesses but two members of the group under consideration. The first of these is the African clawless otter (*L. capensis*), from South and West Africa, which, while agreeing with the Indian clawless otter in the rudimentary condition of its claws, is distinguished by its greatly superior dimensions; being, next to the Brazilian otter, the largest representative of the whole group. Writing of this species, which he alludes to under another Latin name, the late Professor Moseley states that "amongst the animals which live on the Cape Peninsula, the clawless otter is worthy of mention; it is a very large otter, twice or three times as large when full-grown as the European one. It lives about the salt-marshes and lakes, and is tolerably common; it hunts, like the South American marine otter, in companies, but only of three or four. It has no claws on the fore-feet, having lost them by natural selection in some way or other, and on the hinder-feet the claws are wanting on the outer toes, and only rudiments of them remain on the middle ones. There are, however, pits marking the places where the claws used to exist. The webbing between the toes is also in this otter rudimentary; the beast altogether is very heavily built, with the head very broad and powerful. It appears to be an otter bent on returning to land habits."

Spotted-Necked Otter. The spotted-necked otter (*L. maculicollis*) is one of the smaller members of the group, with well-developed claws. It has a naked nose, and very long hind-feet: the colour of the fur being blackish brown, with yellow spots on the throat, chest, and underparts. This otter has been obtained from the Cape and Natal.

Extinct Otters. Reference has already been made to the occurrence of the common otter in the superficial deposits of Europe, and also of an extinct species allied to the hairy-nosed otter in the Siwalik Hills of India. In addition to these, there are numerous extinct otters in the Pliocene and Miocene deposits of Europe, some of which appear to connect existing forms with the martens and their allies. Another is remarkable as appearing to indicate affinities between the otters and the civets, and thus serves to confirm the previously-mentioned evidence as to the existence of some relationship between the now widely divergent families of the weasels and civets. The otter-like animal in question is distinguished from



THE LEFT UPPER FLESH - TOOTH OF AN EXTINCT INDIAN OTTER.

The outer ridge (left side of figure) is broken.

all other members of the present family by having two molar teeth on each side of the upper jaw.

Especial interest must also attach to some giant otters from the Siwalik Hills of India, which were even larger than the existing Brazilian otter. An upper flesh-tooth of one of these otters is represented in the cut on page 97, which will give some idea of their dimensions. By comparing this figure with the corresponding tooth of the recent skull represented on p. 91, it will be observed that these gigantic Siwalik otters are distinguished by having three distinct cusps, instead of a crescentic cutting-edge on the inner tubercular portion of the upper flesh-tooth.

THE SEA-OTTER.

Genus *Lutax*.

As we have already seen, the feline otter of South America is in the habit of frequenting the lagoons and bays of its native coasts rather than rivers, and these



THE SEA-OTTER ($\frac{1}{2}$ nat. size). (After Wolf.)

marine habits are still more characteristic of the animal known as the sea-otter (*Lutax lutris*), which is regarded as forming a genus by itself.

The Sea-Otter has a total length of about 4 feet, of which 1 foot, or rather less, is occupied by the tail. In general appearance it is compared by Dr. Coues to one of the eared seals, a resemblance which is increased by the long and flipper-like hind-feet, quite unlike those of all other members of the family to which it belongs. The body has a bolster-like form, tapering in front to join the rather small and rounded head, without any marked constriction at the neck. Both the limbs and tail are short, the latter being cylindrical, slightly tapering, and somewhat trun-

cated at the end; while the disparity in the size of the fore and hind-feet is quite unknown in any of the Carnivores hitherto described. The skin is remarkably large and loose for the size of the animal, so that when removed from the body it can readily be stretched to a third more than its normal length. The pelage consists mainly of a fine soft woolly under-fur, among which are a small proportion of long stiff hairs. The general colour is dark liver-brown, silvered over with the greyish tips of the long hairs.

Remarkable as are the external characteristics of the sea-otter, it is not, however, solely, or even chiefly on them, that the zoologist relies in referring the animal to a genus apart from that containing the true otters. Equally noteworthy peculiarities occur in the number and structure of the teeth. In the first place, there are but two pairs of incisor teeth in the lower jaw,—a feature in which this species differs not only from other otters but likewise from every other true Carnivore. The total number of teeth is, therefore, thirty-two, as against thirty-six in the common otter; there being, as in the Indian clawless otter, but three pairs of premolar teeth in both the upper and the lower jaws. The cheek-teeth, although of the same general plan of structure as in the true otters, differ by their extremely blunted and rounded cusps. "If," remarks Dr. Coues, "the teeth of ordinary carnivorous quadrupeds be likened to fresh-chipped, sharp, and angular bits of rock, those of the sea-otter are comparable to water-worn pebbles"; and we know of no simile which can better express the difference between the cheek-teeth of the common and the sea-otter.

Habitat.

The sea-otter is an inhabitant of both coasts of the North Pacific; its chief haunts on the American side being Alaska, the Aleutian Islands, the neighbourhood of Sitka Island on the west coast of Canada, and Vancouver Island; its southern limits being the shores of Oregon. On the Asiatic side it occurs in Kamschatka, but apparently more rarely than on the eastern shores of the Pacific.

It is stated by Mr. H. W. Elliot that when the Russian traders first opened up the Aleutian Islands, they found the natives commonly wearing cloaks made of the fur of the sea-otter, which they were at first willing to sell for a mere trifle, esteeming these skins much less than they did those of the fur-seals. Again, when the Prybiloff Islands, situated in Behring Sea to the eastward of the Aleutians, were first discovered, upwards of five thousand skins of this species were taken in the first season, while in six years these animals had completely disappeared from the islands. Nearly the same story is told in all the haunts of the sea-otter, which has now become a very rare animal indeed, and stands in sore need of protection if it is to escape total extermination. Mr. Elliot states that "over two-thirds of all the sea-otters taken in Alaska are secured in two small areas of water, little rocky islets and reefs around the islands of Saanach and Chernobours, which proves that these animals, in spite of the incessant hunting all the year round on this ground, seem to have some particular preference for it to the practical exclusion of nearly all the rest of the territory. This may be due to its better adaptation as a breeding-ground." A similar preference for a small area in the neighbourhood of Gray's Harbour over the whole of the remainder of the coast of Washington and Oregon is also exhibited by these animals.

It is not the mainland of Saanach Island which is frequented by the sea-otters, but the small islets and reefs lying to the southward and westward at a distance of about five miles, and thence stretching seawards, most of which are left bare at low water. Either on these islets and reefs, or, in calm weather, in the open sea around, the sea-otters are to be found.

Breeding. The female sea-otter has only two teats, and produces but a single young one at a birth, so that the increase of the species can be, at the best, but slow. The young may apparently be born at any season of the year, and do not attain maturity till four or five years old. Writing of the general habits of the species, Mr. Elliot observes that the "mother sleeps in the water on her back, with her young clasped between her fore-paws. The pup cannot live without its mother, though frequent attempts have been made by the natives to raise them, as they often capture them alive, but, like some other species of wild animals, it seems to be so deeply imbued with fear of man that it invariably dies from self-imposed starvation."

Habits. The remarkable difference in the structure of the cheek-teeth of the sea-otter from those of the true otters, clearly indicates that there must be an equally marked difference in the food of the two; and the rounded prominences on the crowns of those of the present species would further suggest that they were adapted for pounding and crushing hard substances. As a matter of fact, Mr. Elliot tells us that the food of the sea-otters "is almost entirely composed of clams, mussels, and sea-urchins, of which they are very fond, and which they break by striking the shells together, held in each fore-paw, sucking out the contents as they are fractured by these efforts; they also undoubtedly eat crabs, and the juicy tender fronds of kelp or sea-weed, and fish. They are not polygamous, and more than one individual is seldom seen at a time when out at sea. The flesh is very unpalatable, highly charged with a rank smell and flavour. They are playful, it would seem, for I am assured by several old hunters that they have watched the sea-otter for half an hour as it lay upon its back in the water and tossed a piece of sea-weed up in the air from paw to paw, apparently taking great delight in catching it before it could fall into the water. It will also play with its young for hours. The quick hearing and acute smell possessed by the sea-otter are not equalled by any other creatures in the territory. They will take alarm and leave from the effects of a small fire four or five miles to the windward of them; and the footstep of man must be washed by many tides before its trace ceases to alarm the animal, and drive it from landing."

Hunting. In Alaska the sea-otter is often captured by shooting it in the head with a rifle-bullet when the animal is sporting in the surf; the booming of the surf deadening the report of the rifle, and thus allowing successive shots to be taken till one is successful. An older plan is, however, for a party to go out in canoes when a sea-otter has been observed, and by arranging themselves in a circle around its last point of disappearance, so harass the creature on its subsequent emergence that eventually it becomes exhausted from sheer inability to breathe. The third method is by knocking the animals on the head with heavy clubs: but this can only be done during the winter, at such times when strong gales are blowing from the northward. Then, writes Mr. Elliot, the boldest of the

natives set out in their canoes from Saanaeh, "and send on the tail of the gale to the far outlying rocks, just sticking out above surf-wash, where they creep up from the leeward to the sea-otters found there at such times, with their heads stuck into the beds of kelp to avoid the wind. The noise of the gale is greater than that made by the stealthy movements of the hunters, who, armed each with a short, heavy wooden club, despatch the animals one after another without alarming the whole body, and in this way two Aleuts were known to have slain seventy-eight in less than an hour and a half." Instead of these methods, which are employed in Unalaska Island and the districts to the eastwards, among the Atka Aleuts the sea-otters are caught in small coarse-meshed nets. These nets are spread out over the kelp-beds upon which the otters are in the habit of sleeping. The animals, getting entangled in the meshes on their arrival, appear to become almost paralysed with fear, and thus fall an easy prey to the hunters.

On the other hand, in Kamschatka, according to Dr. Guillemard, the sea-otter is always shot with a bow and arrows. "The former is a tough piece of wood five or six feet in length, which is enormously strengthened by a band of plaited hide on the outer face, so tightly fixed as to give the bow a curve in the opposite direction when unstrung. The arrows are of wood for three-quarters of their length, with feathers fitted diagonally along the shaft, so as to produce a rotatory motion. The remaining portion is of walrus ivory, provided at the end with a socket, into which a barbed copper point is inserted. This is connected to the arrow by a long string of plaited sinew wound around the shaft. When the otter is hit, the barb, which is very loose, becomes at once detached, and if the animal gain the sea, its whereabouts is indicated by the arrow floating above it."

Pelage. The skin of the sea-otter is perhaps the most valuable of all furs, and when prepared for use has all the long hairs removed, leaving only the under-fur. In Kamschatka Dr. Guillemard states that a good skin will bring even as much as a hundred roubles to the native hunter, while a perfect example has been known to realise, according to Mr. Poland, as much as £200 in the European market. The average price in 1891 was £57 per skin.

CHAPTER XIX.

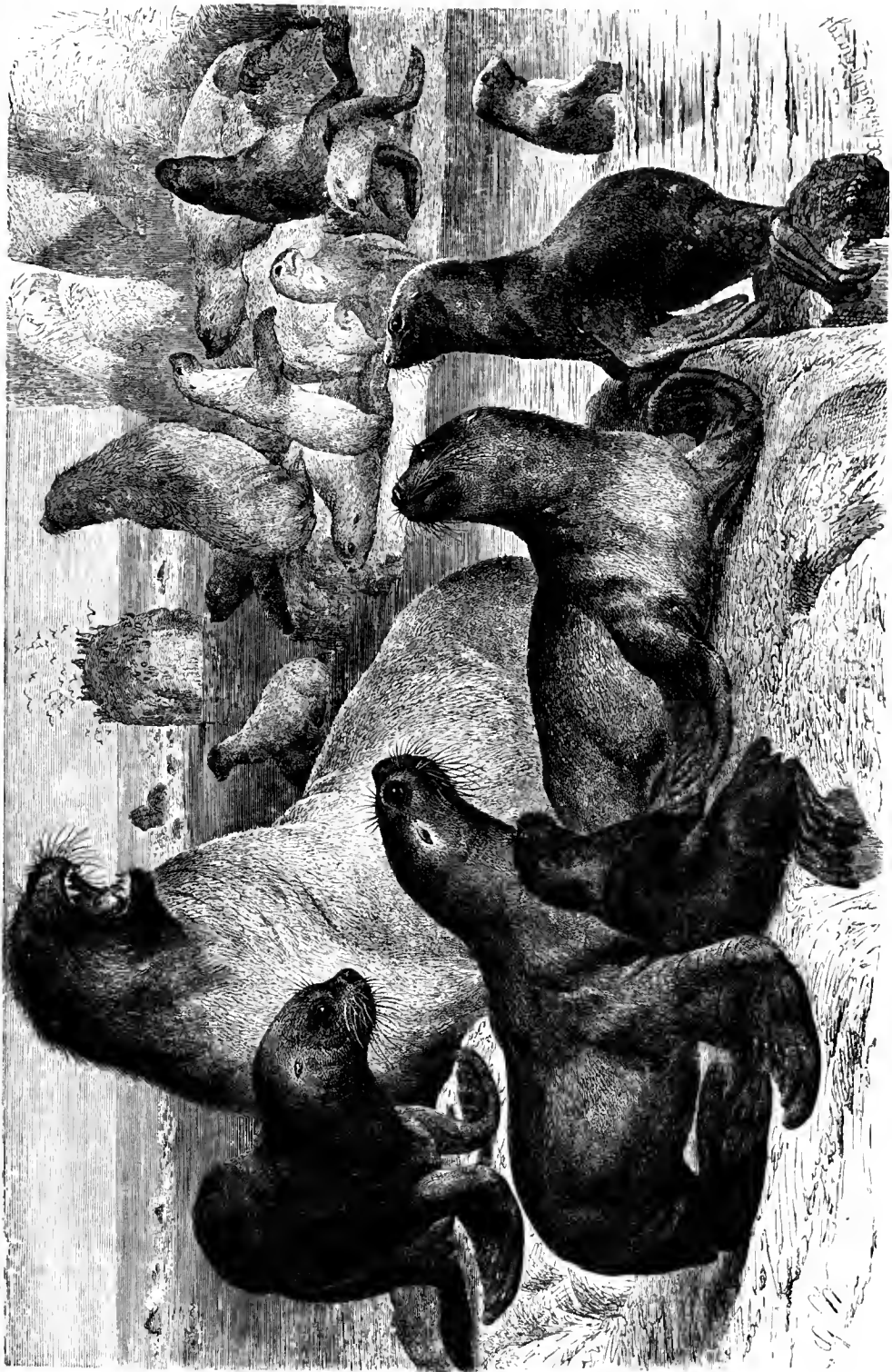
CARNIVORES,—*concluded.*

EARED SEALS, WALRUSES, AND SEALS.

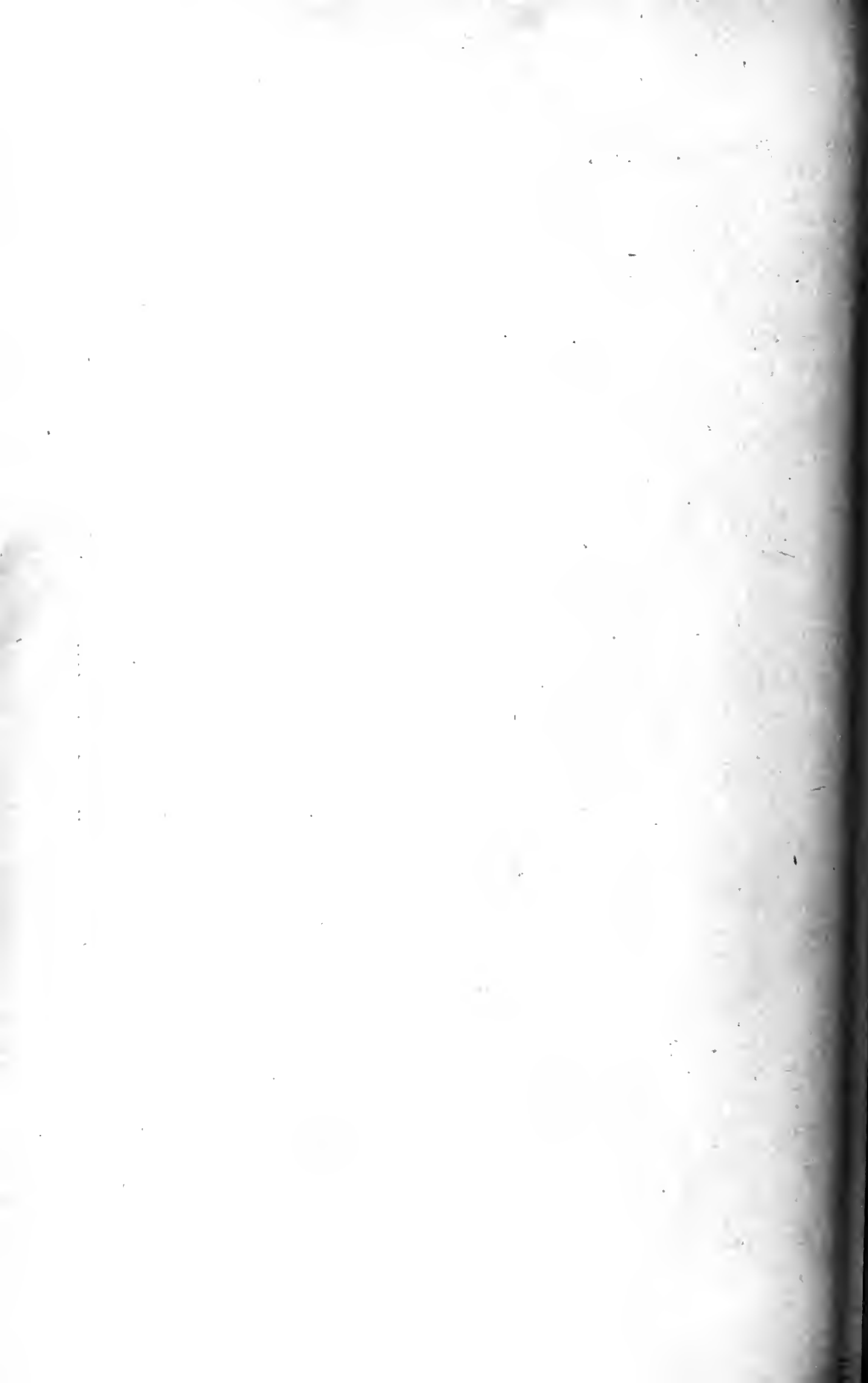
Families *OTARIIDÆ*, *TRICHECHIDÆ*, and *PHOCIDÆ*.

THE whole of the Carnivores treated of in the preceding chapters constitute the more typical representatives of the order, and are hence collectively termed by zoologists true or fissiped Carnivores. In contrast to these is a much smaller group comprising the eared seals, the walruses, and the true seals, differing from the above by their flipper-like limbs, and hence known as the pinniped or fin-footed Carnivores. By some writers the pinnipeds are regarded as entitled to form an order by themselves, quite distinct from the Carnivores; but by the majority of naturalists, in England at least, they are considered to form merely a sub-order.

The members of the pinniped group have their entire organisation adapted for an aquatic life; this adaptation showing itself most markedly in the structure of their limbs. Thus both the fore and hind-limbs are modified into paddle or flipper-like organs, with nearly the whole of their upper portions, as far as the wrist and ankle, enclosed in the common integument of the body; while the feet themselves are greatly elongated—more especially in the hind-limb—and much expanded, with the whole of the five toes completely connected together by web. A peculiarity of the toes of the hind-foot is to be found in the circumstance that the first and the fifth toes, that is to say those corresponding respectively with the human great and little toes, are stouter, and in most cases also longer, than the three middle toes; an arrangement which is quite unknown among the true Carnivores, where the first toe is the shortest of the series. The pinnipeds are also characterised by the structure of their teeth, which are simpler than those of the true Carnivores, and never show a specially-modified "flesh-tooth" in one jaw biting against a somewhat similarly modified tooth in the opposite jaw. As a general rule, the cheek-teeth comprise four premolars and one molar on either side of each jaw; all these teeth being very similar to one another in general structure, and usually consisting of a pointed main cone, which may be flanked in front and behind by smaller cones, so as to produce a tricuspid tooth. Moreover, the number of incisor teeth is invariably reduced below the typical three pairs in each jaw; there being very frequently three pairs of these teeth in the upper, and two in the lower jaw, or but two pairs in each jaw. Then, again, all the pinnipeds are characterised by the reduced or rudimentary condition of their milk or baby series of teeth; these teeth being never of any real use to their owners, and being not unfrequently shed previous to birth. The foregoing characteristics are amply



A FAMILY PARTY OF SOUTHERN SEA-LIONS.



sufficient to distinguish the pinnipeds from the true Carnivores, although these animals also possess certain peculiarities in regard to their soft parts, into the consideration of which it is unnecessary to enter here. It may be mentioned, however, that all the members of the group have very short tails, while they are all remarkable for the large size and prominence of their eyes, this being probably necessary in order to secure accurate vision under water. It is also noteworthy that in all the members of the group the rudimentary collar-bones found in most of the true Carnivores have completely disappeared.

Those who admit the doctrine of the evolution of organic nature can have no hesitation in regarding the pinnipeds as a highly-specialised group, which has originated either from some section or sections of the true Carnivores, or from an extinct group, to be noticed later on. In the structure of their skulls the eared seals come nearest to the bears; and it is quite evident that the whole group must have descended from Carnivores which still retained the typical five digits on each foot. On the other hand, the true seals present some points of resemblance to the otters, and the sea-otter shows us how easily the transition from the ordinary otter type to the pinnipeds might have taken place. The sea-otter, however, is clearly (from the structure of its teeth) in no sense a "missing link"; and it is by no means improbable that the pinnipeds will be found to trace their origin directly to the extinct group of Carnivores to which allusion has been already made.

The pinnipeds are divided into three distinct families, namely, the eared seals, the walruses, and the true seals. Before proceeding to the consideration of these several families, we may refer, however, to a few characteristics common to the whole group. In the first place, the pinnipeds, as already mentioned, are thoroughly aquatic in their habits, resorting to the land only for the purpose of repose or breeding, and when there moving in an awkward and clumsy fashion. Moreover, they are, as a rule, marine; although some ascend tidal rivers, and a few are found in inland seas and lakes. In the latter instance there is, however, no reasonable doubt but that access to the ocean has been cut off since the date when the seals first reached the waters in which they are now confined.

In regard to their general characteristics, Mr. J. A. Allen, who has paid special attention to the American representatives of the group, observes that all the pinnipeds are distinguished by their high degree of intelligence, and are all capable of being easily domesticated, when placed under favourable conditions. They are, almost without exception, thoroughly carnivorous, "subsisting upon fishes, molluses, and crustaceans, of which they consume enormous quantities. The walruses and eared seals are polygamous, and the males greatly exceed the females in size. The ordinary or earless seals are commonly supposed to be monogamous, and there is generally little difference in the size of the sexes. The walruses and eared seals usually resort in large numbers to certain favourite breeding-grounds, and, during the season of reproduction, leave the water, and pass a considerable period upon land. The earless seals, on the other hand, with the exception of the sea-elephants, do not so uniformly resort to particular breeding-grounds on land, and leave the water only for very short intervals."

Only one member of the whole group appears to be strictly tropical, and comparatively few even range into tropical regions; the great majority being

found in the Arctic, Antarctic, and Temperate zones, many of them being exclusively Arctic or Sub-Arctic, while one is as entirely Antarctic. And whereas the walruses are restricted mainly at the present day to the Northern regions, the other two families are well represented on both sides of the Equator. Most of the true or earless seals are confined to the colder latitudes, and generally produce their young on the ice.

THE EARED SEALS.

Family OTARIIDÆ.

Genus *Otaria*.

The eared seals form a well-marked family, which tends to connect the other and more specialised representatives of the group with ordinary terrestrial Carnivores. In the first place, their hind-limbs are decidedly less modified; all the eared seals, as is well shown in the illustration on p. 103, being characterised by having, when on land, the hind-flippers turned forwards under the body in the direction of the head, so that they aid in the support of the trunk in the ordinary manner. They derive their distinctive title from the presence of a small but well-defined external ear; and by these two characters an eared seal may always be distinguished at the first glance from all the other members of the group. They are further characterised by having the soles of both the fore and hind-feet entirely devoid of hair.

These animals also have well-marked necks, and their fore-feet are nearly as long as the hind ones. In the fore-feet the toes decrease in length from the first to the fifth, and have merely rudimentary claws; while in the hind-feet the three small middle toes generally have better developed claws, while the lateral pair are quite clawless. In both fore and hind-feet the skin extends considerably in advance of the tips of the toes, where it terminates in flaps. Usually there are thirty-four teeth, but sometimes, owing to the presence of a second pair of molars in the upper jaw, there may be thirty-six. There are always three pairs of incisor teeth in the upper, and two in the lower jaw.

The eared seals include the animals commonly known as sea-lions and sea-bears; and some of them furnish the "sealskin" of commerce. This sealskin is the under-fur, from which the long hairs of the outer coat have been removed; and such species as possess this under-fur are consequently termed fur-seals. Those species, on the other hand, which have only the ordinary close coat of hair, without any woolly under-fur, are commonly termed hair-seals; and their commercial value is limited to the oil and leather which they yield. In regard to the number of species of eared seals, and likewise as to whether they should all be included in a single genus (*Otaria*), or referred to two or more genera, there have been much discussion and difference of opinion. Writing in 1880 Mr. J. A. Allen put down the number of definable species as nine, of which five are hair-seals and four fur-seals. In the present work the whole of these will be included under the single generic title of *Otaria*; but an alternative plan is to restrict that name to

the Patagonian sea-lion, which differs in certain points from all the rest; and to refer the rest to a second genus (*Arctocephalus*).

This group is widely distributed over the temperate and colder regions of both the Northern and Southern Hemispheres; but, doubtless from the absence of suitable sites for breeding-places, is quite unrepresented in the North Atlantic. As a rule, sea-lions or hair-seals, and sea-bears or fur-seals, are found frequenting the same shores, but generally living apart from one another; while, with but rare exceptions, only one species of each section occurs in any one locality. Of the nine species provisionally recognised by Mr. Allen, two out of the five hair-seals are northern, and three are southern; while of the four fur-seals one is northern and three are southern. By later writers it is considered, however, that there are certainly two other species of southern eared seals.

Habits.

As we have already had occasion to mention, the whole of the eared seals spend a good deal of their time on land, where they assemble in large companies; and they are also polygamous. Moreover, the males are generally much superior in size to their consorts. At the breeding-places, which are known among sealers by the very inappropriate name of "rookeries," the older males are always the first to arrive, and thereupon select particular stations for themselves, where they await the advent of the females. A continual warfare is maintained by the males among themselves for the preservation of these stations, and also for the defence of their females. The strongest males are naturally successful in obtaining possession of the largest number of females; the number of females on the stations of the largest males usually varying from ten to fifteen or more. To guard such large harems requires constant vigilance on the part of the males, who remain on land throughout the whole breeding-season, during which period they undergo an unbroken fast of several weeks' duration. When they first take up their stations on land, the males are fat and in good condition; but at the end of their sojourn they become emaciated and weak to the last degree. The females, although after their arrival they remain continuously for a certain period on the stations of their lords, do not spend nearly such a long unbroken period on shore.

Colour.

The largest members of the family are hair-seals, and the smallest fur-seals. Mr. Allen states that "all the hair-seals are yellowish or reddish brown (in the Californian sea-lion sometimes brownish black), generally darkest when young, and becoming lighter with age, and also in the same individuals towards the moulting season. . . . All the fur-seals are black when young, but they become lighter with age, through an abundant mixture of greyish hairs which vary from yellowish grey to whitish grey. The southern fur-seals are generally, when adult, much greyer than the northern." There is, however, much individual variation in colour among the members of a species according to age.

Pelage.

The fur-seals are, of course, far more valuable commercially than the hair-seals. The best skins are afforded by young males and females; and these are prepared for use by the inner layer of the skin being shaved away with a sharp knife, thus causing the long hairs, which are deeper rooted than the woolly under-fur, to fall out.

Abundance. At the close of the last and during the early part of the present century fur-seals existed in countless numbers in many parts of the world; but human greed and folly have succeeded in so reducing their numbers in most regions that their pursuit is no longer profitable. Fortunately, however, both for science and for commerce, the seal rookeries of the Prybiloff Islands in Behring Sea have been placed under such restrictions as to render the annual slaughter compensated by the number of births. As an indication of the hosts of fur-seals formerly existing in various parts of the world, we may quote some figures given by Mr. Allen. Thus it is stated that in the year 1798 Captain Fanning, of the ship *Betsy* of New York, after obtaining a full cargo of skins from the island of Musapura, on the Chilian coast, estimated the number of fur-seals remaining on the island at from 500,000 to 700,000; and it appears that but little less than a million skins were subsequently taken from the same locality. Fur-seals were still found on the Chilian coast in 1815. From the Georgian Islands, at the extremity of South America, no less than 112,000 fur-seals are reported to have been taken in the year 1800, of which 57,000 were obtained by one American vessel. About this date the discovery of fur-seals in Australia was announced; and in 1804 a single ship obtained 74,000 skins. Large numbers were also taken about the same period on Prince Edward's Islands, lying a few hundred miles to the south-eastwards of the Cape of Good Hope. Again, between the years 1820 and 1821, more than 300,000 skins were taken from the South Shetland Islands alone; while it is estimated that at least 100,000 young seals were left to perish miserably, owing to the destruction of their mothers. In 1814 and 1815 the number of skins exported from Antipodes Island, off the coast of New South Wales, was upwards of 400,000, of which, it is said, no less than a fourth were spoilt owing to bad curing, and on arrival in Europe were sold as manure. As early, however, as the year 1830 the number of fur-seals in the southern seas had been so greatly diminished that vessels generally made losing voyages; and at the present day such a voyage partakes largely of the nature of a lottery. During the voyage of H.M.S. *Challenger*, the late Professor Moseley states that a considerable number of fur-seals were observed about Kerguelen Land; two schooners having obtained seventy in one day, and twenty in another. The number of skins taken in the Prybiloff Islands will be referred to later on; but it may be mentioned that at the present time, according to Mr. F. A. Lucas, the annual slaughter of fur-seals throughout the world averages 185,000, while that of hair-seals reaches the enormous number of 875,000.

THE SOUTHERN SEA-LION (*Otaria jubata*).

The southern or Patagonian sea-lion, of which a group is represented in the illustration on p. 103, is a hair-seal, and differs in certain respects both externally and internally from all the other species. It inhabits the Galapagos Islands, and the coasts of South America from Peru and Chili on the Pacific side, and from the Rio de la Plata on the Atlantic border, southwards to the Falkland Islands and Tierra del Fuego. Externally this species is distinguished from all the others by the long hair of the neck, which forms a kind of mane; although this mane is but

HOOKER'S SEA LION.





indistinctly seen when the skin is wet. The profile of the head is nearly straight, the muzzle deep and somewhat truncated, and the naked portion of the nose large; while the upper lip has a number of thick bristles of considerable length, and hanging nearly straight down. The ears are also shorter in this species than in any other member of the group. There are likewise several features in the skull of this seal by means of which it can be distinguished from all the other eared seals; but it will suffice to mention here that the palate is deeply hollowed out and truncated behind, whereas in the other species it is neither hollowed out nor truncated behind. There are six upper cheek-teeth. The males of this species attain a length of about 7 feet from the tip of the muzzle to the root of the tail, although Captain Cook states that in his time much larger individuals were to be met with.

Habitat. This species was one of the first members of the group known in Europe, having been met with by Magellan as long ago as the year 1579, and long afterwards by Cook. It was likewise the first exhibited alive in England, a specimen having been bought by the London Zoological Society in 1866. Subsequently other examples were obtained from the Falkland Islands by a French sailor named Lecomte; and all who visited the Society's Gardens during 1868 and a few years later will have a vivid recollection of the docility and cleverness of these animals—to say nothing of their marvellous activity when in the water. Formerly these seals were extremely numerous in the Falkland Islands, and on the coasts of Patagonia and other parts of South America; but they are now comparatively few, and their distribution is restricted.

Habits. The following particulars of the habits of the sea-lion in the Falklands were communicated by Lecomte to Dr. J. Murie. At various times these seals were seen in parties of from six to twelve, and even as many as twenty; but fifteen may be taken as the average. Several such families may congregate in the same creek, to the number of from forty to a hundred; but the individuals of different families do not associate with one another. "They seem to prefer headlands or isthmuses, and choose the most southern locality thereon as a resting-place. One of the old males is on guard as a sentinel. Usually he is seen perched on an eminence, and invariably, as Lecomte affirms, with outstretched neck and upraised head, as if sniffing around for the slightest ominous warning. The signal of a grunt or growl sets the others on the alert; and on any real approach of danger they rush all helter-skelter towards the water, from which they never wander far. Their daily occupation seems divided between sleeping and procuring food. They lie huddled together in a drowsy condition, or slumber, for a great part of their time, and this both during the day and night. At high tides, night and day, they take to fishing near the entrance of the fresh-water rivulets into the sea. At such times they will remain a whole tide dabbling about singly after food. This consists of fish and crustaceans. In capturing their prey they swallow it either above or below the water. . . . Lecomte says these eared seals never drink water; and he substantiates the fact that he kept the first animal he brought to this country for a year without fluid, except such as adhered to the fish he fed it with. He tells me, moreover, he has noticed the common seals occasionally suck in water as a horse would, but the otaria never. Another curious

circumstance he assures me of is, that in the stomach of every one he has examined, with the single exception of a young animal, there existed a quantity of pebbles. The amount varied in individuals from a few to many."

Breeding. The females give birth to a single young one about the end of the year, equivalent to our midsummer. During the pairing season, which is in February and March, pitched battles occur between the males, during which the females look quietly on. At such times the males are savage; and if attacked will stand their ground. The old males generally utter a low kind of growl, but in the breeding-season this is prolonged into a loud, voluminous, interrupted roar. The young utter a kind of bleating cry. From July to November these seals migrate southwards from the Falklands. In colour the young are of a deep chocolate, but paler after the first year; the old males being of a rich brown tint, and the females greyer; while at all ages, and in both sexes, the flippers are of a darker hue than the body.

THE NORTHERN SEA-LION (*Otaria stelleri*).

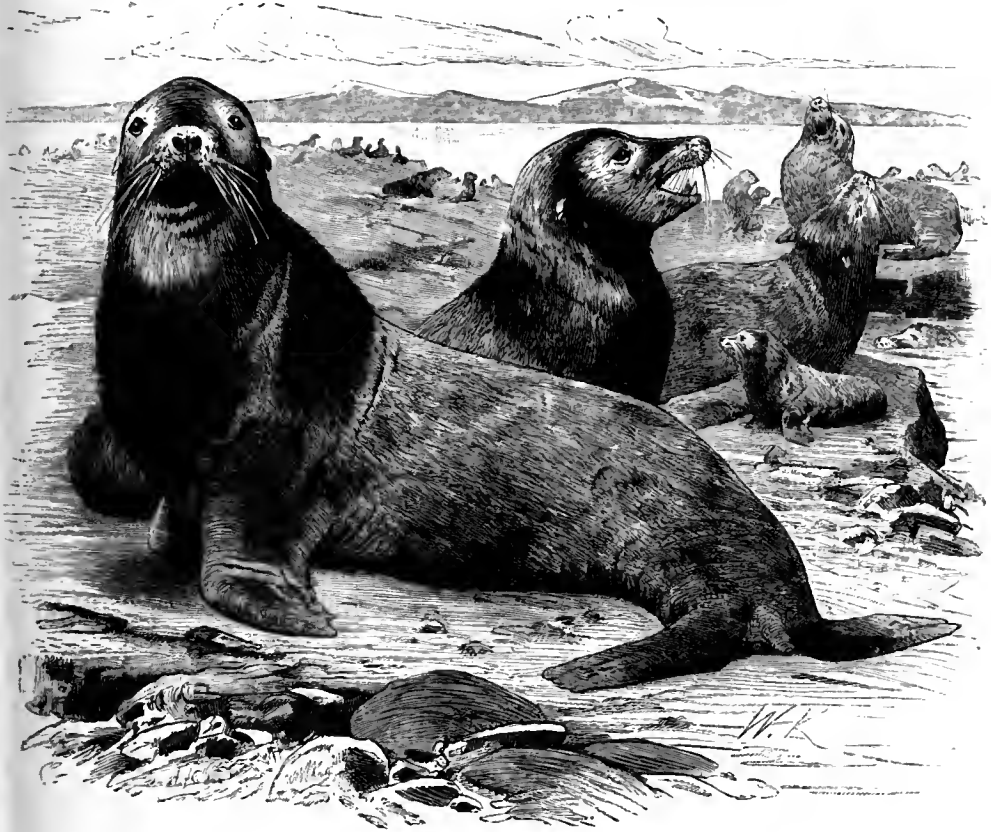
The northern sea-lion, which is likewise a hair-seal, differs from the preceding species, and agrees with all those that follow by the absence of a mane on its neck, by its narrow and pointed nose, relatively long ears, and by the flattened palate of the skull, which is not truncated behind. In the concave facial profile it differs from the southern sea-lion.

This is the largest member of the whole group, full-grown males, according to Mr. Allen, measuring from 11 to 12½ or 13 feet in total length, of which the tail forms 3 or 4 inches; while their girth varies from about 8 to 10 feet, and their weight is estimated at from 1000 to 1300 lbs. In colour the young are of a rich dark chestnut-brown. The adults, when they first reach the breeding-grounds, are of a light brownish rufous colour in both sexes, the tint being darker between the fore-limbs and on the under-parts. Later on in the season the colour changes, however, to a golden rufous or ochrey tint; and when the new winter coat appears in November, the colour has been described as a light sepia, or Vandyke brown, with deeper tints on the under-parts; and at this season of the year the females are distinctly of a lighter colour than the males.

Distribution. This fine seal inhabits the shores of the North Pacific from Behring Strait southwards to California and Japan, and is one of the species found in the Prybiloff Islands in Behring Sea; its northern limits being apparently determined by the southern border of the Polar floating ice. It was first discovered in the year 1741, during Behring's first expedition, and was described by the naturalist Steller, who accompanied that navigator.

Habits. Mr. W. D. Elliot, writing of this species in the Prybiloff Islands, observes that it has a really leonine appearance and bearing, greatly enhanced by the rich golden-rufous of its coat, and the ferocity of its expression. Although provided with flippers, to all external view the same as in the fur-seal, it cannot, however, make use of them in the same free manner. While the fur-seal can be driven five or six miles in twenty-four hours, the sea-lion can barely go two, the conditions of weather and roadway being the same. The sea-lions balance and

swing their long heavy necks to and fro, with every elevation of their hind-quarters, which they seldom raise from the ground, drawing them up after the fore-feet with a slide over the grass, sand, rock, etc., as the case may be; and pausing frequently to take a sullen and ferocious survey of the field and the drivers. It further appears from the same account that the males are less systematic and exacting in the formation and protection of their parties of females than is the case with the northern sea-bear; and they are not known to travel so far inland. Moreover, these seals are very shy and wary, and never allow their haunts to be



THE NORTHERN SEA-LION ($\frac{1}{3}$ nat. size).

visited by man without making a sudden rush to the sea. The males leave the sea and take up their stations on the narrow belts of ground, which they prefer, early in May, while the females follow them after an interval of three or four weeks, thus arriving during the first weeks in June. Usually each male during the breeding-season is accompanied by from ten to fifteen females. The latter are allowed to move freely from place to place; and are accustomed to go down to the shore, accompanied by their young—often carried by the nape of the neck—and disport themselves in the surf; such rambles being never undertaken by the female sea-bears. On the two main islands of the Prybiloff group, respectively known as St. Paul's and St. George's, it was estimated by Mr. Elliot that

not more than 25,000 of these seals were in the habit of visiting the former; while from 7000 to 8000 landed on the latter. The voice of this species is described as a deep, grand roar, forming a low muttering growl.

Another observer, Captain Charles Bryant, gave the following account of the habits of these seals to Mr. Allen:—"From 15,000 to 20,000 sea-lions breed annually on the Prybiloff or Fur-Seal Islands. They do not leave the islands in winter, as do the fur-seals, to return in spring; but remain during the whole year. They bring forth their young a month earlier than the fur-seal, landing during the months of May and June. They advance but little above high tide-mark; and those of all ages land together. The strongest males drive out the weaker, and monopolise the females, and continue with them till September. They go with them into the water whenever they are disturbed; and also watch over the young. When in the water, they swim about the young, and keep them together until they have an opportunity to land again. The females also keep near, rushing hither and thither, appearing first on one side and then on the other of the groups of young, constantly uttering a deep, hoarse growl at the intruder whenever they come to the surface. When left undisturbed they all soon land again, preferring to spend the greater portion of their time at this season on the shore. During the breeding-season they visit the same parts of the shore as the fur-seals; but the sea-lions, by their superior power and strength, crowd out the fur-seals—the latter passively yielding their places without presuming to offer battle to their formidable visitors. After having been disturbed, the sea-lions continue for some time in a state of unrest, occasionally uttering a low moaning sound, as though greatly distressed. Even after the breeding-season they keep close to the shore near the breeding-station until the severe weather of January. After this, they are seen only in small groups till the islands are free from ice and snow in the spring."

Capture.

The sea-lions on St. Paul's Island are driven a distance of from ten to twelve miles along the shore to the village where they are to be killed; and from their slow rate of motion, to which allusion has already been made, the journey is a long and protracted business, usually taking about five days. When once fairly started, and accustomed to the presence of man, the animals are, however, readily controlled, and kept in the desired direction. At the end of a day's journey they are allowed to refresh themselves by plunging in the pools found in many parts of the route. When thoroughly tired out at the end of a day's march, the unfortunate animals stretch themselves at full length on the ground, with extended limbs. Even then, however, writes Captain Bryant, "their rest is not peaceful, for some restless one soon starts up and flounders over the others, as if seeking a better place. This disturbs the whole herd, which constantly keeps up a low moaning, apparently expressive of sore distress." "By this time," the author continues, the sea-lions have "become so accustomed to their captors that they will sooner fight than run from them; and they are too much deafened by their own noise to hear or fear any other sound. As they lie on the ground in a compact mass, one of the men takes an umbrella, and goes twenty to thirty yards to the rear of the herds, and approaching stealthily until he is quite near, suddenly expands the umbrella, and runs with it all along the edge of the herd; then, closing

it, he retires to repeat the manœuvre. This has the effect of rousing the rear rank, which, thus suddenly alarmed, plunges forward and arouses those in front, which suddenly begin struggling and biting. The return of the man with the umbrella communicates another shock, and adds another wave to the sluggish mass. This is repeated at intervals of four or five minutes, till the successive shocks have aroused the whole herd, when, with much roaring and bellowing, the whole mass begins to move, gradually extending itself in a long irregular line in open order, each animal lumbering along as best it can. By shouting and waving flags at the rear, and on the flanks of the herd, they are kept moving until it is necessary to halt them again for rest."

Finally, the herd reaches the village, when the sea-lions, being far too formidable animals to be despatched with clubs, are shot with rifles; the full-grown males being killed first, after which the fore-part of the herd is driven back upon and over the rear, when the slaughter is continued with lances. The description of this scene is, however, by no means pleasant reading, and may accordingly be passed over.

**Californian
Sea-Lion.**

The Californian sea-lion (*O. gillespi*), which, far from being restricted to the country from which it derives its name, is found on

both sides of the North Pacific, is a much smaller species than the last, from which it is readily distinguished by the convex crown of the head, and the sudden descent of the profile at the eye; the side view of the head somewhat recalling that of the dog-faced baboons. The bristles on the side of the muzzle are also very small. The skull is characterised by its narrowness and elongation, and also by the great development of the bony

crests on the brain-case. The general colour is a dark chestnut-brown, becoming blackish brown on the under-parts and limbs; but there is great seasonal and individual variation in this respect. Mr. Allen gives the total length of adult males as varying from 7 to 8 feet; those measurements being taken from the muzzle to the end of the outstretched flippers.

Habits. There has been some confusion as regards the habits of this species, owing to its having been confounded with the northern sea-lion. Both species occur on the Farallone Islands, near San Francisco; but the present species is by far the more numerous of the two, and appears to be the only one represented on the neighbouring island of Santa Barbara. Mr. Elliot states that the two species may be readily distinguished by their voices; the northern



HEAD OF CALIFORNIAN SEA-LION.—After Forbes.

sea-lion uttering only a deep, bass growl, and a prolonged, steady roar; whereas the Californian sea-lion never roars, but utters a sharp bark, sometimes almost approaching a howl.

The general habits of this species seem to be very similar to those of the northern sea-lion. On the Farallones these seals are found in vast numbers, and their barking is described as forming an incessant din. Captain Scammon, writing of his experiences with these animals on the island of Santa Barbara, during the sealing season of 1852, states that soon after the arrival of his party, about the end of May, the colonies of Californian sea-lions "began to augment, and large numbers of huge males made their appearance, belching forth sharp, ugly howls, and leaping out of or darting through the water with surprising velocity, frequently diving outside the rollers, the next moment emerging from the crest of the foaming breakers and waddling up the beach with head erect, or, with seeming effort, climbing some kelp-fringed rock to doze in the scorching sunbeams; while others would lie sleeping or playing among the beds of sea-weed, with their heads and outstretched limbs above the surface. But a few days elapsed before a general contention with the adult males began for the mastery of the different rookeries; and the victims of the bloody encounter were to be seen on all sides of the island, with torn lips or mutilated limbs and gashed sides, while now and then an unfortunate creature would be met with minus an eye, or with the orb forced from its socket, and, together with other wounds, presenting a ghastly appearance. As the time for 'hauling up' drew near, the island became one mass of animation; every beach, rock, and cliff, where a seal could find foothold, became its resting-place, while a countless herd of old males capped the summit, and the united clamourings of the vast assemblage could be heard on a calm day for miles at sea. The south side of the island is high and precipitous, with a projecting ledge, hardly perceptible from the beach below, upon which one immense sea-lion managed to climb, and there remained for several weeks."

The same observer adds that "at the close of the season—which lasts about three months on the Californian coast—a large majority of the great herds, both males and females, return to the sea, and roam in all directions in quest of food, as but few of them could find sustenance about the waters contiguous to the islands, or points on the mainland, which are their annual resorting places. They live upon fish, molluses, and sea-fowls, always with the addition of a few pebbles or smooth stones, some of which are a pound in weight." The quantity of fish consumed by these seals must, indeed, be enormous. Some years ago it was estimated that the total number of sea-lions in the neighbourhood of San Francisco was upwards of twenty-five thousand, each of which consumed from 10 to 40 lbs. weight of fish per diem. In capturing gulls the Californian sea-lions display no little skill and cunning. When in pursuit of a gull Captain Scammon states that the seal dives deeply under water, and swims some distance from where it disappeared, then, rising cautiously, it exposes the tip of its nose above the surface, at the same time giving it a rotary motion, like that of a water-buoy at play. The unwary bird on the wing, seeing the object near by, alights to catch it, while the sea-lion at the same moment settles beneath the waves, and at one bound, with extended jaws, seizes its screaming prey, and instantly devours it.

The Californian sea-lion is the species most commonly seen in captivity in Europe, as it appears to thrive better than any other of the eared seals in that state.

In captivity these sea-lions display great affection for one another; and when one of a pair dies the survivor not unfrequently pines away and dies soon after. From observations made on captive specimens in Chicago, it appears that before the cub takes to the water the parent secretes a kind of oily fluid from her body, with which the hair of the cub becomes anointed, owing to both animals rolling on the same spot.

Hooker's**Sea-Lion.**

With this sea-lion (*O. hookeri*), we come to a southern species of hair-seal, first obtained from the Auckland Islands, lying to the south of New Zealand, during the voyage of the *Erebus* and *Terror*. This species, of which examples have of late years been exhibited alive in the London Zoological Society's Gardens, is subject to great variation in colour, some specimens being greyish, while others have a more or less markedly brown tinge. The head is readily distinguished from that of the preceding species by its nearly straight profile; the muzzle is of considerable length, the ear of medium size, and the bristles on the muzzle well developed. The skull is characterised by the extreme narrowness of the palate, and has seven upper cheek-teeth—in the latter respect agreeing with that of the southern sea-lion.

**Australian Hair-
Seal.**

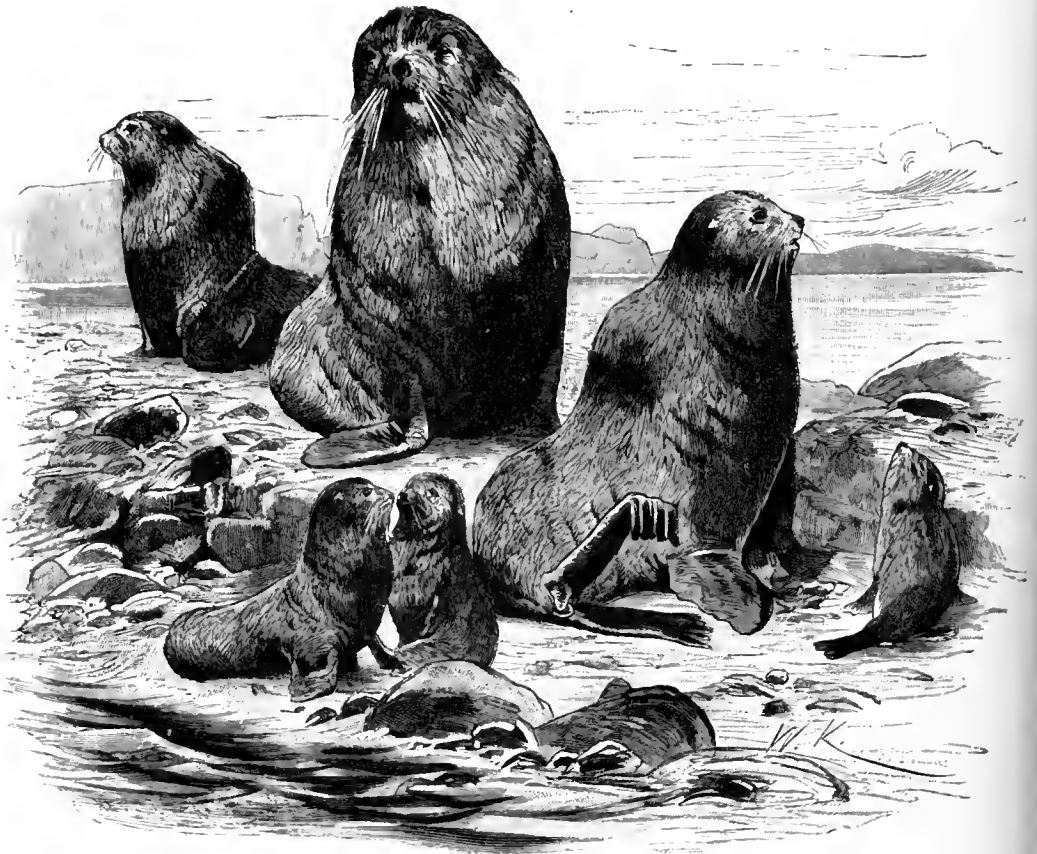
The hair-seal (*O. lobata*), inhabiting the seas of Australia, appears to form a kind of connecting link between the hair and the fur-seals, the cubs having a thick coat of soft under-fur, which quite disappears in the adult. This indicates that the distinction between hair and fur-seals is of no great zoological importance, although it forms a convenient mode of classifying the members of this difficult group. The profile of the head is nearly straight, and the whole head large and massive, with rather small ears. The males are considerably darker than the females, and the cubs are black. From the presence of a stripe of rich deep fawn colour (which is lighter than the general tint of the body) running across the hinder part of the head, nape, and sides of the neck, the name of cowled seal has been applied to this species. The general length of old males is from 8 to 9 feet, but few such specimens are stated now to exist. These seals were found abundantly in King George's Sound, and also in Bass Strait. The Seal Rocks off Port Stephens, to the northward of Sydney, partly derive their name from the presence of colonies of this species.

THE NORTHERN SEA-BEAR (*Otaria ursina*).

The well-known northern sea-bear, or northern fur-seal, is the first representatives of the true fur-seals, and the only one found in the Northern Hemisphere. In this, as in the other fur-seals, the pelage is soft, with an abundant under-fur; and the colour of the adult is some shade of dark grey, while the young are black. There are six cheek-teeth in the upper jaw.

The northern sea-bear, as shown in the accompanying illustration, is distinguished at a glance from all the southern fur-seals by its extremely short face, in which the profile is nearly straight, and likewise by its relatively weak

dentition. In the adult males the general colour of the upper-parts, with the exception of the shoulders, is nearly black, with a more or less marked grey, or reddish grey grizzle; but the shoulders are distinctly grey. The sides of the nose and lips are brownish, the breast is brownish orange, while the limbs and under-parts are reddish brown. The females are much lighter in colour, being uniformly grey above, with the under-parts brownish or rufous. In both sexes the individual variations in colour are largely due to the varying proportions of the grey in the



THE NORTHERN SEA-BEAR ($\frac{1}{2}$ nat. size).

hairs. The young when first born are of a uniform glossy black colour, with the under-fur lighter in hue, and less abundant than in the adults.

These seals are much smaller than the larger sea-lions, the old males, according to Captain Bryant, measuring from 7 to 8 feet in total length, and having a girth of from 6 to 7 feet; while their weight is estimated at from 700 to 800 lbs. They do not attain their full size till about the sixth year. The females, which reach their full dimensions when five years old, measure 4 feet in length and $2\frac{1}{2}$ feet in girth, and weigh from 80 to 100 lbs. The ears are absolutely longer than in the far larger northern sea-lion. The difference in the dimensions of the two sexes is greater than in any other member of the family.

Distribution. The northern sea-bear inhabits both shores of the Northern Pacific, and is known to have been formerly abundant on the American side as far south as California, although the precise limits to which it once ranged in this direction have not been ascertained. On the Asiatic side of the Pacific its range embraced Kamschatka and the Kurile Islands, and extended as far as the southern extremity of Saghalien Island, where it was still abundant at the period of the Crimean war.

At the present day, as is well known, the headquarters of the sea-bear are the Prybiloff Group, which comprises four islands, respectively known as St. Paul's, St. George's, Otter, and Walrus Islands; the two former of which are alone visited by the seals. Here the capture of the seals is strictly regulated, only a certain number being allowed to be captured annually. The Alaska Commercial Company leased from the United States Government in 1869 the sole right of sealing on these islands; the lease permitting them to capture 25,000 seals on St. George's and 75,000 on St. Paul's. And it appears that in the twenty years, from 1869 to 1889, the company has realised upwards of thirty-three millions of dollars by the sale of seal-skins. Of recent years large numbers of British vessels fitted out from Victoria and British Columbia have, however, been in the habit of visiting Behring Sea for the purpose of taking seals; and it is stated that in consequence of this the profits of the Alaska Company have considerably diminished. In the recent dispute between the British and United States Governments regarding this sealing in Behring Sea the United States declared that the sea in question was a *mare clausum*, a claim which the British Government successfully resisted.

Besides St. George's and St. Paul's, no other islands in Behring Sea appear to form suitable habitats for the sea-bears, which require a low, shelving coast, either of smooth rocky ledges or of shingle, with a cold climate and a fog-laden atmosphere. If the ground is such that water can collect in puddles, the seals avoid it, and if the coast is sandy the wind blows the sand into their large, sensitive eyes, causing them intolerable discomfort. The number of sea-bears on these two islands during the breeding-season is so enormous as to defy anything like exact calculation. In the summer of 1872 Mr. Elliot estimated, however, that there were upwards of 3,000,000 on St. Paul's, while in the following year he put down the number on St. George's at about 163,000.

Habits. It is mainly to Mr. Elliot that we are indebted for a full and adequate account of the habits of the sea-bears on the Prybiloffs, and it is from his graphic descriptions that the following summary is derived.

During the winter the Prybiloffs are deserted by these animals, which follow the southward migration of the fish upon which they chiefly subsist. The old males are the first to revisit their old haunts in the following spring; and a few of these may generally be found on the islands during the first week in May. At this time the males are very shy and sensitive, and remain near the shore; indeed, many of them will sometimes spend several days in swimming round the rocks before venturing to land. The first arrivals are not always the oldest, but rather the finest specimens of their race; and are always fully capable of maintaining possession of the stations they select immediately after coming ashore. As a rule, it appears that the males do not reoccupy the same stations year after year, although

sometimes a few may do this for a few seasons. "From the time of the first arrival in May, up to the first of June, or as late as the middle of the month," writes Mr. Elliot, "if the weather be clear, is an interval in which everything seems quiet; very few seals are added to the pioneers. By the first of June, however, or thereabouts, the foggy humid weather of summer sets in, and with it the bull-seals come up by hundreds and thousands, and locate themselves in advantageous positions for the reception of the females, which are generally three weeks or a month later." Then comes the great struggle for obtaining and maintaining a position on the land, those males which are the last to arrive, and also those occupying the posts nearest the water's edge, having the greatest difficulties to overcome. Frequently the combats which then take place result in death; while some of the earlier arrivals which have taken up stations near the shore become exhausted by repeated struggles, and have to shift to more inland quarters. "The fighting," says Mr. Elliot, "is mostly or entirely done with the mouth, the opponents seizing each other with the teeth, and clenching the jaws. Nothing but sheer strength can shake them loose and that effect almost always leaves an ugly wound, the sharp canines tearing out deep gutters in the skin and blubber, or shredding the flippers into ribbon-strips."

During the time that the males are thus engaged in selecting and maintaining their positions, they may be approached from the leeward when asleep so closely as to admit of the bristles on their muzzles being pulled. The adventurous investigator is, however, warned that after one such experiment he must beat a hasty retreat, if he would escape an unpleasant mauling from the animal's teeth.

At this period the males give vent to four distinct cries, namely, a hoarse, resonant, long, and loud roar; a low, gurgling growl; a kind of hissing, chuckling, piping whistle, which must be heard to be recognised; and a kind of spitting sound and action, which is the most characteristic of all. The females, on the other hand, have only a kind of bleating cry, used merely to attract the attention of the cubs; while the call of the latter is still more sheep-like. Indeed, it is stated that some sheep imported into St. George's were constantly misled by the cries of the females and young seals into believing that others of their own species were in the neighbourhood. The seals when on land are extremely impatient of heat, a temperature of 48° being unpleasant to them; while when the thermometer ranges from 55° to 60° they appear to suffer great inconvenience. On such occasions they may be seen lying in every conceivable position, industriously fanning themselves with their flippers, sometimes holding the fore-flippers vertically upwards as a kind of ventilator, while one or both of the hinder pair are employed as fans.

From their first arrival until the end of the pairing season, which terminates during the first third of August, all the males which succeed in maintaining their posts never leave them for a single instant; and consequently never partake of either food or water for at least three months, while in some instances this fast endures for upwards of four months. During this time they must subsist entirely on their own fat; and it will not fail of notice that such a fast is very different from that endured by bears and other hibernating animals, during which most of the functions of the body are dormant. Nevertheless, no ill consequences appear to accrue, since the old male sea-bears come back year after year as fat and sleek as ever.

Between the 12th and 14th of June the first females make their appearance on the Prybiloffs. When they first land, wet and dripping from the sea, they are of a dirty grey colour, darker on the head and back than elsewhere; but when thoroughly dried their coat is of a steel-grey above, and nearly white beneath, with a brilliant gloss. A few days' exposure to the weather is, however, sufficient to tone down this brilliant dress to a sombre greyish brown above, and an ochrey tint below. Immediately on their arrival, the females are received with most marked attention by the males nearest the shore, but they are seldom allowed to rest long with these, as the males on the more inland stations are ever on the watch to seize and take possession of them during the time that their temporary masters are on the look-out for fresh wives. In this manner the unhappy females may be seized by the scruff of their necks as unceremoniously as a cat takes its kitten, and passed on from male to male, until they reach a place of security in the stations farthest away from the water. During all this time fierce contests are continually taking place among the males. By the time of the arrival of the last batches of females, which takes place usually between the 10th and 15th of July, the males have become thoroughly exhausted, and have obtained as many females as they desire. Consequently, the females are now allowed to crowd in through the fifteen or sixteen rows of stations usually intervening between the shore till they reach the open ground in the rear of the colony, where they congregate in droves, carefully selecting places where there are no pools of water.

It is considered by Mr. Elliot that, on the average, each male in the neighbourhood of the shore has from twelve to fifteen females, while those more inland have only from five to nine. One old male was observed with upwards of forty-five females under his charge, but this individual was favoured by his situation, which had but one path of access. A certain number of males in the rear of the colony never obtain partners at all; though towards the close of the season some of them may step into the places of those of their sex as have to leave their stations through exhaustion. The males display extreme courage in defending and maintaining their positions; and will even stand being fired at with shot without forsaking their posts. The females, on the other hand, are remarkable for their gentle disposition, never quarrelling among themselves, and but seldom uttering a cry when roughly handled and severely wounded by the contending males. During their sleep the bodies of all the sea-bears are continually undergoing various quivering and rolling motions, accompanied by twitchings of the paddles.

The cubs are born shortly after the landing of the females, coming into the world with their eyes open, and soon finding their voice, and taking to the water. It is but rarely that there is more than a single cub at a birth. They weigh from 3 to 4 lbs., and vary from 12 to 14 inches in length when born; their jet-black coat being retained for three months. Both parents seem to treat their offspring with marked indifference; and a cub which has strayed a short distance from the station of the father may be killed before the eyes of the mother without evoking any concern on her part. Although the males will often rush right into the middle of a whole party of cubs, it is but seldom that any of the latter are killed.

After the birth of their offspring, the females appear to make frequent visits to the sea, usually returning close to the spot where their cubs were left, and

singling out their own offspring by its cries without a moment's hesitation. The cubs are accustomed at an early period to collect in large numbers, while from the latter part of September to the time of departure in November, they assemble together in tens of thousands. Even among such numbers, the female instantly recognises the voice of her own offspring, and promptly makes her way by thrusting right and left to that spot in the assembly where it may happen to be. It is said that the cubs themselves do not know their own mothers, but as they incessantly utter their cry at short intervals, the females have no difficulty when returning from the sea in finding their offspring.

Between the end of July and the close of the first week in August, the seal colonies have entirely altered in appearance, owing to the breaking up of the various family parties. The old males leave their stations, and betake themselves to the sea, in a very emaciated condition; the majority of them not returning to the land. Such, however, as do make a second visit are in fine condition, and have grown a new and brilliant coat of fur. The return visit does not take place till the end of September; and the males then prefer to congregate on the beach, instead of going up to their old ground. After the departure of the old males in the beginning of August, the females, cubs, and those males which did not succeed in obtaining wives, take possession of the entire seal area in a very disorderly manner; while their numbers are augmented by the landing of a host of young males which had hitherto been prevented by their elder brethren from obtaining a footing on shore. At this time three-fourths of the females are generally in the water, only coming ashore for short intervals to look after their cubs. They lie idly in the waves, now and again lazily rolling over, and continually scratching their sides and backs with their flippers. After the first week in August the cubs nearest the shore make their first attempts at swimming, but are extremely awkward, and quickly tire with their efforts. Soon, however, they become adepts in the art, and may then be seen sporting and frolicking in the water with the greatest apparent enjoyment. By the middle of September all the cubs have become thoroughly familiar with the water, and have entirely deserted the higher grounds to take up a position on the rocks and beaches near the water's edge, previously unoccupied by any of the seals. Finally, in November the islands are deserted by the great mass of the sea-bears, although some do not leave for their southerly migration until driven off by the snow and ice, as late as the end of December or the 12th of January.

The preceding observations relate almost exclusively to the old males, the females, and the cubs; but a few words are necessary as to the young males under six years of age, which are known to the sealers as "bachelors." In the early part of the season these come out of the sea in detachments of from a hundred to a thousand strong, but later on by hundreds of thousands. They generally go to a distance of from a quarter to half a mile from the shore, on what are technically known as the "hauling-grounds," in contradistinction to the "rookeries." These seals are in some cases allowed to pass up and down to their haunts by passages left between the family parties on the rookeries; but more generally repair to the beaches unoccupied by the rookeries, where they will occupy the whole space from the shore to a distance of a quarter of a mile or more inland. Some of the younger

ones will, moreover, occasionally desert the neighbourhood of the shore, and proceed still further inland to play among the fresh moss and grass which grows in the interior. These young seals do not undergo any long periods of fasting, but are constantly repairing to the sea at short but uncertain intervals. For instance, during a few dull and foggy days they may be found by hundreds of thousands on the hauling-grounds; but a single warm and sunny day will drive almost the whole assemblage to the sea, leaving their haunts well-nigh deserted. They are thoroughly restless creatures, being constantly on the move; and although very frolicsome and sportive, never seen to quarrel or fight. In the water these young seals distinguish themselves by their active evolutions; frequently jumping out after the manner of dolphins, more especially when surprised, and in such cases turning their heads when in the air to catch a glimpse at the cause of their disturbance.

Mr. Elliot adds that sea-bears of all ages "swim with great rapidity, and may be fairly said to dart along with the velocity of a bird on the wing under the surface of the water; and in all their swimming I have not been able yet to satisfy myself how they used their long, flexible hind-feet, other than as steering mediums. The propelling motion, if they have any, is so rapid, that my eye is not quick enough to catch it; the fore-feet, however, can be very distinctly seen to work, feathering forwards and sweeping back flatly, opposed to the water, with great rapidity and energy, and are evidently the sole propelling power."

Capture. It appears that of the total number of sea-bears about half are males and half females; but some two-thirds of the former are never permitted by their older and stronger brethren to mix with the females, but herd together by themselves in the manner just described. It is these bachelor seals which are alone allowed to be killed in the Prybiloffs; and it will be evident that their association by themselves—frequently miles away from the breeding-grounds—must greatly facilitate the arrangements for their slaughter. When the bachelor seals are assembled near the water, on some morning early in June, a small party of natives will run along the beach, and readily turn thousands of them inland. When once turned, the party is easy to manage; and on firm or grassy ground the whole herd in cool weather can be driven at the rate of half a mile an hour, but frequent halts must be made. The weaker seals will, however, drop out from time to time, and are left either to recover or to perish, especially when the march is long; it is therefore advisable to make the journey as short as possible.

Arrived at the place of slaughter, the seals are herded, and allowed to rest and cool; after which they are driven off in detachments of from fifty to two hundred, and knocked on the head with heavy oaken bludgeons. The work of killing and skinning is carried out with great rapidity; a party of forty-five men having driven, killed, and skinned upwards of seventy-two thousand sea-bears in less than four weeks during the summer of 1872.

It has been already mentioned that the number of the sea-bears allowed to be killed annually on the Prybiloffs is limited by the terms of the lease to 100,000. There is, however, reason to believe that considerably more than this number are killed by the natives; and it is further asserted that the total number of sea-bears visiting the islands is steadily diminishing.

In addition to the seals killed on the Prybiloffs, a large number have of recent

years been taken in open water by British vessels cruising in Behring Sea; and it was, as already said, in regard to these that the international dispute referred to above arose. The seals thus taken appear to be exclusively young males or barren females, which have remained at sea during the months of May and June, when the great body has gone northwards to the Prybiloffs. Well-appointed schooners are engaged in this trade, and the method of procedure is thus described by a correspondent of the *Times*. When one of these vessels is at sea, "and seal are sighted, the little boats are hoisted out; a hunter, armed with two shot guns and a rifle, and two sailors to pull the boat, take their places, and the hunt begins. A seal swimming on the water, or perchance sleeping, is sighted, and the boat is pulled quietly toward the animal. In nine cases out of ten, the seal takes alarm and dives out of sight before the boat is brought close enough to use the guns with effect, and in no case does the hunter shoot unless he feels sure of his quarry. The seal, when shot, at once commences to sink, and the boat has to be pulled rapidly up to it, when the carcase is 'gaffed' and hauled aboard. This is repeated as long as a seal can be seen. In many instances only one or two will be killed during a whole day's hunting, but at other times as many as twenty will be taken. After a day's hunt the boats return to the schooner, and the seals are skinned and the pelts laid in salt in the hold. This goes on from day to day during the season. The seal has a chance of escaping, and the percentage killed is very small. When it is considered that an extent of ocean of nearly twelve thousand square miles is hunted over, the chance is slight of the seals being exterminated by the fleet of fifty or so vessels engaged in the seal-hunting business. It has been asserted that only a few seals out of every hundred shot are captured by the hunters; that the balance sink or escape wounded, to die later on. This is not so. On the contrary, a seal hardly ever escapes when shot. Of course a few do, but the percentage is small, probably not over five or six out of the hundred." Although it has been asserted that the number of sea-bears in the open sea is annually diminishing, this is denied by unprejudiced experts; and it is mentioned by the writer last cited that "the oldest hands in the business state that there are apparently as many seals in the sea nowadays as there were many years ago. There is, however, some greater difficulty experienced in capturing them. The older ones have learned what a sealing boat is, and at the sound of a gun, or at the approach of a boat, the wary animal is on its guard, and thus it is harder for the hunter to get within range of his quarry. Yet, in spite of this fact, large numbers are killed, and the business is fairly profitable." Of the two methods of sealing, the shooting in the open sea is decidedly to be preferred on humanitarian grounds, more especially if it be true, as asserted, that on the Prybiloffs a considerable number of breeding female seals are killed before their cubs are old enough to shift for themselves.

THE SOUTHERN FUR-SEALS.

In the Southern Hemisphere there are some four species of sea-bears or fur-seals, all of which differ from the Northern sea-bear in their much longer, narrower, and more depressed muzzles, and also in the circumstance that the flaps

of skin projecting in advance of the toes of the hind-flippers are much less elongated. The Southern fur-seals are also, as a rule, decidedly greyer in colour than their northern cousin. There is still some uncertainty as to the number of species belonging to this group, and their resemblance to one another is so close that it requires an expert to distinguish between them.

South American Fur-Seals. The South American, or Falkland Island fur-seal (*O. australis*) inhabits the Galapagos Islands, and the shores and islands of South America southwards from Chili on the western, and from the Rio de la Plata on the eastern side; being more numerous on the Falkland and South Shetland Islands than on the continent itself. The males attain a length of from 6 to 7 feet, while the females average about 5 feet; the disproportion between the sexes being thus much less than in the northern sea-bear. The colour of the fur is distinctly grey.

Habits. The habits of this species seem to be very similar to those of its northern cousin; the old males arriving on the Falklands before the females, and similar contests taking place for the possession of the latter, which arrive in December. The cubs are born during the same month, and are able to swim well by February. The young males remain at sea during the greater part of the summer, not landing till February or March. They sojourn on land till the latter part of April, when they again take to the water; but towards the end of June they once more visit the shore for several weeks, remaining partly on land and partly in the sea. When Weddell visited the South Shetlands during his voyage, lasting from 1818 to 1821, these seals were very numerous, and had so little fear of man that numbers of them were killed and skinned without disturbing the remainder of the party. Moseley, during the voyage of the *Challenger*, found, as already mentioned, these seals still fairly numerous on Kerguelen's Land, although, from the reckless way in which they were slaughtered, they appeared in imminent danger of total extermination. Like the sea-lions of the same regions, the southern fur-seals prey at times upon penguins.

Cape Fur-Seal. The Cape fur-seal (*O. pusilla*) is a very well-marked species, characterised by the straight profile of the head, the overhanging and sharply-pointed muzzle, the relatively long ears, and the extreme length of the numerous bristles depending from the upper lip. A living example, formerly exhibited in the London Zoological Society's Gardens, had a whitish red fur grizzled with blackish hairs, while the under-parts were of a reddish brown colour. This seal appears to be confined to South Africa, inhabiting the small islands round the Cape of Good Hope, as well as others some forty miles distant from Port Elizabeth. It probably also once inhabited Tristan da Cunha. It is still fairly common, but its fur is of comparatively little value, owing to the shortness of the hair, although that of the young animals is longer. Some years ago, from 70,000 to 80,000 skins were annually imported from the Cape into London, but the number is now much reduced. In Algoa Bay as many as from 200 to 300 of these seals have been taken during a single night.

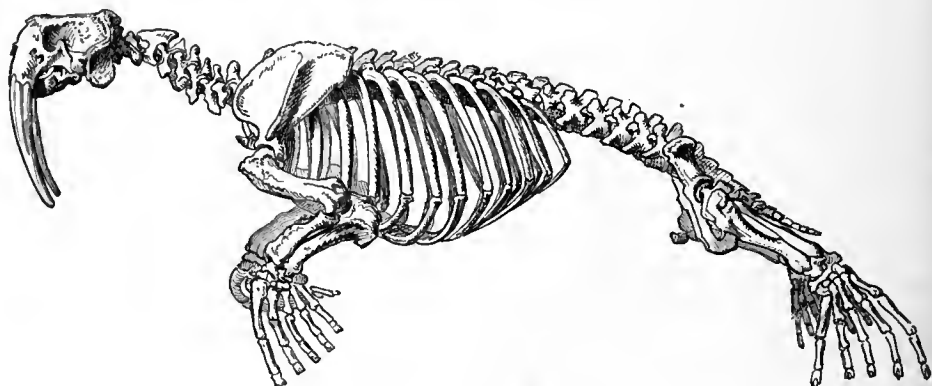
New Zealand Fur-Seal. There has been much uncertainty with regard to the fur-seals of the Australian seas, but it now appears that there is but one species, namely, the New Zealand fur-seal (*O. forsteri*), of which the so-called cinereous fur-seal (*O. cinerea*), according to Mr. H. O. Forbes, is the female. This

seal is the only one found on the New Zealand coasts, and it also occurs at Chatham Island and the Seal Rocks near Port Stephens. Although formerly abundant, it is now becoming very rare. At the time of Flinders' visit in 1798 it was found in thousands at Passage Point, to the north of Tasmania. The males are usually dark grey above and brown below, while the lighter females are generally yellowish brown above and dark below, some of them having a crest of long whitish hairs. While the fur of the male is valuable and beautifully curled, that of the female seems to have frequently but little under-fur, so that skins have been described as those of hair-seals.

THE WALRUS.

Family *TRICHECHIDÆ*.

The huge and ungainly animals, commonly known by the name of walrus (from the Scandinavian *valross*, meaning whale-horse), constitute not only a distinct genus of the Pinniped Carnivores, but are likewise the sole representatives



SKELETON OF THE WALRUS.

of a special family. Walruses are strictly confined at the present day to the Arctic regions of both hemispheres; but there is some difference of opinion as to whether those found in the Pacific are specifically distinct from the typical Atlantic form. The two are, however, so extremely closely allied that we prefer to regard them as belonging to a single species (*Trichechus rosmarus*).

In many respects the walrus is nearly allied to the eared seals, this being especially shown in the structure of the hind-limbs. Thus the hind-feet are capable of being turned forwards beneath the body, and are employed in locomotion on land; while they have the three middle digits much smaller than the outer pair. Moreover, the toes of the hind-feet are similarly terminated by large lobes projecting far beyond the extremities of the bones; and the fore-limbs are nearly as large as the hinder ones.

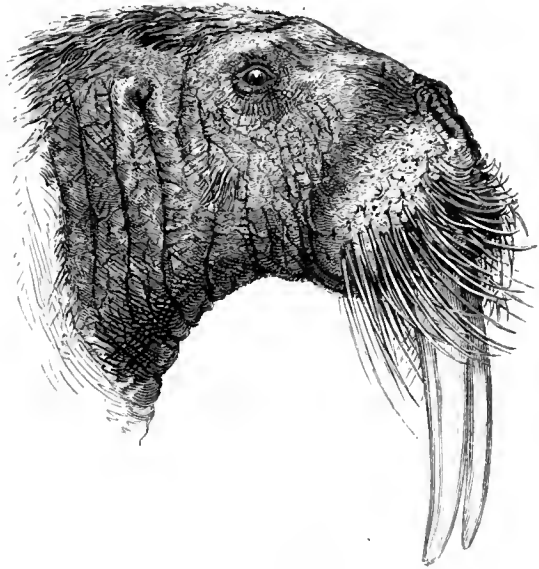
The walrus differs, however, from the eared seals in the total absence of external ears, and also in its massive and clumsy build, as well as in the number and structure of its teeth. Thus the front portion of the skull is greatly swollen, and carries a pair of very long and laterally compressed tusks, or canine teeth,

depending from the upper jaw. In the adult animal internally to these tusks there is usually a row of four small teeth, of which in the young state the first is situated in advance of the latter, and is, therefore, an incisor; the other three being premolars. The lower jaw has but four teeth on each side, of which the foremost corresponds to the upper tusk, while the other three represent the premolars. Consequently, an adult walrus has but eighteen teeth altogether. The young animal has, however, two pairs of incisor teeth in both jaws, and five upper and four lower cheek-teeth; thus, with the tusks, bringing up the total number of teeth to thirty. We thus see that the young walrus presents resemblances to the eared seals in respect of the number of its teeth, which are totally lost in the adult animal. Our figure of the skeleton of the walrus shows the tusks in their full development; the illustration of the living animal being taken from examples with poorly-developed tusks. With the exception of these large upper tusks, all the teeth have low, blunted, sub-conical crowns, admirably adapted for crushing the molluscs on which these animals so largely subsist.

In comparison with the size of the body, the head of the walrus is rather small, and while squared and abruptly truncated in front is somewhat rounded behind; this rounded appearance being increased by the absence of all trace of external ears. The muzzle seems to be divided into two lobes by the

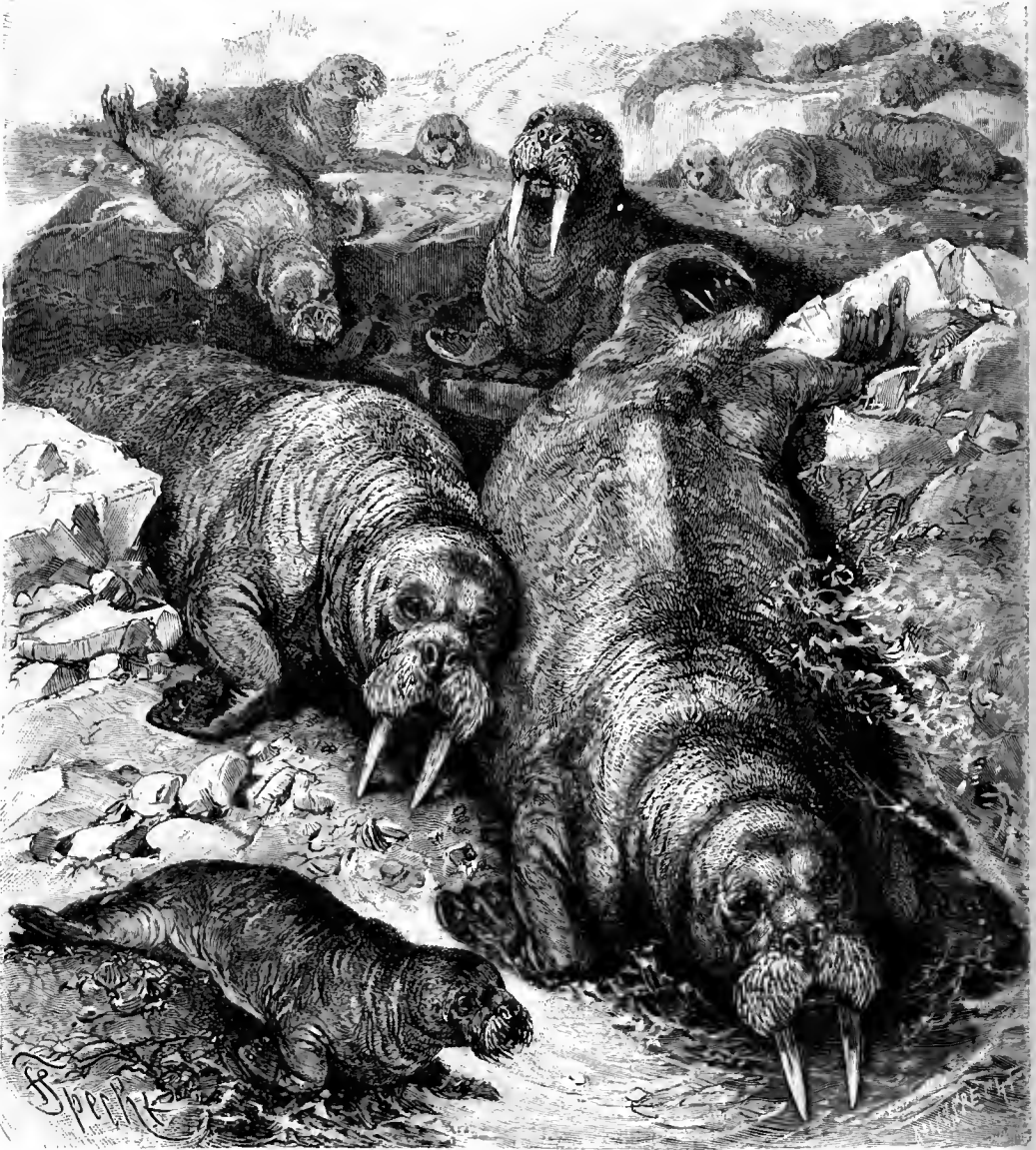
vertical groove below the nostrils, and is furnished on either side with a number of stout translucent bristles growing from the upper lips. The eye is very small; and the entire head has a remarkably rugged and battered appearance; the lower jaw narrowing to a point between the upper tusks. The latter, which ordinarily project to a length of from 12 to 15 or more inches below the level of the gum, communicate, of course, the most striking and characteristic feature to the head, and indeed to the whole animal. Although relatively longer than in the true seals, the neck is shorter than in the eared seals, and gradually thickens posteriorly, where it imperceptibly merges into the trunk. The body is extremely bulky and ungainly, with a rounded outline, and diminishing gradually in size from the shoulders to the hind-quarters. The tail is very small; and the limbs are to a great extent enclosed in the skin of the trunk. There are five rudimentary claws on both the fore and the hind-feet, the soles of which are completely devoid of hair.

In the young of the walrus the body is thickly covered with short, yellowish brown fur, which is thinner and shorter on the under-parts and limbs than elsewhere,



HEAD OF WALRUS.

where it also becomes of a reddish brown or chestnut tinge. This fur persists till middle age, but in old age becomes gradually more and more scanty, frequently disappearing almost completely, or even entirely, from patches of larger or smaller



WALRUSES ON THE ICE ($\frac{1}{10}$ nat. size).

extent; while in some very old males of the Pacific walrus the whole skin may be almost naked. The skin over the entire body is thrown into a number of folds and wrinkles, these folds being heaviest in the region of the shoulders. The frequent fights in which these animals engage add a number of scars to the skin. Of four adult males measured by Mr. J. A. Allen the smallest had a length of $9\frac{1}{2}$

and the largest of 11 feet, from the tip of the snout to the root of the tail. Other individuals have, however, been recorded, measuring somewhat more than 12 feet in total length; but the statements of 15 or even 16-foot walrus must be received with hesitation. There is still much uncertainty as to the weight which these animals will attain. Parry gives the weight of an immature female as 1550 lbs.; while other trustworthy writers set down the weight of full-grown males at from 2250 to 3000 lbs. Larger weights have, indeed, been suggested, but it is probable that in those cases the estimates were far too high. In regard to the size of the tusks of the Atlantic walrus, a fine pair mentioned by Mr. Allen had a total length of 24 inches, of which probably about 18 inches would have protruded from the jaw during life; the weight of each of these being 4 lbs. Others have, however, been obtained with a total length of 31 inches, and a weight of upwards of 8 lbs. apiece; but such are, now at least, extremely rare. The tusks of females seldom exceed 20 inches in length. In the Pacific walrus the tusks are said to be longer and thicker, and more convergent; but we have not met with any account of their maximum dimensions.

In addition to this difference in the form of the tusks, the Pacific walrus has the muzzle proportionately broader and deeper, while the bristles on the upper lip are shorter and smaller. Important differences also occur in the form of the skull of the two varieties.

Distribution. The geographical range of the walrus has been considerably restricted in modern times owing to the incessant persecution of the animal in all accessible regions, and it is now exterminated in many places where it was formerly abundant. Its numbers have, indeed, been sadly diminished everywhere, and unless it receive prompt and efficient protection it is one of those creatures which stand a good chance of becoming extinct; this being more especially the case with the Pacific variety. The Atlantic walrus was known in Europe during the latter part of the ninth century, and appears to have been hunted on the coast of Finmark about a century later, while by the year 1600 walrus-hunting was a regular trade. Occasionally these animals wandered as far southwards as the coasts of Scotland; and they were abundant on many of the islands near the northern coast of continental Europe, and even on the shores of the continent itself; while eastward their range extended into Asia as far as the River Lena. Northwards the walrus appears to extend as far as vessels have penetrated. In 1600 it was very abundant on Cheric, or Bear Island, lying about two hundred and eighty miles to the northward of the North Cape, in Norway; no less than six or seven hundred having been killed on one occasion in six hours, while on another from nine hundred to a thousand were slaughtered in less than seven hours. The animals were accustomed to collect in large parties on the shore; and the plan adopted was first to shoot those nearest the sea, whose bodies then formed a barrier, cutting off the retreat of the rest. In less than eight years the walrus on Bear Island had become scarce and shy, and it was not long before they were completely exterminated. The retreating walrus were then followed to Spitzbergen and Greenland, and even there their numbers have so diminished that walrus hunting cannot be profitably conducted unless carried on in conjunction with whaling. Baron Nordenskiöld states that at the present day

the walrus is seldom found during summer on the west coast of Novaia Zemlia to the south of Matotschkin Skar, but that on the east coast of the same island, and in parts of the Kara Sea it is fairly common. It is but rarely seen in Iceland, but is not unfrequent on the coasts of Western Siberia.

In America the Atlantic walrus formerly ranged from Nova Scotia to about latitude 80° , and was at one time abundant in the Gulf of St. Lawrence and the eastern coasts of Newfoundland and Labrador. About 1534 walrus were very abundant on the Magdalen Islands in the Gulf of St. Lawrence; and many expeditions were soon after fitted out in Europe for the capture of the animals on these and adjacent islands. Till a few years ago, the heaps of walrus bones on the shores of the Magdalen Islands attested the slaughter that had taken place. According to Dr. A. S. Packard, the last walrus seen in the Gulf of St. Lawrence was killed in 1840; but a few have been observed subsequently on some of the neighbouring coasts and islands. In Greenland it was stated that about the year 1877 the walrus was only sparsely distributed in most places, with the exception of the tract lying between the 66th and 68th parallels, where it was sometimes met with in considerable numbers, and was regularly hunted by the natives in their canoes. Walrus also occur on the west coast of Baffin's Bay, and some of the islands to the north; but their range appears to be limited by the western shore of Hudson's Bay; and as they are not again met with till we reach Alaska, a large part of the coast of Arctic America is probably uninhabited by them.

Although the Pacific walrus has been known in Europe since the middle of the seventeenth century, it was not much molested by hunters till about the year 1860, by which date whaling had become much less profitable than it had been. The range of this variety was always much more restricted than that of its Atlantic cousin, reaching from the limit of ice southwards on the American coast as far as latitude 55° , and on the Asiatic shores to latitude 60° . In longitude its range to the north of Behring Strait in the Arctic Sea was limited to the eastwards by Point Barrow in Northern Alaska, and to the westward by Cape Chelagskoi, in longitude 170° , on the northern coast of Siberia. As on the latter coast the range of the Atlantic walrus did not extend eastwards of the Lena, the two varieties were widely separated from one another in this direction, as they also were in the opposite direction. On the Alaskan side of Behring Sea and Behring Strait the Pacific walrus was formerly found in enormous herds in Bristol Bay and Norton and Kotzebue Sounds; and in summer it also visited the Prybiloff Islands in large numbers. These animals were likewise common on the Aleutian Islands; but in the more southern portions of their range they were always sparsely distributed. Up to the year 1874 they were still found in innumerable herds where the waters of the Arctic Sea join with those of Behring Strait, and also in Behring Sea; but since that date their diminution has been rapid. It is stated that between the years 1870 and 1880 close on 2,000,000 gallons of walrus-oil, and 400,000 lbs. weight of ivory were obtained from these regions; thus representing the destruction of not far short of 100,000 animals. When the Russians first opened up the Prybiloff Islands, walrus were found in numbers on both St. Paul's and St. George's, but they soon retreated to Walrus Island, leaving the other two to their

less timorous cousins the sea-bears and sea-lions. It is stated that in a single year upwards of 28,000 lbs. weight of walrus-ivory was obtained from the Prybiloffs alone.

In prehistoric times the range of the Atlantic walrus was much more extensive than during the historic epoch, on both the eastern and the western sides of the Atlantic. Thus its remains have been dredged up from the Dogger Bank off the eastern coast of England; while a skull was dug up from the peat near Ely, indicating that the animal formerly inhabited the valley of the Ouse, which was at that time probably an estuary. On the eastern coast of America walrus bones have been dug up as far south as New Jersey, Virginia, and even California. At a still earlier period walruses, which are considered to belong to an extinct species, inhabited both the eastern coast of England and the shores of Belgium; numerous remains having been obtained from the so-called crags of the Pliocene period in both countries.

Habits.

There appears to be no well-marked difference between the habits of the Atlantic and Pacific varieties. Walruses are usually found in the neighbourhood of shores or masses of floating ice, and are but seldom seen in the open sea. As a rule, they associate in companies or herds, depending in size upon the number of individuals in the particular locality. In addition to this fondness for each other's company, Baron Nordenskiöld states that curiosity is a distinguishing trait of the walrus, and relates how that when on one occasion he rowed right into the midst of a herd, "part followed the boat long distances quite peaceably, now and then emitting a grunting sound; others swam quite close, and raised themselves high out of the water, in order to take a view of the strangers. Others, again, lay so closely packed on pieces of drift-ice as to sink them down to the water's edge, while their comrades swimming about in the sea endeavoured with violence to gain a position on the already overfilled resting-places, though a number of unoccupied pieces of ice floated up and down in the neighbourhood." When on shore, or on an ice-floe, the various members of a party of walruses are described as huddling and pressing together against one another like pigs. From April to June, according to the latitude, is the breeding-season; and during this period the walruses are stated to remain on shore for about a fortnight, during which time they neither eat nor drink. Usually there is but a single young produced at a birth; and there is never more than a pair. The young are stated to be suckled by the parent for upwards of two years; and it is hence believed that the same female breeds but once in every three years. The females, while suckling their young, are said to assemble in herds apart from the males. Like seals, walruses appear to have circular breathing-holes in the ice, to which they can resort from below without exposing themselves. The voice of these animals is a loud roar, which in the case of large herds can be heard at the distance of several miles.

Unless molested, the walrus is stated to be gentle and inoffensive in disposition; but when attacked displays great fierceness and vindictiveness, while its huge bulk renders it a formidable antagonist, especially when its aggressors are afloat in a small boat. Not less noteworthy is the affection of the female walrus for its young, and likewise the sympathy of all the members of a herd for a

wounded comrade. When one of the herd is wounded, all its fellows are stated to combine together for its defence; and on such occasions the aspect of the animals is described as absolutely terrific. Either through confidence in their size and power, or from want of appreciation of danger, walruses when on shore or on the ice can often be approached very closely, and may thus be easily dispatched; they learn, however, greater caution with experience. In other cases they seem to be more vigilant on all occasions, having a certain number of their body acting as sentinels. In hunting them the great object is to cut off their retreat to the water, as if they once gain the open sea they generally escape. The number of walruses formerly found on the ice-floes of Spitzbergen was so great, and so thickly were the creatures crowded together, that an eye-witness wrote of them as presenting the appearance of solid islands of animals.

Food. The walrus feeds chiefly upon thick-shelled bivalve molluses, especially those commonly known as gapers. For crushing the shells of these molluses the stunted and short cheek-teeth of the walrus are admirably adapted; but it appears that, after being broken, the shells themselves are rejected, and only the soft portions of the molluses swallowed. This molluscan diet is also supplemented by fish and various crustaceans; while in addition to these, large quantities of sea-weed are also swallowed, although it is quite probable that their introduction into the creature's mouth is not intentional. It appears to be now ascertained beyond doubt that the chief use of the tusks of the walrus is to dig in the mud and ooze for the purpose of raking up the molluses, on which it feeds so largely. Dr. R. Brown states, however, that he has seen walruses employ their tusks to aid in dragging their unwieldy bodies on to the ice, and also to aid their clumsy progress when on land. These observations are fully confirmed by Dr. Kane, who states that he has known walruses in this manner drag themselves on rocky islands to heights of sixty or a hundred feet above the level of the water.

Hunting. The walrus is killed when on land or ice either by means of long lances, or with rifles; while when at sea it is chased with special boats and harpooned. Allusion has already been made to the enormous numbers of these animals killed in the Magdalen Islands, in the Gulf of St. Lawrence, in the sixteenth and seventeenth centuries; but one more instance of an enormous destruction of these animals may be referred to in greater detail. This occurred in the summer of 1852, on Thousand Island, lying off the south-west coast of Spitzbergen. Here, writes the narrator, Mr. Lamont, "two small sloops, sailing in company, approached the island, and soon discovered a herd of walruses, numbering, as they calculated, from three to four thousand, reposing upon it. Four boats' crews, or sixteen men, proceeded to the attack with spears. One great mass of walruses lay in a small sandy bay, with rocks inclosing it on each side, and on a little mossy flat above the bay, but to which the bay formed the only convenient access for such unwieldy animals. A great many hundreds lay on other parts of the island at a little distance. The boats landed a little way off, so as not to frighten them, and the sixteen men, creeping along shore, got between the sea and the bay, full of walruses before mentioned, and immediately commenced stabbing the animals next them. The walrus, although so active and fierce in the water, is very unwieldy and helpless on shore, and those in front soon succumbed to the

lances of their assailants; the passage to the shore soon got so blocked up with the dead and dying that the unfortunate wretches could not pass over, and were in a manner barricaded by a wall of carcases." The slaughter went on until the men were drenched with blood and thoroughly exhausted, while their lances became so blunt as to be useless. After returning to the ship to refresh themselves and grind their lances, the work of destruction was, however, resumed, and did not cease until upwards of nine hundred animals had been slain. Even then, however, so sluggish and lethargic were the walruses, that several hundreds were still lying on adjacent parts of the island. When the narrator visited the spot six years later the carcases were still lying as they fell, in some instances two or three feet deep, and the stench from them was perceptible for miles out at sea. The worst feature of this great slaughter was, indeed, the circumstance that the perpetrators, owing to the size of their vessels, were only able to carry away a small proportion of their victims.

The walrus is hunted for the sake of its oil, hide, and tusks. The yield of oil is proportionately less than in the seals; the amount obtained from the largest specimens seldom exceeding 500 lbs.; and the quality also is stated to be inferior to seal-oil. The hides are chiefly exported to Russia and Sweden, where the leather is used for harness and the soles of boots and shoes, and also is twisted into tiller-ropes. The value of the hides in America is stated to be from two to four dollars per half skin. In thickness the skin varies from 1 to 1½ inches. More valuable are the tusks, although their ivory is far inferior to that of elephants. The large amount of walrus-ivory annually obtained has been already mentioned; and it may be added that, in America, while the price per lb. was only 40 or 45 cents. in 1879, it had risen to a dollar or a dollar and a quarter in 1880; while in 1883 the price varied from four to four and a half dollars.

Another Scandinavian name for the walrus is morse, while to the Inuits the animals is known as the awuk.

THE TRUE, OR EARLESS SEALS.

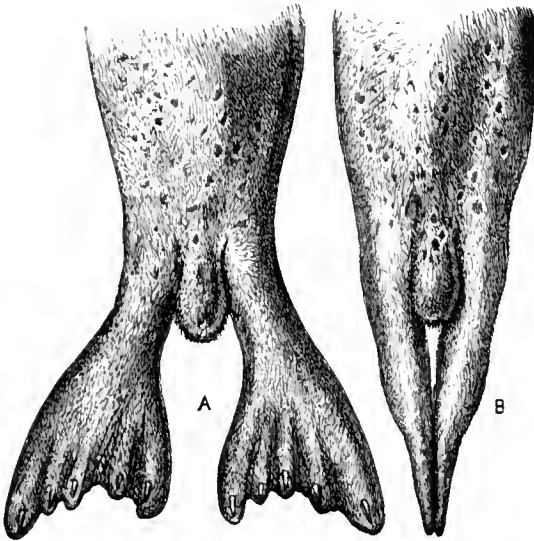
Family PHOCIDÆ.

With the true seals we come to the third and last family of the Pinniped Carnivores. These animals are at once distinguished from the eared seals and the walruses by the characters of the hind-limbs, which, as shown in the accompanying figure, are permanently directed backwards, and conjointly form a kind of rudder-like organ. Then, again, there is no trace of any external ear; and the neck is shorter than in either of the two preceding families. As additional characters of the limbs, it may be mentioned that the front pair are always smaller than the hinder, and that the first digit or thumb of the former is always longer than the other digits; while the whole of the digits are furnished with well-developed claws situated at their extremities. The hind-feet, which are incapable of the great expansion characterising those of the eared seals, usually have all the digits armed with claws, and generally want the long flaps of skin at their extremities, which characterise those of the eared seals. The number of front or

incisor teeth is variable in the different groups; but there are constantly five pairs of cheek-teeth in each jaw, of which the first four belong to the premolar series.

In all the species the under-surfaces of both the fore and hind-feet are covered with hair; while the fur clothing the body is invariably stiff and devoid of any woolly under-fur.

The true seals form a much less homogeneous group than the eared seals, and are arranged under several distinct genera; the total number of species being about sixteen or seventeen, although there is still a certain amount of doubt in some cases as to whether some forms should be regarded merely as local races or as distinct species. The greater number of the genera have but a single species each, and in only one of the genera does the number of species exceed two.



HIND-FLIPPERS OF RINGED SEAL—OPEN (A) AND CLOSED (B).

Distribution and Habits. True seals occur along the shores of the temperate and colder portions of the globe; but the greater number are found in the Northern Hemisphere. Moreover, with the exception of the elephant-seals, the seals of the Northern Hemisphere belong to genera distinct from those inhabiting the Southern Hemisphere; and the whole of the Arctic species are generically distinct from those of the Antarctic regions. Nearly the whole of the true seals are characterised by their strongly-developed social instincts and their extraordinary affection for their young. In disposition they are, as a rule, gentle and submissive, offering no resistance when attacked by man; although the crested seal of the North Atlantic is an exception in this respect. Many of the species are accustomed to assemble in large flocks during the breeding-season, while others are gregarious at all periods of the year. It is, however, only the elephant-seals that resemble the eared seals in passing a period of several weeks, during the breeding-season, entirely on land, and without partaking of any kind of food. As a rule there is but a single young one produced at a birth, and there is never more than a pair. All the seals are in the habit of spending a large portion of their time basking in the sun on sandy beaches or ice-floes.

Their food, of which a large quantity is necessary, consists chiefly of fish, but also comprises crustaceans and molluscs; and most of the species, like the eared seals, are in the habit of swallowing a number of pebbles.

As may be at once seen from the total absence of external ears and the structure of the hind-limbs, these seals are more specialised creatures than the eared seals, and are thus more completely adapted for an aquatic life. This is especially shown by the long period these animals can remain under water without coming

up to breathe. According to Dr. Robert Brown, the average time of a seal's submergence is from five to eight minutes, while the limit is set down by the same observer, at a quarter of an hour. Other authorities state, however, that the time may be extended to as much as twenty or thirty minutes. The sounds uttered by seals are various, in some cases taking the form of a kind of barking note, while in others they assume a more bleating tone, or even resemble the cry of a child; the note of the young being always more plaintive and less hoarse than that of the adult. In no cases, however, do they utter barking roars comparable to those characteristic of the eared seals.

The strange circumstance that young seals take to the water reluctantly, and have to be taught the art of swimming by their parents, would alone appear to be a sufficient indication that seals are originally descended from land Carnivores. Among some species the young remain entirely on the land or the ice for the first two or three weeks of their existence, or until they have shed their first coat of woolly hair. Numbers of seals are destroyed by the Polar bear, while others fall victims to the rapacious killer-whale. Others again are frequently destroyed by being jammed between ice-floes; and it is stated that thousands are sometimes killed by this means. The reduction in their numbers by all these causes are, however, trivial compared to those inflicted by man, who, according to Mr. J. A. Allen, requires about a million and a half to supply his annual needs. So reckless, indeed, has been the destruction of seals, that some species are already well nigh exterminated, while others have been so reduced in numbers as to render their pursuit no longer profitable.

Several species of seals inhabiting the Northern Hemisphere are in the habit of making long migrations, moving southward to avoid the intense cold of winter, and returning northward in summer; such migrations being most marked in the Greenland and the hooded seal. These movements have been carefully observed by Mr. J. C. Stevenson, on the Atlantic coasts of North America. The southern migration commences soon after the frost sets in; and at this season, he writes, "a fisherman, posted as sentinel on some headland commanding an extensive sea-view, communicates to the hamlet the first indication of the approaching host, the vanguard of which invariably consists of small detachments of from half a dozen to a score of seals. Such parties continue to pass at intervals, gradually increasing in frequency and numbers during the first two or three days of the exodus, by the end of which time they are seen in companies of one or more hundreds. The main body is now at hand, and during the greater part of the next two days one continuous uncountable crowd is constantly in sight. The whole procession coasts along at no great distance from the shore, presenting to an eye-witness a most extraordinary scene. In all quarters, as far as the eye can carry, nothing is visible but seals—the sea seems paved with their heads."

From the conformation of their hind-limbs, the true seals are unable to progress on land in the manner characteristic of the eared seals and the walrus; both the latter being able to bring their hind-limbs under the body by arching the back and carrying forward the hind-feet by a kind of jerk. Very generally the true seals move on land merely by a kind of wriggling motion of the body, with the fore-limbs held close to the sides of the trunk and the hind-limbs stretched out straight

behind. Dr. Murie has, however, ascertained that in the case of the Greenland and crested seals there is a kind of motion somewhat intermediate between the above and that characteristic of the eared seals. Thus the former of these two species "very often uses its fore-limbs, placing these on the ground in a semi-grasping manner, and, by an alternate use of them, drags its body along. The hind-legs meantime are either trailed behind slightly apart, or with opposed plantar surfaces slightly raised and shot stiffly behind. On uneven ground, or in attempting to climb, a peculiar lateral wriggling motion is made; and at such times, beside alternate palmar action, the body and the hind-limbs describe a sinuous spiral track." On the other hand, the common seal appears far less capable of making use of its fore-limbs in progression on land, these being only occasionally employed to obtain a hold on rocks.

On smooth ice seals are able to progress with considerable rapidity; the average rate being about one mile an hour in cool weather. Such journeys are always undertaken during the night; and the seals advance by raising their bodies from the ice by means of the fore-limbs, and then drawing themselves forward. On land, seals will occasionally travel considerable distances; and it is on record that in the winter of 1829 a grey seal in Norway travelled through the snow a distance of fully thirty miles; the time occupied in accomplishing this journey being believed to have been about a week, during which period the creature could not have touched food.

The true seals are not a very ancient group, geologically speaking, although their remains are found through the Pleistocene and Pliocene strata, and in a portion of those belonging to the Miocene period. Fossil seals are very common in the Pliocene deposits of Belgium; most of them being more or less nearly allied to the species now inhabiting the Northern Hemisphere. It is very noteworthy that while true seals range downwards to the Miocene period, no remains which can be definitely assigned to the eared seals have hitherto been discovered in any but the most recent and superficial deposits. If this apparently late origin of the eared seals be confirmed by future researches, it will go far to confirm the suggestion that the latter have taken rise from land Carnivores quite independently of the true seals.

THE GREY SEAL.

Genus *Halichoerus*.

The grey seal (*Halichoerus grypus*), which is the sole representative of its genus, belongs to a group confined to the Northern Hemisphere, and distinguished from all the other members of the family by the presence of three pairs of incisor teeth in the upper jaw, and two pairs in the lower jaw. A further characteristic of the group is to be found in the presence of claws on all the toes of both pairs of limbs; while all those of the hind-feet are of nearly equal length.

The grey seal is at once distinguished from the other members of this group by the circumstance that the crowns of the relatively large cheek-teeth are composed of but a single conical cusp, although there may occasionally be fore-and-aft cusps in the last two teeth of the lower jaw. Another peculiar feature of these teeth is

that, with the exception of the last one or two in the upper and the last one in the lower jaw, they are implanted in the jaws by means of only a single root each.

The grey seal is a rather large species, full-grown males usually measuring about 8 feet in length, although occasionally reaching as much as 9 feet; these measurements being taken from the tip of the nose to the end of the hind-feet. The general colour of the fur is silvery or yellowish grey, becoming lighter on the under-parts, and marked with a number of blackish or dusky ill-defined spots. There is, however, great individual variation in this respect, some specimens being uniformly silvery or yellowish white, with little or no trace of spots, while others are almost black. The young are always white or yellowish white at birth, but, as a rule, soon acquire darker tints.

Distribution. The grey seal, according to Mr. Allen, is one of the least common of the northern members of the family, and has a somewhat restricted distribution, being only found within comparatively narrow limits in the North Atlantic. On the shores of northern Europe it appears to be commoner than on the American side; and it occurs in Iceland, Scandinavia as far north as Finnmark, the British Islands, and probably Greenland. It appears, however, to be unknown in Spitzbergen and the islands of the Arctic Sea, and is not met with, at all events as a regular inhabitant, on the shores of the English Channel. On the American coast this species extends as far south as Sable Island, off Nova Scotia, while northwards it is met with occasionally in the Straits of Labrador and Belle Isle, and ranges as far as Disco Island.

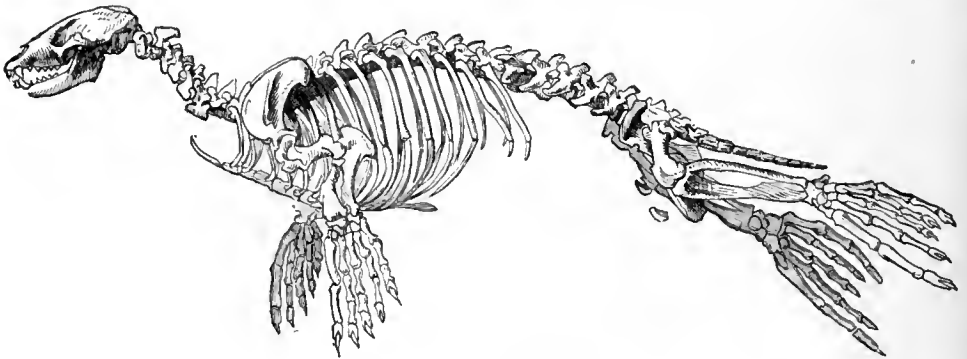
Habits. With the possible exception of the bearded seal, the present species is peculiar in breeding in the autumn; the young being produced in the Shetland Islands from September to November. There the grey seal is commonly found associating in pairs, and frequenting the most exposed positions. Describing the habits of this seal in the Gulf of St. Lawrence, Mr. Lucas writes that "it is fond of crawling out on the rocks, especially on sunny days, when it will lie basking in the sunshine for hours at a time. The seals do not come on shore at any convenient spot, but at a limited number of chosen localities, and these vary according to the force and direction of the wind. Except in very light breezes the lee-side of the island is selected, not entirely on account of the difficulty of effecting a landing on the windward side, but also because the seal relies very largely upon its acute senses of smell and hearing to warn it of approaching danger from the land. The chosen landing-places are where a shelf of rock, raised but little above the level of the sea, descends vertically for several feet beneath, thus enabling the seal to plunge head-first into the water and disappear at once from sight. Before landing, the animal will swim back and forth several times with head raised, and eye, ear, and nose on the alert to detect any sign of danger, the wary nature of the creature being well shown by the fact that almost immediately after emerging from the water the animal turns completely around so as to lie with the head seaward, and in readiness for an instant dive. The fairer the day and the lighter the breeze the more readily the seals come ashore, while during rough weather they not only do not land so often but are more watchful when they do come out." This species is less docile and intelligent than the common seal, and cannot be tamed in the same manner. A specimen measuring 8 feet in length weighed nearly 400 lbs.

THE COMMON SEAL AND THE GREENLAND SEAL.

Genus *Phoca*.

The common seal (*Phoca vitulina*) and the Greenland seal (*P. grœnlandica*) may be selected as well-known examples of the genus *Phoca*, which is the only genus in the family containing more than two species. All the members of this genus differ from the grey seal by their smaller and more pointed teeth, but more especially by the circumstance that each of the cheek-teeth, with the exception of the first in each jaw, is implanted by two distinct roots, and has its crown composed of three or four compressed cusps arranged in a line. In such a tooth there is one large main cusp in the middle, which corresponds to the single cusp of the teeth of the grey seal; while in front and behind this are one or two much smaller cusps.

Common Seal. The common seal, which is the only species in addition to the grey seal ordinarily met with on the coasts of the British Islands, is one of three nearly-allied forms, which in the young condition cannot always be



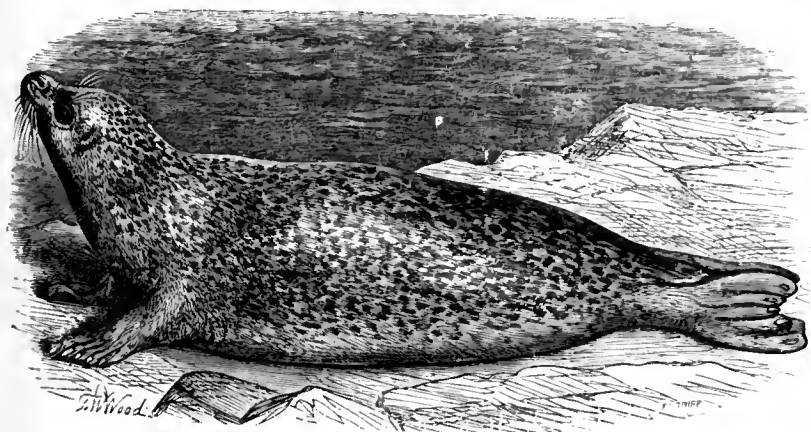
SKELETON OF THE COMMON SEAL.

satisfactorily distinguished from one another by colour alone. The three species in question are the common seal, the ringed seal (*P. hispida*), and the Greenland seal. All these three species are much smaller than the grey seal; the ringed seal being the smallest of all. The latter species can always be distinguished from either of the others by the greater length of the first digit in the fore-foot, which exceeds that of the other toes. When adult, the ringed seal is blackish grey above, with oval whitish rings, and whitish on the under-parts; its usual length varying from $4\frac{1}{2}$ to $5\frac{1}{2}$ feet. The common seal, on the other hand, can be easily distinguished from either of the others by its more massive teeth; the cheek-teeth being very broad and thick, and set obliquely and close together in the jaws, instead of being placed in the same straight line, and separated from one another by distinct intervals. It is, moreover, a relatively stouter-built animal, with a larger head, broader nose, and shorter limbs.

The adult of the common seal is very variable in colour, but the usual tint of the hair on the upper-parts is some shade of yellowish grey, with irregular dark brown or blackish spots; the under-parts being yellowish white, generally marked with smaller spots of brown. The length of the male varies from 5 to 6 feet. The

young when first born are yellowish white, and are peculiar in that they shed their woolly coat either on the day of birth or very shortly afterwards.

Distribution. The common seal has a much wider distribution than the grey seal, occurring not only in the North Atlantic but also in the North Pacific, and extending on the shores of both oceans to the Arctic regions, and thus being doubtless circumpolar. In the Atlantic it is found, though rarely, as far southwards as the Mediterranean, and on the American side as far as New Jersey. In the Pacific its southern limits appear to be marked on the Asiatic side by Kamschatka, and on the American by Southern California. It is, moreover, by no means confined to the coasts, but ascends some of the larger tidal rivers to a considerable distance from their mouths; and it has been known to pass up the St. Lawrence to the Great Lakes. In the North Atlantic this seal is strictly littoral in its habits, and always avoids the ice of the open seas. It is very common in Spitzbergen and Greenland; the number of individuals belonging to this species

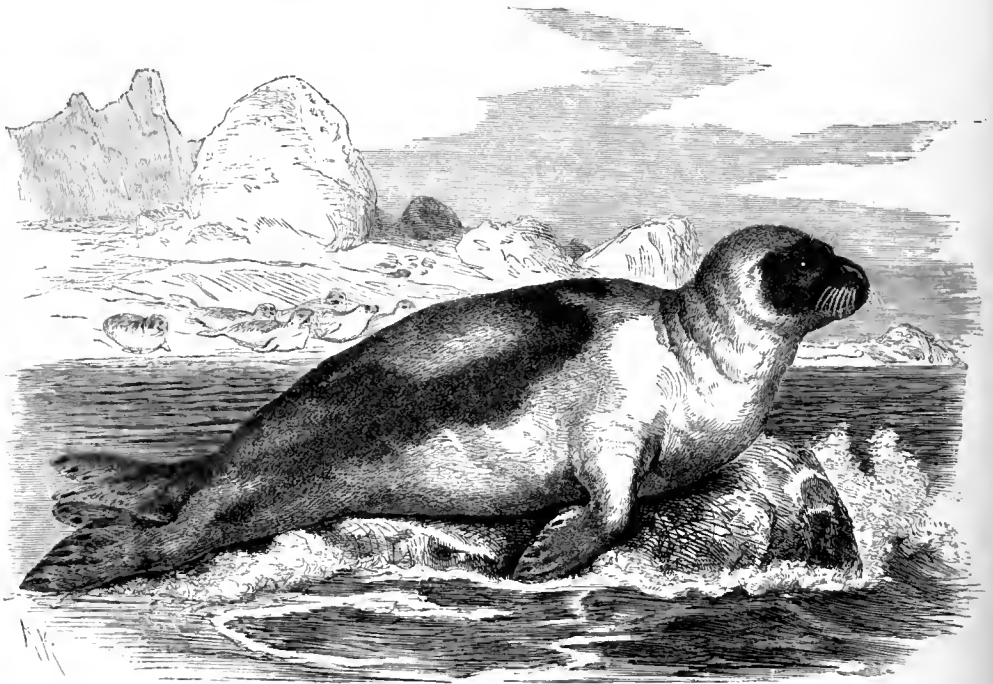


THE COMMON SEAL.

and the ringed seal captured annually some years ago in the Danish settlements in Greenland being, according to Dr. Robert Brown, upwards of 700,000. In the British Islands, according to the authors of Bell's *British Quadrupeds*, this seal "is found all round the coast in suitable places, but is much less abundant than it formerly was, and has been quite banished from many places where it was formerly well known. It is common on many parts of the Irish coast, and is very abundant among the Scotch islands, especially in Shetland and Orkney. In Wales and Cornwall it is well known, but is now very rarely seen on the shores of the southern and eastern counties of England." Not many years ago one of them was observed on the beach at Brighton.

Habits. The common seal does not make any seasonal migrations, but is found in the same haunts throughout the year. It prefers sheltered sounds and bays, with shallow water and an abundant supply of fish, to more exposed positions; and leaves the water at every tide to rest on the rocks or beach, almost invariably selecting such rocks as are separated from the mainland. The young are born in the latter part of May or June, and take to the water at an early

period. Like other members of the family, this seal is readily attracted by music, and will follow boats from which such sounds proceed to a considerable distance. Whether, however, this attraction by musical sounds is due merely to the curiosity characterising all the Pinniped Carnivores, or to an appreciation of the music itself, has not been ascertained. In disposition the common seal is more intelligent and gentle than most of its congeners; these qualities being displayed not only in the care and affection they bestow on their offspring, but likewise by the readiness with which they can be tamed, and their fidelity and affection for their masters. There are, indeed, many instances where these seals have followed their owners about like a dog; and some where they have come back to a house after every effort had been made to drive them away.



THE GREENLAND SEAL ($\frac{1}{10}$ nat. size).

Greenland Seal.

Although the Greenland or, as it is often called, the harp, or saddle-backed seal, in its immature condition is not easy to distinguish from the common seal, in the case of adult males of the two species there is no sort of difficulty in this respect, the peculiar coloration of the Greenland species being amply sufficient. In the adult male, as shown in our illustration, the general colour is yellowish white or white; the nose and the fore-part of the head to behind the eyes are black; and there are very generally some black spots on the throat and chest. The most characteristic mark is, however, the irregular crescentic band of black on each side of the body, extending from the shoulders nearly to the tail; these bands being generally widest where they unite in the middle line over the shoulders. They may be interrupted posteriorly, but more generally join once more in front of the tail, so as to enclose an ellipsoidal

area. The length of the male is usually from 5 to 5½ feet, but may, it is said, be as much as 6 feet. The female has generally much the same coloration as the male when adult, but the black markings are less distinct, and may be wanting. The full coloration is not obtained till the fifth year, and so different is the appearance of the animal at different stages of its growth that the Greenlanders have distinct names for it according to age. The white or yellowish white woolly fur of the young is not changed for the hairy coat till several weeks after birth.

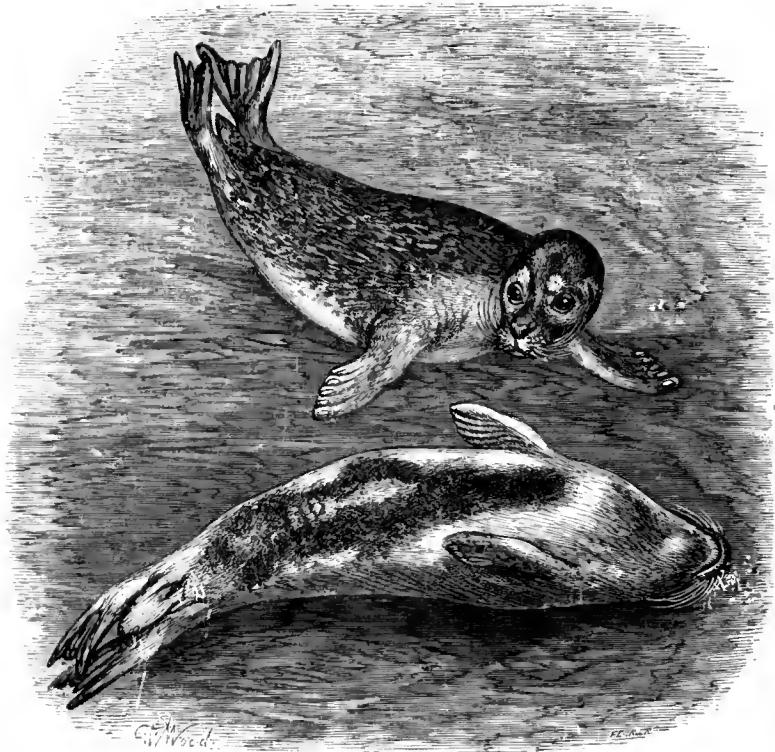
The Greenland seal, which can at most be regarded only as a very occasional visitant to the British Isles, is essentially a northern species, ranging in the Atlantic from Newfoundland and the North Sea to the Arctic regions, and also occurring in the North Pacific.

Habits. The migratory habits of this species have been already alluded to at sufficient length; the most noted breeding-stations are Newfoundland and the vicinity of Jan-Mayen, at which localities these animals may be seen in enormous herds in the spring; but where they pass the remainder of the season is not ascertained. In Greenland these seals visit the coasts both in the autumn and in the spring; and it may be some of these herds that pass westwards to Jan-Mayen. During their migrations the seals keep close to the coasts, and frequently enter the bays and estuaries; but when settled at their breeding-resorts they prefer exposed ice-floes in the open sea, never resorting to the shores, and being seldom met with on the firm ice. Everywhere the Greenland seal is in the habit of assembling in immense herds; and it is so abundant that its numbers probably exceed those of all the other species put together. In consequence of this abundance, it is this species which forms the main basis of the sealing trade of the northern seas. Unlike the bearded and ringed seals, the Greenland seal never forms a breathing-hole in the ice; and this is doubtless the reason that it frequents the ice-floes rather than the continuous stretches of unbroken ice. Off the coast of Newfoundland the young are born in the early part of March, but in the Jan-Mayen district not until the end of that month. When assembled in their countless herds on the ice-floes during the breeding-season, it is stated that their cry may be heard at a distance of several miles, more especially if the ear be applied to the ice. As an indication of the enormous numbers in which these seals once existed, it may be mentioned that during the year 1866 a single steamer obtained 22,000 seals in nine days; and it was not uncommon for a ship's crew to kill from 500 to 800 adults and 2000 young ones in a day. In Greenland the annual catch was estimated at 33,000, while that in Newfoundland used to exceed 500,000, and in the Jan-Mayen seas the total number killed each year was fully 30,000.

Other Species. Of the remaining members of the genus *Phoca* our notice must be very brief. It has been already mentioned how the ringed seal (*P. hispida*) may be distinguished at all ages from the two preceding species, and reference has likewise been made to its adult coloration. It may be added that the ringed seal differs from the common seal by its more slender form, longer limbs and tail, narrower head, and more pointed nose. The ringed seal is an inhabitant of the Arctic and North Atlantic and Pacific Oceans, occasionally visiting the British Islands; but it may be regarded as pre-eminently boreal, its true home being the icy Arctic seas. Its favourite resorts are stated to be sheltered bays and fjords,

in which it remains so long as they are filled with solid ice; but when this breaks up the seals betake themselves to the ice-floes, upon which the young are born in the months of March and April. The ringed seal is not a migratory species, and in some localities is found in considerable numbers. It is one of those seals which make a circular "blow-hole" in the ice, through which they can ascend or descend at pleasure; such apertures being made while the ice is forming.

Nearly allied to the ringed seal are the Baikal seal (*P. sibirica*) and the Caspian seal (*P. caspica*), which are respectively confined to the inland seas from which they take their names. Both these seals are rather larger than the ringed seal, and are very similar to one another. Their especial interest is derived from



SEALS SWIMMING.

their habitat; the Baikal seal inhabiting a fresh-water lake, while the waters in which the Caspian seal dwells are but slightly salt. The curious part of the matter is that neither Lake Baikal nor the Caspian Sea appear to have had any recent connection with the Arctic Ocean; and if, as is most probably the case with the latter, we have to look to a former connection with the ocean to the southward, it becomes difficult to see whence came the stock from which these two allied species were derived. Mr. Allen has suggested, however, that the ringed, the Baikal, and the Caspian seal may be all descended from an allied extinct species whose remains are found in the Pliocene deposits of Belgium.

Lastly, we have the bearded seal (*P. barbata*), which is distinguished from all the other members of the genus by its superior size, its broad muzzle and convex

forehead, as well as by its small and weak teeth, some of which generally fall out in the adult. Moreover, the front flipper differs from that of all the other species in having the third or middle digit longer than the rest; whereas in the other species the digits decrease in size from the first or first and second together. The colour of the bearded seal is some shade of grey, darker on the middle of the back than elsewhere, but varying considerably in different individuals. In distribution the bearded seal is circumpolar and almost exclusively boreal, its only migration in winter being that due to the extension of the unbroken ice-fields, by which it is compelled to move somewhat to the southward. On the American side of the Atlantic this seal extends as far as Labrador, but not apparently down to Newfoundland. It is abundant on the coasts of Greenland, but in Europe does not appear to occur further south than Iceland and the North Sea.

The bearded seal is by far the largest of all the northern seals, full-grown males being said to attain a length of about 10 feet. An adult female skeleton, measured by Mr. Allen, had a length of 7 feet 2 inches. The species is said to be nowhere abundant, and is more or less solitary in its habits, never congregating in large herds. It is fond of basking upon large pieces of floating ice, and generally keeps well out to sea; and upon such occasions is easily approached and killed by the Eskimos. A distinctive peculiarity of this species is its habit of turning a complete somersault when about to dive, especially when fired at. The skin is thicker than that of any other northern seal, and is consequently valued by the Eskimos, who employ it in making their harpooning lines. Its flesh and blubber are stated to be more delicate in flavour than those of other species. Owing to its comparative rarity, the bearded seal is of no commercial importance; the total annual number caught some years ago in Greenland not exceeding a thousand.

THE MONK-SEAL.

Genus *Monachus*.

The monk-seal (*Monachus albiventer*) belongs to a group differing from the preceding by having but two pairs of incisor teeth in both the upper and lower jaws; and also by the first and fifth toes of the hind-feet being much longer than the others, and having their claws either rudimentary or absent. With the exception of the first in each jaw, the cheek-teeth are implanted by double roots; and the total number of teeth is thirty-two, against the thirty-four of the last group. The monk-seal is distinguished from the other members of the group by the character of its cheek-teeth; these being large, hollowed on the inner side, and marked with a prominent ring at the base, while the cusps on either side of the main cusp are very small. Moreover, the claws on all the toes are small and rudimentary. The fur is short, and is dark brown mingled with grey on the upper-parts; and whitish beneath. Full-grown males attain a length of from 7 to 8 feet, or more.

Distribution. Together with its ally the West Indian seal (*M. tropicalis*), the monk-seal is the only species of the family inhabiting the warmer seas; it is found in the Mediterranean and Black Seas, and on the coasts of the

neighbouring portions of the Atlantic, extending to Madeira and the Canary Islands. Although but little is known of its habits in a wild state, the monk-seal is very readily tamed, and is the species which used to be exhibited in England as the "talking fish."

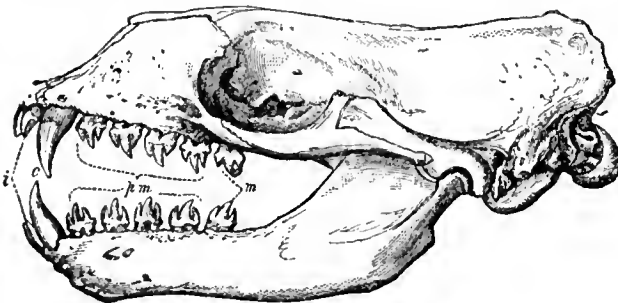
West Indian Seal. The closely-allied West Indian seal is of nearly the same colour as the monk-seal in the adult state, but the young are of a deep glossy black. This species is interesting from its restricted distribution, and the prospect of its impending extermination. Although discovered as far back as the year 1494 by the flotilla of Columbus, when cruising in the West Indies, this seal, up to the year 1883, was represented in scientific collections only by a single skin sent to the British Museum in 1846 by Mr. P. H. Gosse. In the year 1687, when Sir Hans Sloane visited the Bahamas, these seals were extraordinarily abundant, the sealers sometimes killing as many as a hundred in a single night. In less than two centuries they had, however, become exterminated from most of their former haunts, although some were known to remain on the rocky islands of Pedro Keys, to the southward of Jamaica. In 1886, as Mr. F. A. Lucas tells us, a vessel visited three small islands lying between Yucatan and Florida, known as the Triangles, with the hope of finding a colony of these seals. In this hope the expedition was not disappointed, upwards of forty specimens being secured before the vessel was compelled to put back from stress of weather. We are not told how many of these seals were then remaining on the islands.

It has been already mentioned that the seals of this group have the first and fifth toes of the hind-feet much longer than the others, and since this is a character which they possess in common with the eared seals, it is interesting to learn that the West Indian seal has the power of bringing the hind-feet forwards to a certain extent when on land by curving the body upwards. When straightening itself the creature pitches ahead on its breast, advancing about a foot by the operation.

THE LEOPARD-SEAL.

Genus *Ogmorhinus*.

The leopard-seal (*Ogmorhinus leptonyx*) may be taken as the best known representative of four genera confined to the Southern and Antarctic Seas, and each containing but a single species. These seals differ from the monk-seal by certain characters of their skulls, and are likewise distinguished from that species and from one another by the form of their cheek-teeth.



SKULL OF LEOPARD-SEAL.

The leopard-seal or, as it is often called, the sea-leopard is distinguished by the great length of its skull, and by the cheek-teeth consisting of three large and

distinct cusps. The middle and largest of these cusps has its tip slightly inclined backwards, while the summits of the two smaller cusps are curved towards the middle one. Adult males of this species attain a length of as much as 12 feet. Moseley describes these animals as much resembling the common seal in coloration; the short and glossy fur being spotted yellowish white and dark grey on the back, and the under-surface of a general yellowish colour. The females are usually darker than the males, in which the ground-colour of the fur is often of a silvery grey.

Distribution. The leopard-seal has a wide distribution in the southern, temperate, and Antarctic seas, having been recorded from the coasts of New Zealand, Australia, and the adjacent islands, from the Falkland Islands, Kerguelen Land, and the shores of Patagonia, and being also found on the pack-ice in the Antarctic Ocean. It does not appear to be migratory, and is sometimes found on the ice or on islands in considerable herds. In Kerguelen Land it was still pretty common at the date of the visit of the *Challenger*, a herd estimated at four hundred in number being reported on one of the small islands adjacent.

Crab-Eating Seal. The first of the remaining members of this group is the crab-eating seal (*Lobodon carcinophaga*) of the Antarctic Ocean. It is of a nearly uniform olive colour above, with the sides of the face and the under-parts yellowish white, and sometimes a few light-coloured spots on the flanks. The cheek-teeth are even more complex than those of the leopard-seal, having one cusp in front of the large main cusp, and from one to three distinct cusps behind the latter. The claws are entirely wanting on the hind-feet. Practically nothing is known of the habits of this species.

Weddell's Seal. Weddell's seal (*Leptonychotes weddelli*) is another Antarctic species, distinguished by the teeth having simple conical and somewhat compressed crowns, without additional fore-and-aft cusps. It was originally obtained from the Southern Orkneys, but has also been obtained from Patagonia and the Antarctic pack-ice. The general colour is very similar to that of the leopard-seal, being pale greyish above, spotted with yellowish white on the back, and yellowish beneath. The jaw is weaker and the sockets of the eyes larger than in the leopard-seal.

Ross's Seal. The last of these four southern species is Ross's seal (*Ommatophoca rossi*), long known by two skulls and a single skin obtained from the Antarctic pack-ice during the voyage of the *Erebus* and *Terror* in the years 1839-1843, and appropriately named after the commander of that expedition. The fur is rough and coarse, with a general greenish yellow colour, marked with oblique yellow stripes on the sides of the body and paler on the under-parts. There are no claws on the hind-feet, and but very small ones in front. The skull is characterised by the immense capacity of the sockets of the eyes, and also by the small size of the teeth. The cheek-teeth have very small fore-and-aft cusps.

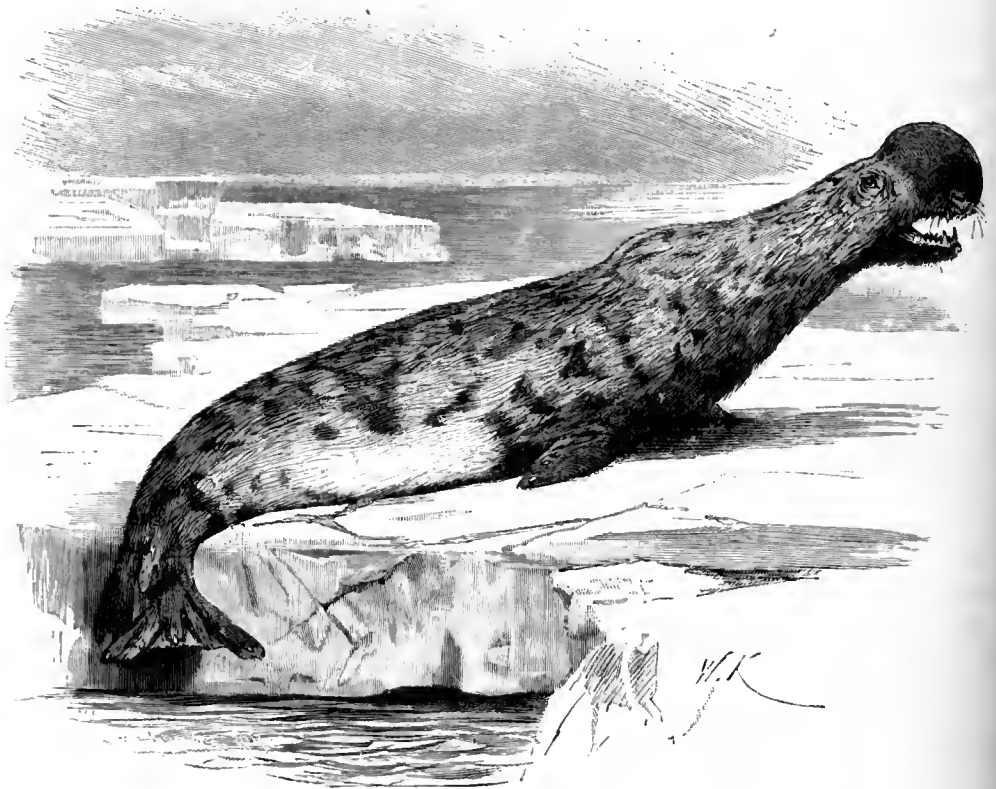
One of the two known skulls of this seal is peculiar in that, while on one side the first upper cheek-tooth and both the corresponding lower teeth are imperfectly divided by a vertical groove, on the opposite side of the upper jaw the place of this

tooth is taken by two complete simple teeth. Hence it is obvious that we have here a case where an originally single tooth divides into two distinct but simpler teeth. This may not at first sight seem a fact of much importance; but in reality it serves to show how the numerous simple teeth characteristic of the toothed whales may have been derived by the splitting up of teeth originally composed of three distinct cusps like those of the leopard-seal; each cusp of such a tooth forming, as we shall see, a distinct tooth in the whales.

THE CRESTED SEAL.

Genus *Cystophora*.

The remarkable-looking animal represented in the accompanying illustration, and commonly known as the crested, hooded, or bladder-seal (*Cystophora cristata*), is



THE CRESTED SEAL ($\frac{1}{2}$ nat. size).

at once distinguished from all the other members of the family by the casque-like prominence crowning the fore-part of the head. This seal, together with the under-mentioned elephant-seal, differs from all the species yet noticed in having but thirty teeth, owing to the reduction of the incisors to two pairs in the upper, and to one pair in the lower jaw. In both the cheek-teeth are small and simple, with,



LEOPARD - SEAL.

in general, but a single root each; and in the males of both the nose is furnished with an appendage which can be inflated at will. Moreover, the first and fifth toes of the hind-feet are considerably longer than the three middle ones, and are furnished with long lobes projecting in advance of the rudimentary claws, or the position which these should occupy.

In the crested seal the appendage on the nose takes the form of a large sac, which is in communication with the nostrils, and when inflated covers the head as far back as the eye; but the female has no trace of this appendage, which does not make its appearance in the male till a considerable time after birth. The hind-feet of this species are provided with small claws; and the last cheek-tooth generally has two roots. The ground-colour of the fur is bluish black, becoming lighter on the flanks and under-parts, and marked with small irregular whitish spots: the head and limbs being uniformly black. Sometimes, however, the ground-colour is light greyish white, varied with dark brown or blackish spots. The woolly fur of the newly-born young is pure white. In size, full-grown males of this seal vary from $7\frac{1}{2}$ to 8 feet in total length; females measuring about 7 feet. The skull is very short and broad; and the bony partition dividing the nostrils is produced above the level of their margin in order to support the sac. This seal is restricted to the colder regions of the North Atlantic and certain portions of the Arctic Sea; its range extending from Greenland eastwards to Spitzbergen, and thence along the northern coast of Europe. Southwards these seals are but seldom found below Norway on the one side, and Newfoundland on the other.

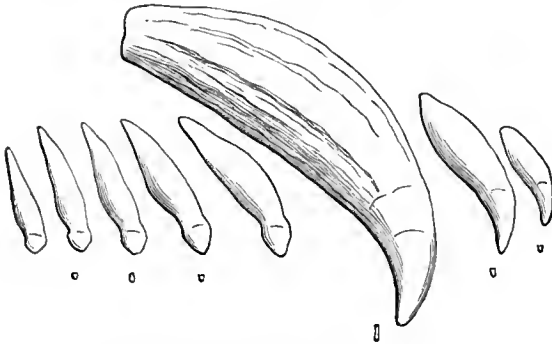
Habits.

In habits the crested seal is essentially migratory and pelagic, travelling south in winter, and always preferring the drift-ice of the open sea to the neighbourhood of land; indeed, it very seldom, if ever, resorts to the shores or even to outlying rocks. Compared with the Greenland seal, the present species is a comparatively rare one, and is nowhere met with in large numbers, although apparently more numerous in the Gulf of St. Lawrence than in most of its haunts. Although at times the sexes are said to live apart, they usually associate together in family parties or small herds during the breeding-season, previous to which the males engage in fierce contests for the possession of the females. While these fights are going on, the males utter cries which may be heard at the distance of several miles. The young are born on the ice, far away from land, during March; and in defence of their offspring both parents will lose their own lives rather than escape by flight. In disposition the crested seal is much fiercer and bolder than any of the other members of the family; and it will not unfrequently turn upon its aggressor, so that its pursuit in the frail *kayaks*, or canoes, of the Eskimo is attended with a considerable share of danger, the protection afforded to the head by the inflated sac rendering the males difficult to kill in the ordinary manner by means of clubs. What is the precise use of the appendage in question has not yet been fully determined; but from its presence in the males only it may be inferred to be a sexual feature analogous to the antlers of the deer. It was estimated some years ago that the total number of these seals annually killed in Greenland did not exceed 3000. In addition to fish, the crested seal feeds largely upon cuttles and squids.

THE ELEPHANT-SEAL.

Genus *Macrorhinus*.

In the elephant-seal or sea-elephant (*Macrorhinus leoninus*) the appendage on the nose of the male takes the form of a short proboscis, which, though generally hanging in a limp condition, can be expanded and dilated at the will of its owner. The end of this proboscis is obliquely truncated, and penetrated by the nostrils, and the whole organ communicates a most peculiar and almost ridiculous physiognomy to the animal. The female, however, resembles an ordinary seal in the form of the head. The teeth (which are shown in the accompanying woodcut) are very



THE UPPER TEETH OF THE ELEPHANT-SEAL.

The two on the right are the incisors, the next the tusk, and the five small ones to the left the cheek-teeth.—After Sir W. H. Flower.

small in proportion to the size of the head; those of the cheek-series being of simpler structure than in the crested seal, and each inserted only by a single root. In the hind-feet the claws are wanting, and their first and fifth toes are longer in proportion to the others than is the case with the crested seal.

The elephant-seal is the largest of all the pinnipeds, not even excluding the walrus, adult males attaining a length of from 15 to 16 feet to the end of the body, or, reckoning from the tip of the trunk to the extremities of the outstretched flippers, a length of 20 or 22 feet. When in good condition the girth of an old male will be as much as 15 or 16 feet, while the yield of oil from such an animal will reach 210 gallons. The females are much smaller, not exceeding 9 or 10 feet in total length. The general colour of the coarse and short fur is grey, with a more or less marked blackish or olive tinge, darker on the upper than on the underparts.

Distribution. The typical elephant-seal formerly inhabited many of the islands in the South Atlantic, Pacific, and Indian Oceans, as well as those in the Antarctic Sea; some of its favourite haunts being Juan Fernandez, the Falkland Islands, Kerguelen Land, New Georgia, the South Shetlands, and Tristan da Cunha. In such places, during the earlier portions of this century and in the preceding one, these animals were met with in enormous herds, as described in the accounts of the voyages of Cook, Péron, and Anson. Northwards the elephant-seal reaches Patagonia, and extends some distance up the western coast of South America, but how far does not seem to be clearly ascertained, although it certainly stops short of the tropic of Capricorn. When, however, we have crossed the Equator and reached some distance north of the tropic of Cancer, elephant-seals are, or were, once more met with between latitude 25° and 35° on the coast of California. The difference between the Antarctic and Californian elephant-seals is very slight

indeed; and it appears that the chief reason that the American naturalists have for regarding them as distinct species is their isolated habitats. It may be that the area between these two habitats was once occupied by these seals, but the suggestion that the Californian race took origin from a few individuals that succeeded in crossing the tropical zone appears the more probable view, as it seems difficult to believe that the same species should inhabit both the Antarctic Ocean and the Equatorial seas. In any case, the Californian elephant-seal, whatever its origin, and whether it be a distinct species or only a local race of its Antarctic cousin, is, from a distributional point of view, of considerable interest, and its extermination, which, if not actually accomplished, must be imminent, cannot fail to be a source of regret.

Habits. In the southern seas the elephant-seals have long since been practically exterminated from the Falkland Islands; and at the time of the visit of the *Challenger* Moseley states that, while elephant-seals had completely disappeared from Tristan da Cunha, they were still to be met with in Marian Island, were comparatively numerous in Kerguelen Land, and on the neighbouring Heard Island occurred in thousands. After mentioning an encounter with a male on Kerguelen Island, when the animal assumed a threatening attitude, and raised its tail nearly to the level of its head, as depicted in Anson's voyage, Professor Moseley goes on to state that, on the more exposed side of Heard Island, "there is an extensive beach, called Long Beach. This is covered over with thousands of sea-elephants in the breeding-season, but it is only accessible by land, and then only by crossing two glaciers. No boat can live to land on this shore, consequently men are stationed on the beach, and live there in huts; and their duty is constantly to drive the sea-elephants from this beach into the sea, which they do with whips made of the hide of the seals themselves. The beasts thus ousted swim off, and often 'haul up,' as the term is, upon the accessible beaches elsewhere. In very stormy weather, when they are driven into the sea, they are forced to betake themselves to the sheltered side of the island. Two or three old males, termed 'beach-masters,' hold a beach to themselves and cover it with cows, but allow no other males to haul up. The males fight furiously, and one man told me that he had seen an old male take up a younger one in his teeth and throw him over, lifting him in the air. The males show fight when whipped, and are with great difficulty driven into the sea. They are sometimes treated with horrible barbarity. The females give birth to their young soon after their arrival. The new-born young are almost black, unlike the adults, which are of a light slate-brown. They are suckled by the female for some time, and then left to themselves lying on the beach, where they seem to grow fat without further feeding. They are always allowed by the sealers thus to lie, in order to make more oil. This account was corroborated by all the sealers I met with. I do not understand it. Probably the cows visit their offspring unobserved from time to time. Péron says that both parent elephant-seals stay with the young without feeding at all, until the young are six or seven weeks old, and that then the old ones conduct the young to the water and keep them carefully in their company. The rapid increase in weight is in accordance with Péron's account. Goodridge gives a somewhat different account, namely, that after the females

leave the young, the old males and young proceed inland, as far as two miles sometimes, and stop without food for more than a month, and during this time lose fat. The male sea-elephants come on shore on the Crozets for the breeding-season at about the middle of August, the females a little later."

SEAL-HUNTING.

Although incidental mention has been made here and there of the annual catch of various species of the true seals, nothing has yet been said as to the various modes in which these animals are captured. The chief sealing districts, or, as they are technically called, "sealing-grounds," in the Arctic and North Atlantic oceans are West Greenland, the Newfoundland district, the Jan-Mayen seas, Novaia Zemlia and the Kara Sea, the White Sea, and the Caspian. The most important of these is the Jan-Mayen area, where, as in all the other districts except the Caspian, the Greenland seal is the species mainly hunted. So incessant and unremitting has been seal-hunting in the icy Jan-Mayen seas that the numbers of these animals have been very sensibly diminished; and as far back as 1871 attention was called to the necessity of some stringent regulations being applied to the sealing trade. This was followed in 1876 by an enactment on the part of the British Government establishing a close-time for seals, so far as their own subjects were concerned; and not long after similar action was taken by the other governments interested.

The chief sealing-trade in the North Pacific was the capture of the elephant-seals on the Californian coast—a trade which has of necessity come to an end by the extermination of the object of pursuit. In the more southern seas the trade was likewise confined to the capture of elephant-seals. From their great numerical abundance and their large size, the pursuit of these animals was an extremely lucrative occupation in the early years of this century. Now, however, as we have seen, these seals are exterminated from most of their former haunts, and only remain in any numbers on Kerguelen and Heard Islands, where they would also long since have disappeared had it not been for the inaccessible nature of the beaches they frequent. Consequently, the southern sealing-trade has now shrunk to an inappreciable fraction of its former volume, although there is a prospect of its being revived in the neighbourhood of the Antarctic pack-ice.

Harpooning. Of the various methods of capturing seals in the northern seas notably the oldest is that of harpooning from canoes, or *kayaks*, as now practised by the Eskimo. The kayak, which is made of skins, although upwards of eighteen feet in length, is so light as to be easily carried in the hand. In "sealing" the victim is approached within some twenty-five feet, when the harpoon is hurled from a wooden "thrower." The harpoon, in addition to its line, is furnished with a bladder attached by another cord, which marks the course of the seal while below the water, and enables the hunter to follow its track and wound it with his lance time after time as it comes to the surface to breathe, until it is finally despatched. The lance, it should be observed, is thrown from the hand, and, after striking the seal, always detaches itself and floats on the surface.

Netting. A large number of seals are also captured in nets, this method being chiefly employed during the spring and autumn visits of the migratory species to the shore. Nets appear to have been in use longest in the Gulf of Bothnia, the Caspian Sea, and Lake Baikal, where they are set either from the shore or beneath the ice. In the Gulf of Bothnia such nets are from 60 to 90 feet in length, and about 6 feet in depth. Two of them are generally set together in the neighbourhood of rocks to which the seals resort, and are always placed to the leeward of the mainland or some headland. When they strike against the nets, the seals thrust their heads through some of the meshes, and by twisting themselves about gradually become completely involved. In the Caspian Sea the nets are usually hung from boats at a considerable distance from the shore. In Lake Baikal, on the other hand, the nets are let down through the breathing-holes of the seals in the ice, and the animals become entangled on rising.

Seal-Box, etc. The seal-box used in parts of Scandinavia is a contrivance with a swinging plank, upon which, when the seal lands, it is precipitated headlong into a deep pit. Another Scandinavian plan is to surround a seal-rock with a line armed with a number of barbed hooks. These hooks allow the seals to land with impunity; but when a number of the animals are on the rock, and through a sudden fright rush headlong into the water, some of them are pretty sure to be caught. A third method employed in the same country is to fix a harpoon in a tube, with a spring-and-trigger arrangement, and to bury the whole contrivance in a hole bored in a seal-rock in such a manner that when a seal presses against the trigger the weapon will be discharged into its body.

A large number of seals are also shot on the shore with rifles; and others fall to the harpoon of the Eskimo, who either steals up to them while asleep, or awaits their rising at a breathing-hole. When a large number of seals can be surprised on shore at one of their favourite landing-places, clubbing is resorted to as the most effectual and speedy means of despatch; and it is said that sometimes as many as 15,000 have been killed in this manner in one night.

Capture on Ice. The above methods apply only to sealing on or near the shore; **Floes.** but for the capture of seals on the ice-floes at long distances from land, vessels of some kind have to be specially equipped. In the Gulf of Bothnia these expeditions are or were carried out in open boats, each manned by eight sailors; but in the Newfoundland and Jan-Mayen seas steamers of considerable size are now employed. When the seals are found on the ice, they are killed in the same way as on shore, that is, either by shooting, harpooning, or clubbing.

Products. The most valuable product of the sealing industry is the oil, which is used both for lighting and for lubricating machinery. Writing in 1880 Mr. J. A. Allen states that the total annual quantity of seal-oil then obtained reached close on 90,000 barrels. Next in value to the oil are the skins, which are manufactured into leather of various sorts; a large number being used for lacquered leather. To the northern tribes seals are all important, furnishing not only the greater part of their food, but likewise most of the materials from which their boats and sledges are made, as well as their clothes and their hunting implements.

THE PRIMITIVE CARNIVORES.

No account of the Carnivores would be complete without some reference, however brief, to a number of peculiar species occurring in the Miocene and Eocene formations of Europe and America, which differ so remarkably from all living terrestrial representatives of the order, as to render it imperative to refer them to a totally distinct group. These extinct primitive, or, as they are technically called, Creodont Carnivores, differ from modern land Carnivores in the absence of a distinct flesh-tooth in either jaw; all the molar teeth of each jaw being constructed on the same plan, and the whole of those in the lower jaw being frequently like the single flesh-tooth of other Carnivores. As a rule, the crowns of the upper molar teeth are triangular in form, and of the type noticed on p. 340 of the first volume. And whereas in all existing Carnivores the two bones in the upper row of the wrist, technically known as the scaphoid and lunar, are completely welded together, in nearly all the Creodonts they remain quite distinct. These and other characters indicate that these primitive Carnivores are a much more generalised group than the modern land Carnivores, of which they may have been the direct ancestors. Moreover, the teeth of many of these extinct forms are so like those of the carnivorous Marsupials (although agreeing generally in number with the modern carnivorous type, as exemplified by some of the dogs), that there is considerable probability that in these animals we have a direct connecting link between the Marsupials and the existing land Carnivores. The best known representatives of this group in Europe have been described under the names of *Hyænodon* and *Pterodon*; and while some of the species were no larger than a fox, others attained dimensions nearly or fully equal to those of a brown bear. There is little doubt that from some of these primitive Carnivores—and more especially the North-American forms known as *Miacis*—the majority of the existing land Carnivores are descended. It is noteworthy that an American and European genus known as *Palaonictis* shows a remarkable gradation in the structure of its teeth towards the cats, although it is rather difficult to believe that the cats are directly derived from this primitive form.

CHAPTER XX.

THE UNGULATES, OR HOOFED MAMMALS,—Order UNGULATA.

THE HOLLOW-HORNED RUMINANTS.

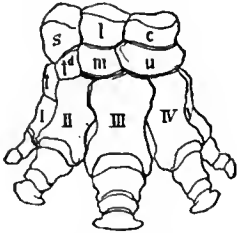
Family *BOVIDÆ*.

IF we except the bats, in which the outermost fingers of the wings are clawless, and some of the seals and their allies, the whole of the Mammals described in the preceding chapters are characterised by having the digits of both the fore and hind-limbs provided either with claws, or with thin nails. Moreover, in the greater number of instances, the fore-limbs themselves are endowed to a larger or smaller degree with the power of free movement in several directions; these movements being displayed to the fullest degree among the Primates, where the hand can be rotated upon the fore-arm, although they are also well-developed in the Cat family. Then, again, the number of digits in the great majority of these animals is five on either one or both pairs of limbs, and in no instance is it less than four. Further, the crowns of their cheek-teeth are never complicated by vertical and lateral infoldings of the enamel, so as to produce when worn down an elaborate pattern.

The Ungulate, or Hoofed Mammals, such as cattle, deer, camels, swine, horses, tapirs, rhinoceroses, and elephants, of which we have now to treat, differ in many important respects from the above. Thus, while no existing member of the order has the feet provided with claws, in the great majority of cases the toes are enclosed in solid hoofs, although in a few instances they are furnished with broad and flat nails. Then, again, the movements of the fore-limbs are mainly or entirely restricted to a backwards-and-forwards motion, and in no case can the fore-foot be rotated on the fore-leg. Many extinct forms had five or four functional and well-developed digits to the limbs, but in all living members of the order, except the elephants, there are never more than four functional digits; and in a large number of instances these functional digits are reduced to two, or more rarely three in number. Some species, like the giraffe, have, indeed, but two digits to each foot, while in the horse and its living allies only a single digit remains.

Feet of Ungulates. It must not, however, be assumed from the last sentence that the toes are gradually reduced from three to two, and from two to one; the fact really being that the reduction takes place along two different lines, in one of which the number is diminished from four to two, and in the other from three to one. As it is of primary importance, in order to understand the relationship of existing Ungulates to one another, to have a clear idea of the manner in which this reduction of the digits takes place, the subject may be dealt with in some detail.

In all the Ungulates the limbs have entirely ceased to be used as organs of prehension, and there would seem to be no necessity why there should be any adherence to the primitive five-toed type, as development advances. The majority of the members of the order being, however, unable to protect themselves against foes, and being also, in proportion to their height, heavy-bodied animals, the attainment of a high degree of speed was essential to their well-being and development, if not for their actual existence. For such a kind of life it will be obvious that the greater the length and slenderness of limb, the greater will at first sight be the speed. Now, in order to produce a long and slender, and at the same time a strong limb, from a stout and short-toed one, greater strength will clearly be attained by reducing the number of the toes, and lengthening and strengthening those which

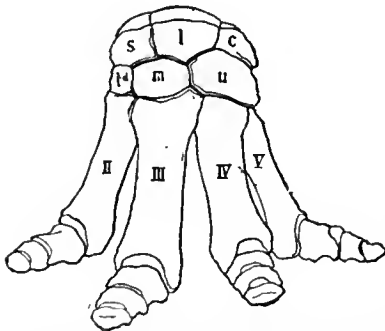


BONES OF THE LEFT WRIST AND FORE-FOOT OF THE CORYPHODON ($\frac{1}{4}$ nat. size).

The letters indicate the bones of the wrist (cuneiform, lunar scaphoid, trapezium, trapezoid, magnum, unciform), and the numerals those of the metacarpus.—After Osborn.

remain, rather than by lengthening the whole of the five toes, the slender bones of which would be liable to fracture by the concussion of the solid hoofs against the ground. Accordingly, among the Ungulates, the plan has been to gradually lengthen and strengthen the bones of one or more of the original five toes, and at the same time to dispense more or less completely with the others. In almost the lowest Tertiary rocks of Europe and North America there occur, for instance, the remains of certain large Ungulates, known as coryphodons, in which both the fore and hind-feet (as represented in the accompanying figure) have five complete toes. It will be observed that both the metacarpal bones and the toe bones by which they are succeeded are very short; and these animals must accordingly have walked to a certain extent upon the soles of their feet in the old-fashioned plantigrade manner.¹ It will also be noticed that the third or middle toe (III) is larger than either of the others, and symmetrical in itself. Another feature of this type of foot is that the component bones forming the two

horizontal rows of the wrist are placed almost vertically one above another, the bone lettered *l* merely touching the adjacent angle of the one marked *u*.



BONES OF THE LEFT WRIST AND FOOT OF THE TITANOTHERIUM ($\frac{1}{8}$ nat. size).—After Osborn.

When we ascend to the overlying Miocene Tertiary deposits we meet with other large Ungulates having a foot of the type of that shown in our second figure, where it will be noticed that while all trace of the first toe (I) has disappeared, the metacarpal bones of all the others have become very much more elongated, in consequence of which the animal no longer walked upon the soles of its feet, but entirely upon the toes, or was, in other words, digitigrade. It will also be observed that the third toe has become

still larger in proportion to the others. Moreover, the upper row of wrist-bones

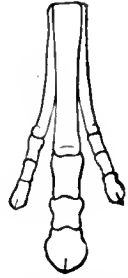
¹ As a matter of fact, the coryphodon was partially digitigrade in its fore-feet, but entirely plantigrade in the hinder ones.

appears to have been slid over those of the lower row towards the fifth toe, so that the bone marked *l* largely overlaps the one lettered *u*; and it will be obvious that this interlocking of the bones of the wrist produces a joint much more capable of resisting strain than is that of the coryphodon. The hind-foot of the titanothera, as the extinct Ungulate we are now considering is called, exhibits a still further advance, having lost the fifth as well as the first toe, and thus being three-toed. The living tapirs are in a precisely similar condition, being four-toed in front and three-toed behind; but the rhinoceroses have advanced one step still further, having but three toes both in front and behind.

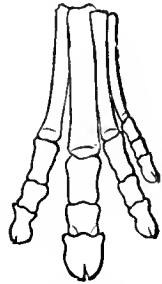
In the foot of the titanothera, while the bones of the metacarpus have become longer than in the coryphodon, the toe-bones still remain as short as in the latter; and the same is the case with the rhinoceroses. All these are, indeed, bulky animals, fitted for dwelling in swampy localities, and not specially adapted for speed. In another group, however, as shown in our third figure, the toe-bones themselves have become elongated, while the metacarpal bones are still longer and more slender. In the feet represented in our third and fourth figures the middle or third toe is very much larger than either of the others; but whereas in the one the fifth toe still remains, in the other it is represented only by a rudiment of the upper end of its metacarpal bone. This type of foot leads on to that of the extinct three-toed horse, or hipparion, of the Pliocene Tertiary, shown in our fifth figure, where the two side-toes have become still smaller, and the last trace of the fifth has disappeared. Finally, at the very top of the geological series, we have the horse, where the only remaining toe is the third, now very large; the metacarpal bones of the second and fourth toes being represented solely by the small splints on either side of the large metacarpal, now known as the cannon-bone.

A complete transition has thus been traced from a five-toed Ungulate, walking partly on the soles of its feet, to one provided with but a single toe to each foot, and walking entirely upon the very tip of that one toe, by which means the full extent of the limb comes into play as an aid to speed. Throughout this series it is the third or middle toe which has undergone development at the expense of the others; and since this toe is always symmetrical in itself, the term Odd-Toed Ungulates is applied to the members of the group thus characterised.

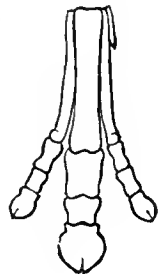
Odd-Toed and Even-Toed Ungulates. The resources of nature are, however, manifold, and instead of this being the only line of evolution of the Ungulates, nearly similar results have been reached by a totally different series of modifications. Starting once more from a foot somewhat similar to the one represented in the first figure of this chapter, it will be found that instead of the third toe remaining symmetrical in itself and gradually increasing in size at the expense of the others,



LEFT FORE-FOOT OF A THREE-TOED HORSE-LIKE ANIMAL.



BONES OF THE LEFT FORE-FOOT OF A FOUR-TOED HORSE-LIKE ANIMAL.



LEFT FORE-FOOT OF THE HIPPARION.

the third and fourth toes become symmetrical to a vertical line drawn between them. When this takes place the first toe disappears, and the second and fifth become diminished in size; an instance of this stage of development being presented



BONES OF FORE-
FOOT OF HORSE.

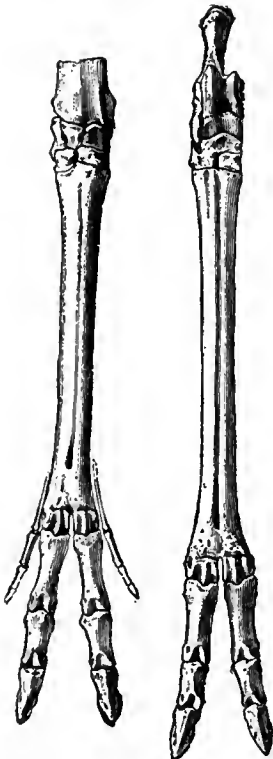
by the pig, where the two large and medially-symmetrical toes represent the third and fourth of the typical series, while the two small lateral ones are the second and fifth. In the pigs¹ all the metacarpal bones remain distinct and relatively short; but in the water-chevrotain¹ of Africa the third and fourth metacarpals become much elongated and closely applied to one another, while the second and fifth are reduced to mere splints, and their toes so diminished as to become practically functionless. Finally, in the deer, oxen, and their allies, the third and fourth metacarpals in the fore-limb, and the corresponding metatarsal bones in the hind-limb, have become completely fused into a single rod-like bone, corresponding in function with the cannon-bone of the horse, and generally known by the same name. The dual origin of this cannon-bone is, however, proclaimed by the formation of its lower extremity, which carries two pulley-like surfaces, with which the bones of the two functional toes (the third and fourth) articulate.

Since all the Ungulates displaying this second modification of foot-structure agree in having the third and fourth toes arranged symmetrically to a line drawn between them, they are collectively termed the Even-Toed Ungulates.

It is accordingly evident that although a few living Ungulates, like the elephant and the hyrax, retain a generalised type of foot, the greater number of the living representatives of the order are characterised by their more or less markedly specialised feet.

Teeth.

As regards their teeth, the Ungulates are characterised by those of the cheek-series having broad crowns, surmounted either by columns or transverse ridges, and adapted for grinding and masticating vegetable substances. In the more specialised forms, like cattle and horses, these cheek-teeth have their columns or ridges of great height and closely approximated to one another, in consequence of which the bases of the hollows, or valleys by which these columns or ridges are separated from one another, cannot be seen when the tooth is unworn; while the pattern produced on the crown by the wearing down of these columns or ridges is complex. On the other hand, in the more primitive types, such as pigs and tapirs, the crowns of the cheek-teeth have low columns, or ridges, so that the bases of the intervening valleys can be distinctly seen at all

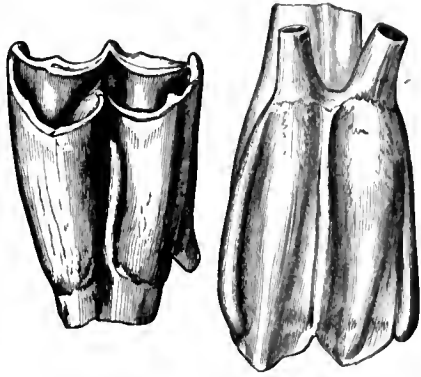


BONES OF THE FORE AND HIND-
FEET OF AN EXTINGUISHED DEER.
—After Osborn.

¹ Figures of the bones of the feet of these animals are given under their respective headings.

stages of wear. This will be apparent from a comparison of the accompanying figures, the first of which shows a tall-crowned tooth viewed from the inner and outer sides, while the second shows a short-crowned tooth seen directly from above.

In the former the valleys between the four crescent-shaped columus form deep pits, penetrating the whole extent of the crown of the tooth, while in the latter they are mere shallow channels. It will be found that while all the earlier Ungulates have short-crowned cheek-teeth, the greater number of living species have high-crowned ones; and it will also be observed later on that the development of high-crowned teeth has taken place independently in each of the four great groups into which existing Ungulates are divided. It should also be mentioned that whereas in Carnivores the upper molar teeth are generally of the primitive triangular type, in all existing Ungulates they have assumed the quadrangular form. The food of the Ungulates consisting in most cases entirely of vegetable substances requiring much mastication, is the inducing cause for the complex structure of the cheek-teeth in the more specialised kinds; and to the same cause may be attributed the circumstance that Ungulates always retain the full number of molar teeth, and, except in the camels, at least three out of the typical four premolars. In this respect they are in marked contrast to the Carnivores, in



A LEFT UPPER MOLAR TOOTH OF THE NILGAI, SEEN FROM THE INNER AND OUTER SIDES.

which, as we have seen, there is a great tendency to a reduction in the number of the molar teeth, only one living member of the order (the long-eared fox) having the typical three molar teeth in the upper jaw. On the other hand, among the more specialised representatives of the order, there is a decided tendency to the reduction, either in size or number, of the front teeth; the tusks being very frequently small or absent, while the whole of the incisor teeth, and sometimes the canines also, in the upper jaw, and more rarely both incisors and canines in the upper and lower jaws, may be wanting. All the earlier Ungulates, as well as the modern pigs, have, however, well-developed tusks, as well as the full number of front teeth;

and it is thus apparent that in this respect also the result of specialisation has been the reverse of that in the Carnivores, where the tusks have obtained extreme development, and the full typical number of incisor teeth is very generally retained. In both cases these distinctions are due to the difference in the nature of the food and habits of the two groups of animals. In addition to these characters of their feet and teeth, the Ungulates of the present day are characterised by the total absence of collar-bones or clavicles in the adult condition, although traces of these may occur in the foetal state.



A RIGHT UPPER MOLAR TOOTH OF THE EXTINCT MERYCOPOTAMUS, VIEWED FROM ABOVE.

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Definition of Ungulates. Having said thus much, it may be well to endeavour to briefly summarise the chief characteristics by which the existing members of the Ungulate order may be distinguished collectively from those of the other groups of Mammals.

In the first place, all Ungulates are adapted for a life on land; while, with the exception of some species of hyrax, none of them are arboreal. Then, whereas some of the more generalised forms are omnivorous, all the more specialised kinds are strictly vegetable feeders. In all cases the cheek-teeth have broad crowns, furnished with columns or ridges of greater or less complexity; and there are never less than three pairs of molar teeth in each jaw. Collar-bones are invariably absent; and the limbs are, as a rule, restricted entirely to a backward-and-forward motion, there being in no case any power of rotating the fore-foot or the fore-leg. The upper end of the radius, or smaller bone of the fore-limb, instead of being rounded, is accordingly elongated transversely in the typical Ungulates. The terminal joints of the toes are generally invested in solid horny hoofs, although in some cases furnished with broad and blunt nails, but never with claws. Moreover, the number of toes is but very rarely five, and may be reduced to three, two, or one; while in a large number of instances, where four toes are present, only a single pair are of any functional importance.

When, however, we have to take fossil species into consideration many of these characteristic features will not hold good; certain extinct Mammals, which it is very difficult to separate satisfactorily from the Ungulates, having either collar-bones, or claws, or perhaps both together. In others, again, the upper molar teeth, instead of having square crowns, show the triangular shape found in many Carnivores. Indeed, strange though it may seem, the connection between the early Carnivores and the early Ungulates is so close that it is frequently a matter of some difficulty to determine to which group an extinct form should be referred; and it is highly probable that the Ungulates are really a side-branch, descended from the same stock which gave rise to the Carnivores. This difficulty, or rather impossibility, of defining groups of animals, when we have to take into consideration their extinct relatives, is merely what must of necessity be the case if the doctrine of evolution be the true explanation of their mutual relationship.

Size. As a rule, existing Ungulates are characterised by their relatively large size; and among the order are included the most bulky of all land mammals. There is, however, a great variation in point of size among the order; the smallest forms being the pigmy hog, the royal antelope, the chevrotains, and the hyrax; while the largest are the elephants, the hippopotamus, the rhinoceroses, and the giraffe.

Horns. A frequent, although by no means general peculiarity of the Ungulates is the tendency to the development of horns of some kind or other on the head; the nature of these horns, as we shall show later on, varying greatly in the different groups.

Distribution. The order is well represented on all the continents of the globe, with the exception of Australia, but at the present day it has a far larger number of species in the Old World than in the New; many of those from the former area belonging to groups quite unknown in the latter. Although repre-

sented in the Arctic regions only by the reindeer and the musk-ox, Ungulates are found alike in the coldest and the hottest regions of the globe. The maximum number of peculiar forms, as well as those of greatest corporeal bulk, are, however, inhabitants of the tropical and subtropical regions; and it is also in the warmer regions that the greatest number of species occur. As regards the number of individuals of particular species, many Ungulates far exceed any other of the larger mammals; this being especially the case with the bisons, that but a few years ago roamed in countless thousands over the prairies of North America, and with the myriad hosts of springboks in the South African veldt. Through the advance of civilisation and the incessant persecution of both the sportsman and the trader, these wonderful instances of the profusion of animal life have, however, been swept away for ever.

Not only are the Ungulates widely distributed in longitude and latitude, but they are also found at all elevations suitable for the existence of animal life; some of the wild sheep of the Himalaya ranging to elevations of fully twenty thousand feet above the level of the sea. In time the order is an ancient one, being represented in the earliest stages of the Eocene division of the Tertiary period, although the species were mostly small, and in all cases widely different from any now living.

THE HOLLOW-HORNED RUMINANTS.

Family BOVIDÆ.

Unfortunately we have no concise English term to designate collectively the animals commonly known as oxen, sheep, goats, and antelopes, and we are hence compelled to allude to them by the periphrasis of the hollow-horned Ruminants, unless we prefer to call them by their scientific title, *Bovidae*. This is the more to be regretted, since the term hollow-horned Ruminants will likewise include the American prongbuck, which is the representative of a family by itself.

Taking, then, the term hollow-horned Ruminants, for want of a better, to designate the animals mentioned above, we have in this family our first representative of the Ungulate order. But before entering into the consideration of the especial characteristics of this family, it is necessary to point out those distinctive of the great group of even-toed Ungulates, under which title are included not only the hollow-horned Ruminants, but likewise deer, camels, swine, and many other living and extinct types.

Even-Toed Ungulates. It has been already mentioned that the even-toed Ungulates (or Artiodactyles, as they are technically termed), are distinguished by the third and fourth toes being almost equally developed, and arranged symmetrically on either side of a vertical line drawn between them; this line being continued upwards to the wrist or ankle, and the metacarpal and metatarsal bones similarly arranged in respect to it. As a consequence of this it results that in the typical members of the group the hoofs are of the so-called "eloven" type. This character is alone sufficient to distinguish all the members of the group; but there are a few others which it is advisable to mention. One of these characters is afforded by the cheek-teeth, in which the molars are almost always more complex

than the premolars. This is shown in the accompanying figure, where the first of the three upper molar teeth is shown on the left side, and is seen to consist of two lobes, while the adjacent premolar has but a single lobe. Another feature connected with the teeth is exhibited by the last molar in the lower jaw, which almost invariably consists of three lobes; whereas in the living representative of the odd-toed Ungulates it has only two lobes. In their single-lobed upper premolar teeth the even-toed Ungulates show a retention of the primitive triangular type of tooth, which has been lost in the molar teeth.



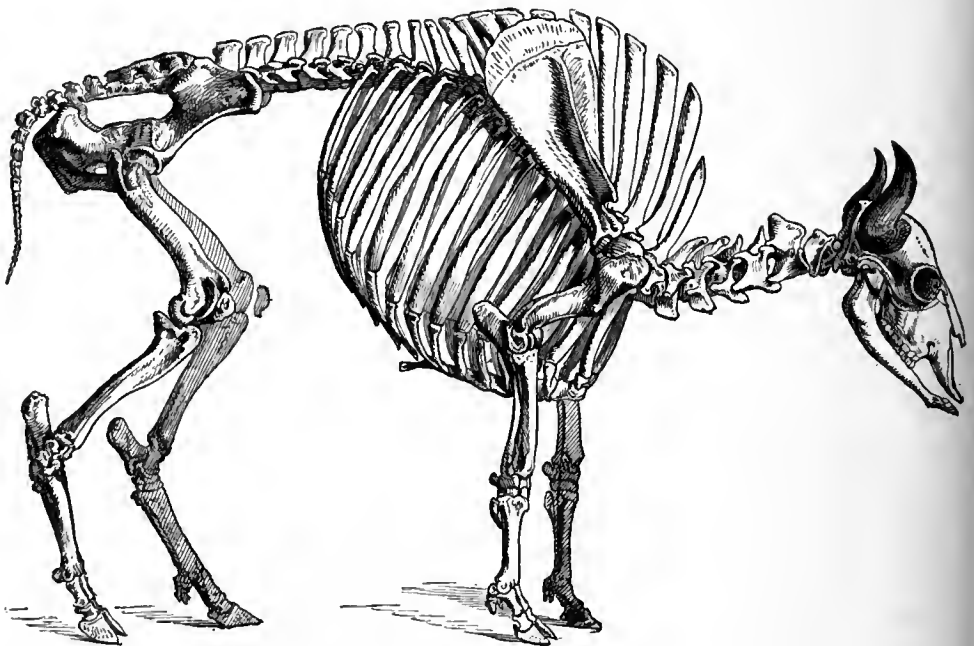
THE FIRST MOLAR AND THE THREE PREMOLAR TEETH OF THE RIGHT SIDE OF THE UPPER JAW OF THE FOUR-HORNED ANTELOPE.

Then again the thigh-bone, or femur, in all the members of the present group is characterised by the absence of any projecting process on the hinder surface of the shaft.

There are other less obvious distinctive features of the even-toed Ungulates, but the above are sufficient for our present purpose. It must be added, however, that both in this group and in the odd-toed Ungulates there are never more than four toes to each foot; and that all the members of both groups walk on their toes alone.

We are now in a position to consider somewhat more closely the characters of the hollow-horned Ruminants, but we have still to notice that these, together with the giraffe, the prongbuck, and the deer, form a

Ruminants.

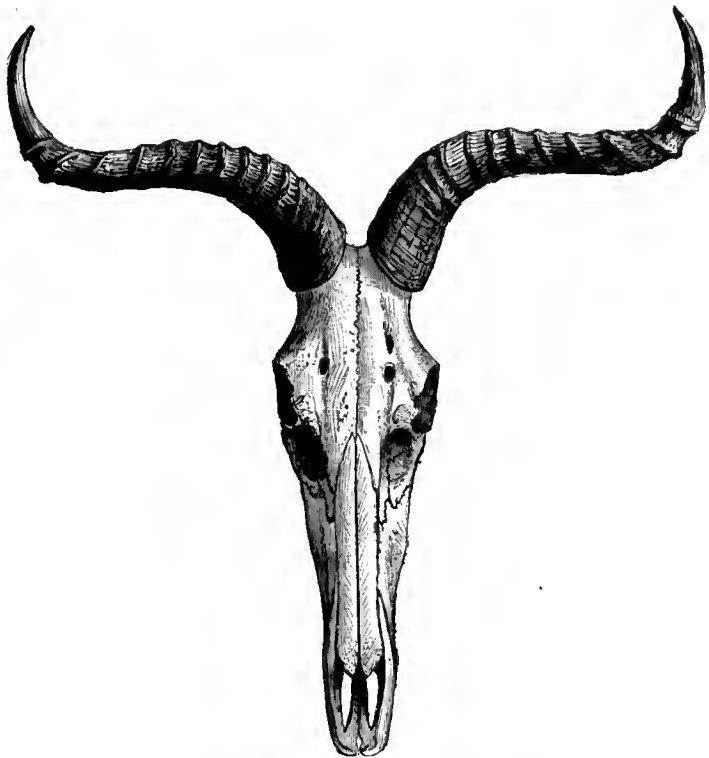


SKELETON OF THE EUROPEAN BISON.

group distinguished from all the other even-toed Ungulates by certain important characters. In all the members of this assemblage of four families there are no front (or incisor) teeth in the upper jaw; and the upper tusks or canines are

generally small or absent. In the lower jaw, on the other hand, all the incisor teeth are present, while the canine tooth on each side is in immediate contact with the outermost incisor; and since all the three pairs of incisors and the single pair of canines have nearly similar spatulate crowns, they appear to form a single series of four pairs of teeth. This may be easily verified by examining the lower jaw of a sheep or an ox. The six cheek-teeth on either side of both jaws are placed close together; those of the lower jaw being separated by a long space from the four pairs of spatulate teeth. In the fore-feet the third and fourth metacarpal bones,

and in the hind-feet the metatarsal bones, are respectively fused into single "caannon-bones," as shown in the two figures given on p. 154; while the two lateral pairs of toes are always small and rudimentary, and may be completely absent; the toes themselves being encased in complete hoofs. Another peculiarity of this group is that the stomach is divided into four complete cavities, into the first of which the food is temporarily received, until it is regurgitated into the mouth, when it is completely masticated, and afterwards conveyed to the true digesting stomach.



SKULL OF SWAYNE'S HARTEBEEST, TO SHOW HORNS.
(From Sclater, *Proc. Zool. Soc.*, 1892.)

This process is known as the function of "chewing-the-cud," or ruminating; and the Ungulates in which it occurs are consequently termed Ruminants. The ruminating function is, however, developed in the camels and chevrotains, as well as in the assemblage of four families constituting the present group; but as the camels and chevrotains differ in several important respects, it is convenient to designate the group under consideration as the true Ruminants, or technically, the *Pecora*.

It has yet to be mentioned that all the ruminating even-toed Ungulates are characterised by the peculiar structure of their cheek-teeth. It will be observed from the figure of the upper molar tooth of the nilgai given on p. 155, and also from that of the four-horned antelope on p. 158, that these teeth consist of four distinct columns, of which the innermost pair are crescent-shaped, with the horns

of the crescents turned outwardly. In the lower jaw the molars are narrower, and with a reverse structure; that is to say, the crescents are on the outer side of the tooth, with their horns turned inwardly. Accordingly the name of crescent-toothed (*selenodont*) Ungulates is applied to all the ruminating members of the group.

It is important to observe that the true Ruminants are alone characterised by the whole of the four under-mentioned features, viz. no front teeth in the upper jaw, a four-chambered stomach, complete cannon-bones, and the feet encased in hoofs. Moreover, it is only in the members of this group that horns are ever met with; these appendages being always arranged as a symmetrical pair (occasionally two pairs) on either side of the middle line of the skull.

Hollow-Horned Ruminants. The hollow-horned Ruminants, or *Bovidae*, are distinguished from their allies by the presence of true horns; that is to say, of hollow and unbranched sheaths of horn growing upon bony protuberances, or cores, arising from the frontal bones of the skull, as shown in the figure on p. 159; neither the horny sheaths nor the bony cores being shed at any period of existence. In all existing wild species these horns are present at least in the male sex; but in many domesticated races of cattle, sheep, and goats, they are absent in both sexes; and the same holds good for certain extinct members of the family. Usually the molar teeth of the hollow-horned Ruminants are characterised by the great relative height of their crowns, as shown in the figures of the molar teeth of the nilgai given on p. 155; and in all cases there is no tusk or canine tooth in the upper jaw. In some few instances the small lateral toes may be completely absent, but they are generally represented merely by the small spurious hooflets alone, which may be supported internally by minute and irregularly-shaped nodules of bone.

The hollow-horned Ruminants are chiefly Old World forms, although they are represented in North America by the musk-ox, the American bison, the Rocky Mountain goat, and the bighorn sheep. They are quite unknown in the southern half of the New World.

THE OXEN.

Genus *Bos*.

The oxen include the largest and most massively-formed members of the hollow-horned Ruminants, and comprise not only the animals thus commonly designated, but likewise the bisons, yak, and buffaloes. As a rule, they are large and heavily-built animals, with very short and thick necks, and the massive and relatively short head carried nearly in the line of the back; the males generally being provided with a large dewlap, running along the throat from the chin to between the fore-legs. The tail is always long, and is generally thinly haired throughout the greater part of its length and tufted at the extremity, but in the yak it is thickly haired throughout. The muzzle is broad, naked, and moist; and there are never any "tear-pits" or glands below the eye, which are so frequently present in the antelopes; and in consequence of the absence of these tear-pits there are no depressions in the skull immediately below the eyes for their reception. The horns, which are present in both sexes and of nearly equal dimensions in both, may be either cylindrical or more or less markedly angulated; and are

usually situated in the immediate neighbourhood of, or actually upon, the summit of the skull, whence they generally sweep in a more or less outward direction, and then curve upwards, and sometimes inwards, at their extremities. They are never spirally twisted, or ornamented with prominent transverse knots or wrinkles. If the horn-cores be cut through, they will be found to be completely honeycombed by a number of irregular cavities of large size. The upper molar teeth are very tall and broad, and are provided with an additional column on the inner side, as shown in the figure of the tooth of the nilgai on p. 155.

Distribution. With the exception of the American bison, the whole of the existing species of oxen are confined to the Old World, where by far the greater number of species are continental. There is, however, one species, of smaller size than any of the rest, confined to the island of Celebes; and another which may, however, have been introduced, in the Philippines. Domesticated races are spread over nearly all the globe. The wild species inhabit either open grassy plains or dense forest, while one of them is confined to the higher regions of the Himalaya and Tibet. All of them live in herds of larger or smaller size, which are protected by the bulls; the number of individuals in these herds being in some cases reckoned by thousands, only the old bulls becoming solitary in their habits.

Habits. All cattle can swim readily, and some species will cross rivers of considerable breadth without the slightest hesitation. They are remarkable for their strength and endurance; and as beasts of draught oxen are superior to horses for dragging heavy vehicles through soft and yielding ground. The usual pace of these animals is a walk, but when excited they break into a heavy and awkward gallop. Their senses of smell and hearing are acute, but their sight does not appear to be particularly keen. Their food may consist either of leaves and the tender shoots of trees, grass, mosses, or various kinds of marsh and water-plants; and all the species display a marked partiality for salt.

Usually but one calf is produced at a birth, but there may be occasionally two. As is the case with other Ruminants, the calf is born in a highly-developed state, and is soon able to run by the side of its parent.

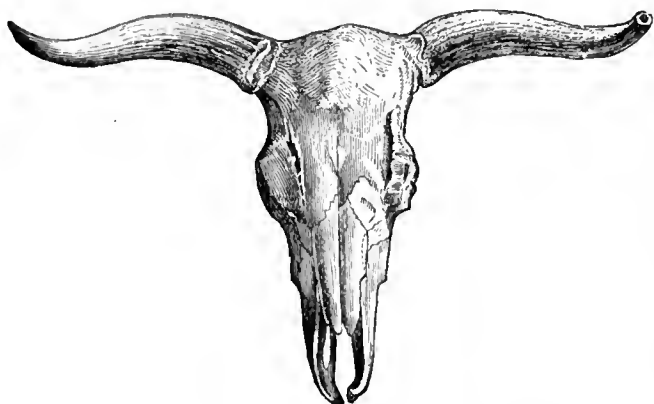
Specialisation. In most of their structural peculiarities the oxen appear to be among the most highly specialised of all the hollow-horned Ruminants; and this is confirmed by the lateness of their appearance in the geological series, the group being quite unknown before the Pliocene period, and attaining its maximum development in the Pleistocene and present epochs. Probably the origin of the group may be traced to Ruminants more or less closely allied to the antelopes; and it is noteworthy that in some of the extinct species horns were present only in the male sex.

THE AUROCHS AND DOMESTIC OXEN (*Bos taurus*).

The aurochs, or ancient wild ox of Europe, although now quite extinct as a wild species, is doubtless still represented by the half-wild cattle of some of the British parks; although the confined areas in which they live have caused them to degenerate sadly in size from their wild ancestors. Moreover, although there may

have been a certain amount of crossing with other species, the origin of our domestic cattle is certainly to be traced back to the same wild ancestor.

The aurochs and the half-wild and domesticated cattle of Europe are characterised by their horns being circular in section and placed at the very summit of the skull immediately over the occiput, as shown in the accompanying woodcut. Where they first arise from the skull the horns have their upper border convex; and the forehead of the skull is flat or slightly concave, and much longer than



SKULL OF THE AUROCHS (about $\frac{1}{10}$ nat. size).—After Owen.

broad, so that the sockets of the eyes are separated by a long interval from the bases of the horns. The tail is of great length. The spines of the vertebræ of the withers are not greatly elongated, and thus do not form a distinct ridge in this region of the body.

That the wild aurochs was an animal of huge bulk is proved by the skulls and bones found in the turbaries, fens, and

brick-earths of England and the continent. In the skull figured in the woodcut the bony cores of the horns have a span of upwards of 42 inches from tip to tip, and when these were covered with their horny sheaths the whole could not have fallen short of 50 inches. This specimen was obtained from a turbarry—that is a peat-bog—near Athol; but some of the skulls found in the brick-earths at Ilford, in Essex, are of considerably larger dimensions, although from the more forward direction of their horns the span between their tips is somewhat less.

Distribution and Extinction. The aurochs was pursued and killed by the prehistoric hunters of Europe, as we know from the circumstance that skulls have been found with the forehead pierced by flint hatchets. The date from which it disappeared from Britain is, however, uncertain, although it probably lingered longer in a wild state in Scotland than in the southern districts of England. On the continent there is evidence that in Julius Cæsar's time the aurochs, or urus, was abundant in the Hercynian, or Black, Forest of Germany. Old chronicles also prove that in the middle of the sixth century these animals were found, although rarely, in the province of Maine; while there is evidence that some of them at least were white in colour. In the ninth century Charlemagne hunted the aurochs in the forests near Aix-la-Chapelle; while at the close of the following century we find the flesh of these animals alluded to in the rolls of an abbey in Switzerland. The aurochs was met with during the route taken through Germany by the first crusade, in the eleventh century; and that it still lingered in the neighbourhood of Worms during the twelfth century is indicated by the mention of the slaughter of four individuals in the Nibelungen-Lied. The accounts of conflicts with gigantic wild oxen, so rife in classic literature, doubtless refer to the aurochs; and thus

indicate that the range of the animal extended as far southwards as Greece. Bones of the aurochs have been obtained from England and Scotland, but are unknown in Ireland. On the continent they occur in France, Switzerland, Italy, Scandinavia, Germany, and Austria; while it may be taken as certain that the species ranged over Russia, although its exact eastern and northern limits are not ascertained. Southwards the aurochs ranged as far as Algeria.

The mention of a white aurochs, which may, however, have been a tamed individual, in one of the chronicles referred to above, coupled with the coloration of the Chillingham cattle, renders it probable that the colour of the aurochs was white, more or less mingled with dun and red; this inference being confirmed by the prevalence of these colours in so many of our domestic breeds of cattle.

Domestication. It is probable that the aurochs was the direct ancestor of our largest breeds of domestic cattle. At a very early period (although later than the epoch of the brick-earths, when the aurochs first existed) the inhabitants of Europe had succeeded in domesticating a small variety of ox, known as the long-fronted ox (*Bos longifrons*), from which it is considered probable that the small Welsh and Highland breeds of cattle are descended. If, however, we are right in our view that the whole of the cattle of Europe belong to one species, it is evident that the long-fronted ox itself must likewise have been originally derived from the aurochs.

Park-Cattle. Having said thus much as to the extinct wild cattle of Europe, we proceed to notice the half-wild races preserved in certain English and Scottish parks, after which we shall pass on to the consideration of the chief domestic breeds. It may be premised that while several of the former are probably much closer to the aurochs than are any of the latter, there seems but little doubt that in all cases these half-wild cattle are descended from more or less completely domesticated early breeds, and are not directly derived from the wild aurochs. The British park-cattle, when pure bred, are white in colour, with the exception of the ears and muzzle, and sometimes the front of the legs, which may be either red or black; the horns being white with black tips. In size these cattle are small; but their proportions are well-nigh perfect, their heads being small, their backs straight, and their legs short. According to Mr. J. E. Harting, herds of these cattle were formerly kept at all of the following parks, viz., Aucheneruive (in Ayrshire), Barnard Castle (Durham), Bishop Auckland (Durham), Blair Athol (Perthshire), Burton Constable (Yorkshire), Cadzow Castle (Lanarkshire), Chartley Park (Staffordshire), Chillingham Castle (Northumberland), Ewelme Park (Oxfordshire), Gisburne Park (Yorkshire), Hoghton Tower (Lancashire), Holdenby Park (Northamptonshire), Kilmory House (Argyleshire), Leigh Court (Somersetshire), Lyme Park (Cheshire), Middleton Park (Lancashire), Naworth Castle (Cumberland), Somerford Park (Cheshire), Whalley Abbey (Lancashire), and Wollaton Park (Nottinghamshire). Of these numerous herds the only ones now remaining are those at Cadzow, Chartley, Chillingham, Kilmory, Lyme, and Somerford.

Chillingham Cattle. The best known of all is the famous Chillingham herd. There is some doubt as to the date of the enclosure of Chillingham Park, which, however, very probably took place early in the thirteenth century; and there is undoubted evidence of the existence of the herd rather more than two

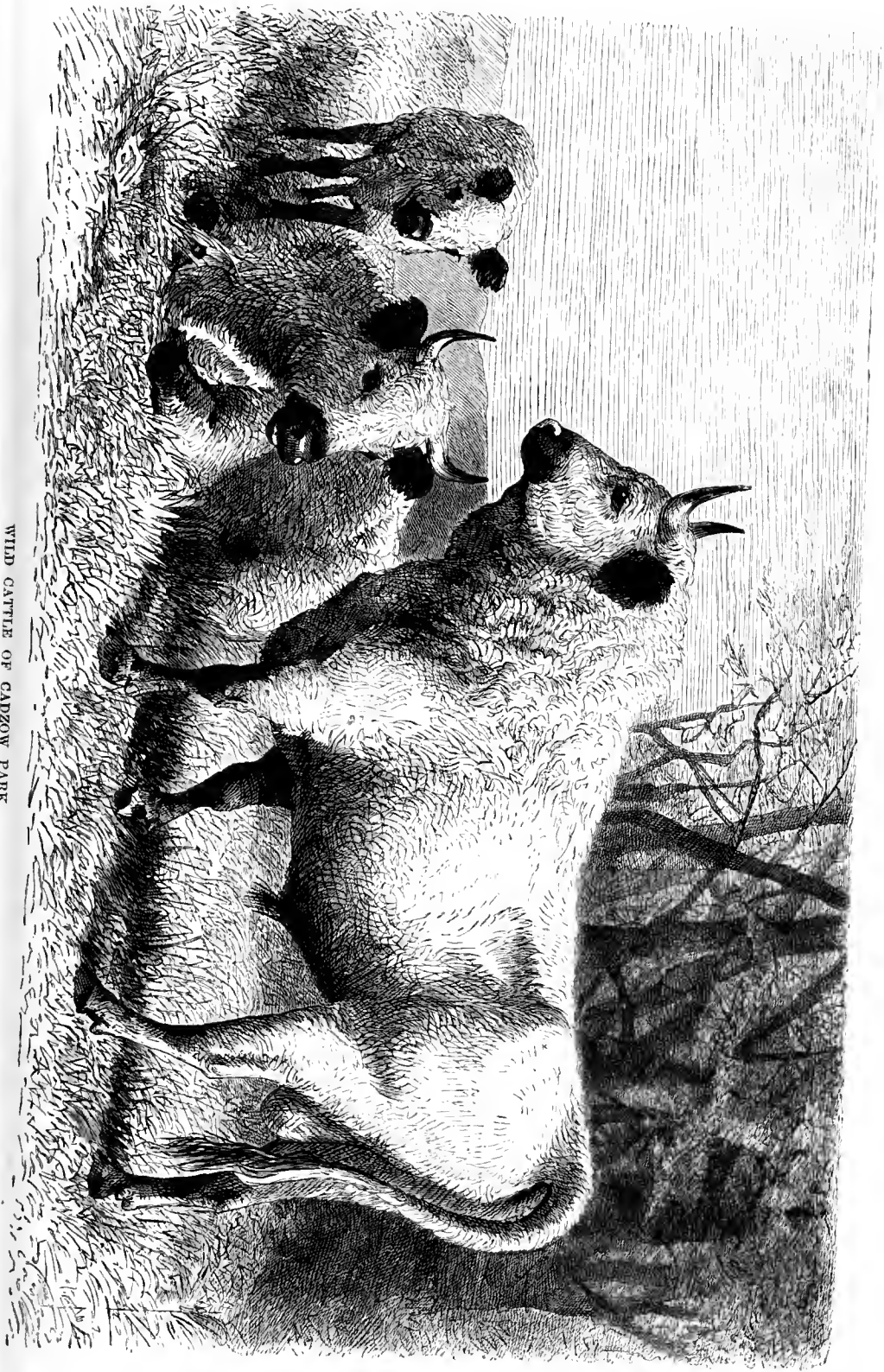
hundred years ago. The Chillingham cattle are small, with moderately rough and curly hair, and short upwardly-directed horns. At the present day the insides of the ears and the muzzles are red; but it appears that in 1692 black ears were more numerous than red, and that the present coloration has been produced by selection. Mr. J. Hindmarsh, writing in the year 1838, states that the Chillingham cattle "have pre-eminently all the characteristics of wild animals, with some peculiarities which are very curious and amusing. They hide their young, feed in the night, basking or sleeping during the day; they are fierce when pressed, but generally speaking very timorous, moving off on the appearance of anyone, even at a great distance." The following statement of the numbers of the Chillingham herd at different periods is compiled by Mr. Harting from numerous accounts which have from time to time appeared. "In 1869, according to the steward's account, the herd consisted of only 14 breeding animals, bulls, and cows, and calves of both sexes, and 12 steers; in all 28. In 1838, according to Mr. Hindmarsh, there were about 80, comprising 25 bulls, 40 cows, and 15 steers of various ages. In May 1861, Mr. Darwin was informed by the agent that they numbered about 50. This was about the number we saw when visiting the park in May 1863. In August 1873 the herd consisted of 64 head, 17 bulls of all ages from calves upwards, 19 steers, and 28 cows, heifers, and female calves. In October 1874, according to Lord Tankerville (the owner), the herd numbered 71. In March 1875 the number had again decreased, amounting to 62 only, viz., 14 bulls and bull calves, 31 cows, and cow-calves, and 17 steers. In July 1877 there were still fewer—51 only—consisting of 8 bulls, 27 cows and heifers, and 16 steers. Lord Tankerville says they increase slowly, several dying each year by accidents or by overrunning their calves when disturbed; and the cows breed slowly, owing to having frequently the calves still sucking in the second year."

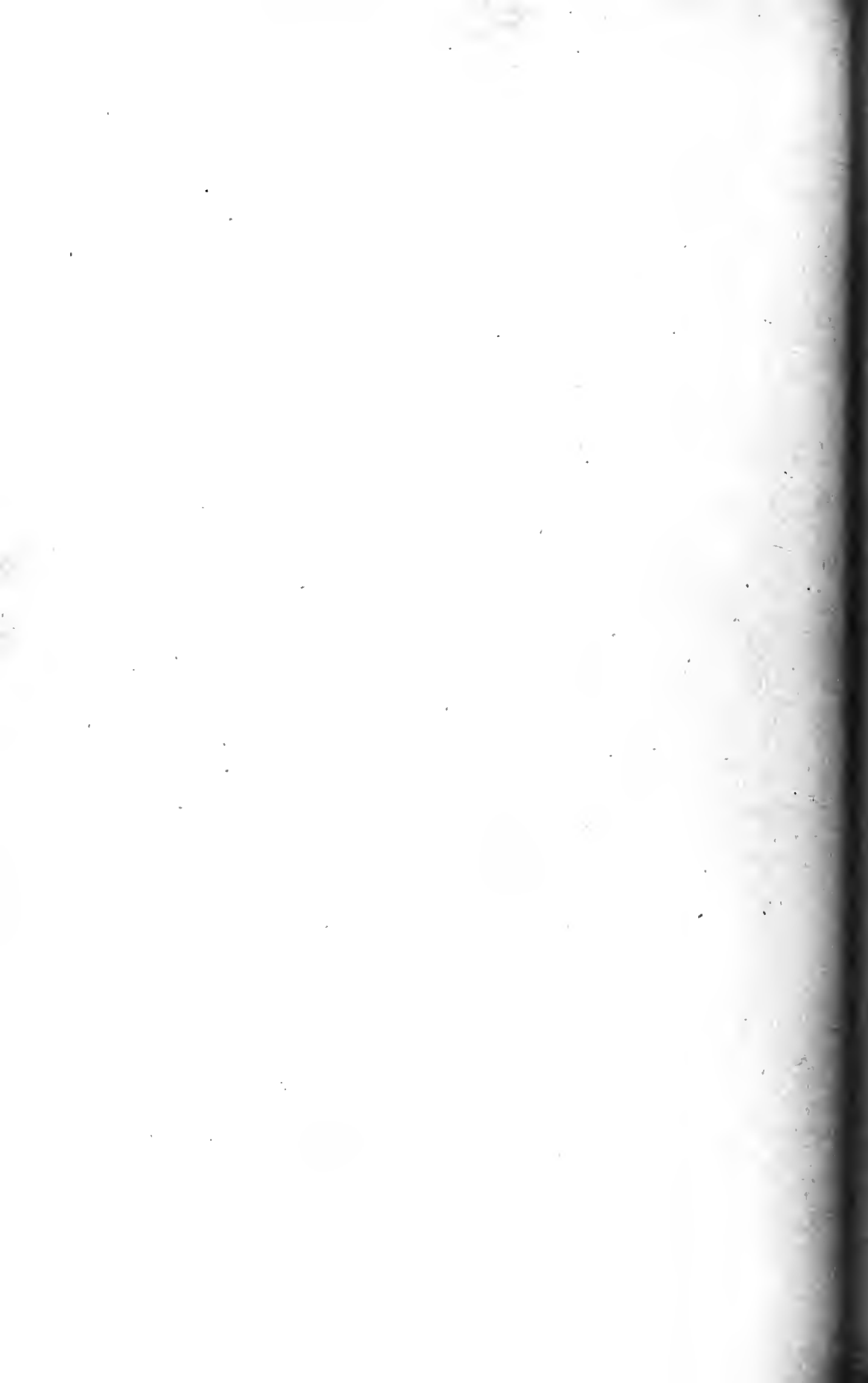
Cadzow Cattle. The Cadzow cattle, belonging to the Duke of Hamilton, of which a group is represented in our illustration, differ from the Chillingham breed in having the ears and muzzles black, while there is also a greater or smaller amount of black on the front of the fore-legs. Their heads are also more rounded, and their limbs stouter; and very generally the cows are devoid of horns. This herd is a very ancient one, and in 1874 numbered forty-five head, which in 1877 had increased to fifty-six.

Chartley Cattle. Very different in appearance to either of the above are the Chartley cattle, the property of Earl Ferrers. It is known that these cattle are the direct descendants of the wild cattle which roamed at large in the forest of Needwood at the date of the enclosure of Chartley Park in 1248. In this breed the ears are black, and the horns are longer and directed much more outwardly than in the Chillingham breed, resembling in these respects much more closely those of our domestic "long horns." In 1877 this herd comprised only twenty individuals.

Other Herds. The Kilmory breed is derived from the one which formerly existed at Blair Athol. The Lyme Park breed is interesting as being of larger size than any of the others. The hair is remarkable for its length and curliness, more especially on the shoulders; the ears are generally red, although occasionally black or bluish black; and Mr. Harting describes the horns as inter-

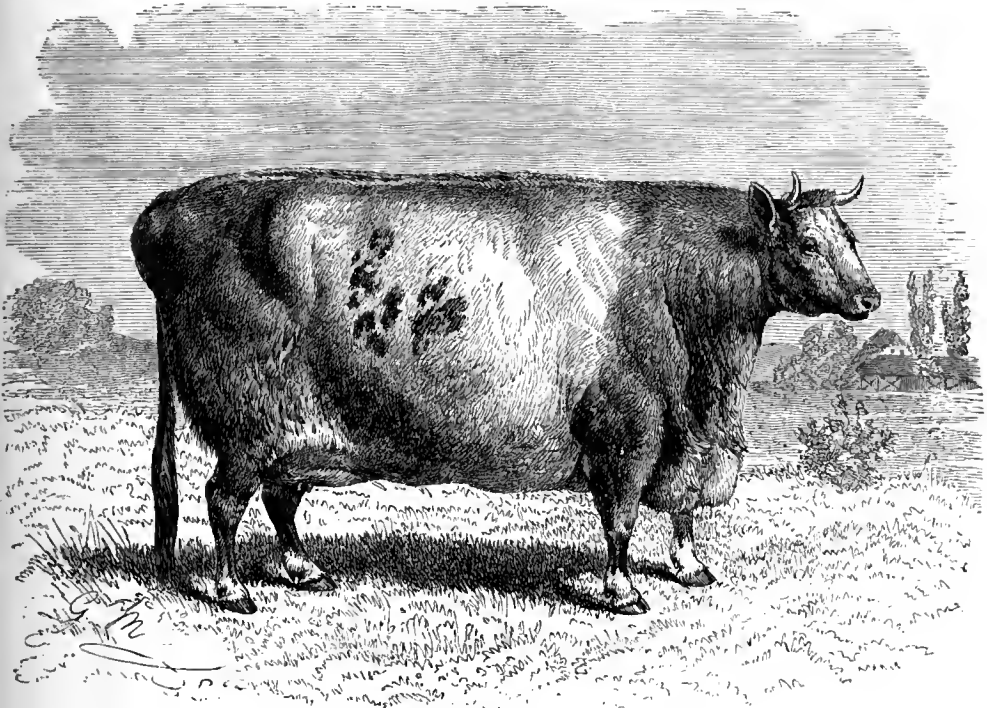
WILD CATTLE OF CADZOW PARK.





mediate between those of the Chillingham and Chartley breeds. In 1875 this herd was reduced to four individuals, but had increased in 1877 to six, although one of the four cows was parti-coloured.

Of the breed at Somerford Park, situated in the heart of what was formerly Maxwell Forest, Mr. Harting writes that "an ancient herd of white cattle, resembling those at Chartley, but polled, still exists here; and these animals are considered to be the best surviving representatives of the hornless and tame variety of the original wild white breed. The colour is pure white; the ears, rims of the eyes, muzzle, and hoofs being quite black. Like all other herds of the forest breed they have a strong tendency to produce small black spots on the neck, sides, and legs."



DURHAM SHORTHORN ($\frac{1}{2}$ nat. size).

It may be added that all these various herds of white cattle are doubtless derived from the half-wild cattle which, as we learn from the writings of Fitz-Stephen, dating from about the year 1174, were common in the forests around London, and probably therefore in other parts of England. When the various parks were enclosed a certain number of these cattle were driven in, and the herds thus obtained have been preserved with more or less care by their subsequent owners.

Our notice of the domestic breeds of European cattle will be brief, and chiefly confined to those met with in the British Islands.

First of all we have the small Shetland cattle, inhabiting the islands from which they take their name, but also extending to the Orkneys and Iceland. These cattle, although of small size, are esteemed on account

of their milk-yielding qualities, and the readiness with which they fatten. They have short horns, and are generally parti-coloured, with lighter shades of colour than the Highland breeds.

Highland Breed. The well-known Highland cattle, of which there are several strains, are characterised by their small size, the presence of horns, directed more or less upwardly, in both sexes, their short and sturdy limbs, and their rough and generally uniformly-coloured coats, which are greatly developed in the region of the neck. Generally the muzzle is black; but the colour of the hair may be either black or brown, or a mixture of these two, and sometimes of mouse-dun. These cattle are remarkable for their hardy habits, and vary in size according to the nature of the pasture of their native districts. Although far from good milkers, when brought down to the rich pastures of England they fatten readily. The West Highland breed is the finest, that of the Central Highlands the smallest, and that of the eastern coasts near the Lowlands the largest.

Welsh Breed. The Welsh cattle are best known by the Pembroke breed, and are generally of rather larger size than the Highland races, with yellow or orange-coloured unctuous skins; the hair being generally black. They are quite as hardy as the Highland cattle, and will thrive on very scanty nutriment, while they have the advantage of being much better milkers.

Kerry Breed. The Kerry breed is a well-known strain of hardy mountain cattle, agreeing in the colour of their skins with the Pembroke breed. The hair is generally black with a white streak down the back, and sometimes another along the belly; but it may be pure black or brown, black and white, or black and brown. The horns are long, tapering, and directed upwards. These cattle are valued for the good milking qualities of the cows, even when nourished upon inferior pasture.

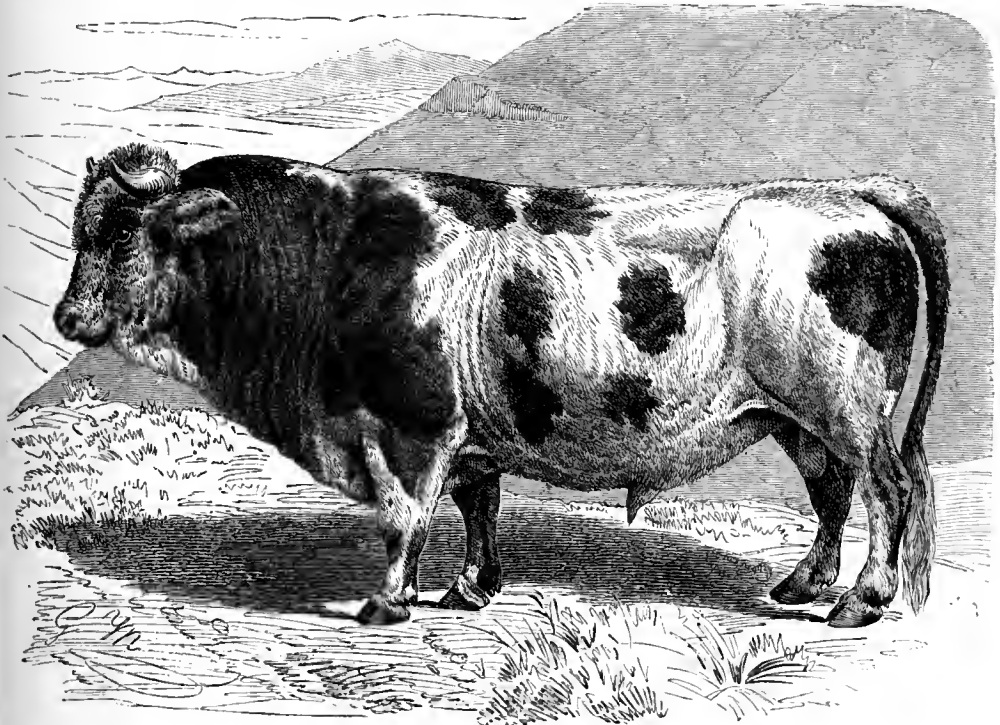
Polled Angus. The polled Angus breed, produced on the Devonian rocks of Forfar and Kincardine, are larger than the Highland cattle, from which they are readily distinguished by the absence of horns in both sexes. They are mostly black with white markings, but may be brindled black and brown; the skin being dark-coloured. This breed has in all probability been derived from the Highland cattle, and has attained its superior size and excellent milk-yielding qualities from having been reared on the richer pastures of the Lowlands. The polled Aberdeenshire breed is another strain of hornless cattle of mixed origin, bred in the lower districts of the county from which it derives its name.

Galloways. The Galloway breed is also a hornless one, and is of great antiquity, having been in existence at least since the sixteenth century. They inhabit a district underlain by Silurian and Cambrian rocks in the south-west of Scotland; and are essentially a mountain breed, being inferior in size to the polled Angus, although superior to the Highland breed. The skin is dark-coloured, and the hair generally black; while the great depth of the body will always suffice to distinguish this breed from all other polled strains. Mr. D. Low states that "these cattle are hardy, exceedingly docile, sufficiently good feeders, when carried to suitable pastures, and weigh well in proportion to their bulk."

Polled Suffolk. The polled Suffolk is a less important hornless breed from the eastern counties of England, which was originally of a mouse-dun, or

some nearly similar shade of colour, and is of small size, and somewhat defective form. There is also a polled Irish breed, which includes animals of large size, but frequently more or less crossed with other races.

Alderneys and Jerseys. The three nearly-allied strains from the Channel Islands, respectively termed Alderney, Jersey, and Guernsey, are now so well known in England, and are so easily distinguished from all others, that they require but scant notice. They are characterised by the bulls being considerably larger than the cows, by their small size, their short, thin, and often erumped in-turning horns, and their delicate and (from the butcher's point of view) somewhat "ragged" build. The head is delicately formed, with very prominent eyes, and a narrow



THE FRIBURG BULL ($\frac{1}{2}$ nat. size).

muzzle, but may be either very short or somewhat elongated; the bones of the pelvis are very prominent; and the limbs are slender and deer-like. The colour of the short and glossy hair is generally some shade of rufous or fawn, mingled with white; but it may be black, mixed with white or dun, and is more rarely cream; the skin being thin and orange-coloured. Although of delicate constitution, the Channel Island breeds are esteemed for their elegant appearance, and the richness and yellow colour of their cream and butter.

Ayrshire. The Ayrshire breed, whose proper home is the county of Ayr, although it is now widely spread over Scotland and some parts of Ireland, is another race bred exclusively for the purposes of the dairy. They are of medium size, with short horns curving inwards in the Alderney manner; and the fore-quarters are light, the loins broad and deep, the neck and head small, and

the limbs slender. The colour of the skin is yellowish orange, and the prevailing tint of the hair reddish-brown, more or less mixed with white.

Devons. The rich red soil of Devonshire is tenanted by a breed of cattle readily distinguished by the deep red colour of their hair. They have orange-yellow skins and fine tapering horns. Mr. Low describes them as "of a light and graceful form, agile, and suited for active labour. They fatten with sufficient facility in good pastures, and in a temperate climate; but they are inferior in hardiness and the power of subsisting on scanty herbage to the mountain cattle of Scotland and Wales." The cows are relatively small, and their yield of milk not great, although excellent in quality and rich in cream.

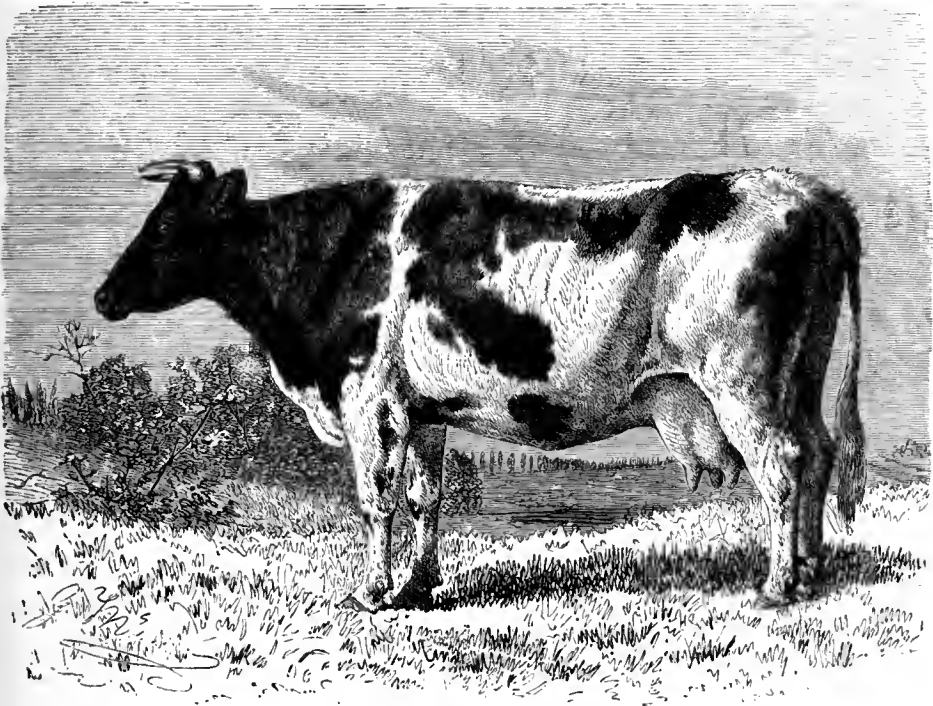
Herefords. Omitting mention of the Sussex and Glamorganshire breeds, as being of minor importance, we pass on to the well-known Herefords, easily recognised by their large size, white faces, and dark red or reddish brown colour, marked more or less with white on the back and under-parts. Mr. Low considers this breed remotely related to the Devon; and it exhibits the same inferiority in the size of the cows, and a similar deficiency in the yield of milk. The breed is, however, an excellent one for fattening, and is hence in much favour in the West of England.

Longhorns. The longhorned breed, which is likewise from the West of England and is also largely reared in Ireland, is one which has of late years steadily declined in favour in this country. The original breed of longhorns was subject to considerable variation in size; but the prevailing colour of the hair was either black or brown, with a white stripe down the middle of the back, and more or less white on the body. The hair was abundant and the skin thick and dark. The long horns generally curved downwards at the tips; but in southern and eastern England they often turned up. Ultimately great improvements were effected in the breed, and the knowledge thus acquired paved the way for the gradual development of the shorthorns, by which the longhorns have been so largely supplanted.

Shorthorns. The shorthorn breed was originally an East Anglian race of cattle, but was modified into its present perfection in Durham, whence it is often known by the name of Durham shorthorn. The illustration on p. 167 represents an ox of the best strain of this breed. In these animals the height of the body is comparatively low, but there is great depth, and the chest, back, and loins are remarkable for their width. The skin is light-coloured, and the hair either reddish brown or white, or a mixture of the two, or the well-known strawberry colour. The muzzle should be flesh-coloured; and the horns are short, curving inwards, light in colour, and frequently somewhat compressed. The skin is soft and yielding, and the general form of the body square and massive, with upright shoulders and roomy hind-quarters. The great advantages of the shorthorns are that they are hardy and good-tempered animals, of large size and eminently distinguished by the rapidity with which they reach maturity of flesh and muscle. Although inferior in their yield of milk to the Suffolk and Ayrshire breeds, shorthorns are now more widely spread over England, both as dairy and fattening cattle, than any other kind.

**Continental
Breeds.**

On the continent there are likewise numerous breeds of cattle, but only a few of these can be even mentioned. One of the most esteemed is the Friburg breed, of which a bull is represented in the illustration on p. 169. This breed seems to be allied to the English shorthorns, but has a longer body and neck. The horns are short but sharp, and the colour is a mixture of black or reddish brown with white. These cattle are largely bred in Switzerland, and are considered to be the parent stock from which several other breeds have originated. The Dutch breed, as represented by the cow figured in the accompanying woodcut, was originally a native of the lowlands of Holland, but has now spread over a large part of Germany. Fitzinger regards the Dutch cattle



DUTCH COW ($\frac{1}{2}$ nat. size).

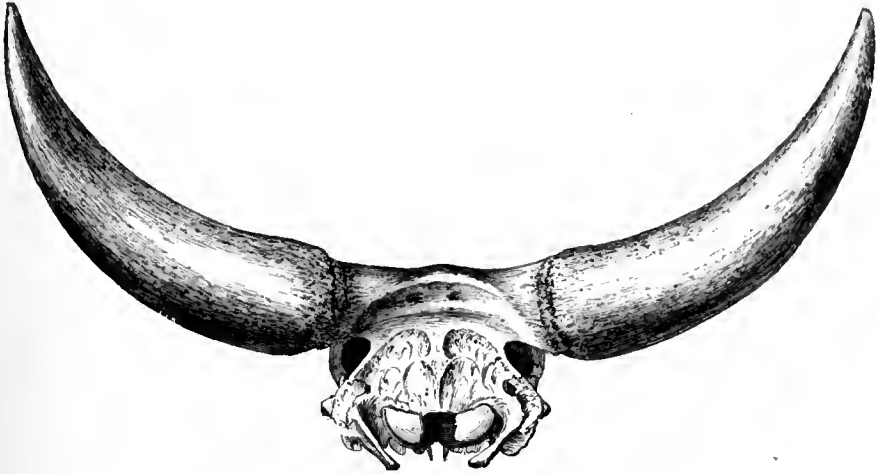
as the direct descendants of the aurochs, and they seem to approximate to the Ayrshire breed. They are of large size, with long necks and pointed muzzles, and moderate-sized horns, directed forwards and inwards. The usual colour is black upon a white or greyish white ground, but the dark markings may be brown or reddish.

Very different from all others are the large Hungarian cattle, characterised by their uniform pale fawn colour, their enormous, slender, outspreading horns, and their free light step. The horns may measure as much as 5 feet from tip to tip, and are black at the extremities, but greyish throughout the rest of their length. This breed ranges through Hungary into Turkey and Western Asia. The Podolian cattle constitute another well-marked breed characterised by the great relative height of the fore-quarters.

Indian Cattle. In Northern India many of the breeds of domestic cattle appear to be a cross between the ordinary European cattle and the humped Indian cattle, showing the general shape of the former but the white rings on the fetlocks characteristic of the latter. In Africa there are several kinds of humpless cattle, among which the Namaqualand breed most nearly resembles ordinary European cattle. On the other hand, the Damara breed is distinguished by the large size of the bones, the small feet, slender legs, the long tuft of bushy hair at the end of the tail, and the extraordinary length of the horns. The horns are, however, even still larger in the cattle of Béchuanaland, Mr. Darwin mentioning a skull in which the span of the horns is 8 feet 8 inches in a straight line, while the measurement from tip to tip along the curve is upwards of 13 feet 5 inches.

America and Australia. In certain parts of America, the Falkland Islands, Australia, New Zealand, and other countries, the cattle introduced from Europe have run wild, and form vast herds. Those found in Texas and on the Argentine pampas have become of a nearly uniform dark brownish red colour; while in the Ladrone or Mariana Islands, in the Pacific Ocean, all the wild cattle are white with black ears. When Lord Anson visited the Ladrone in the year 1742, the number of these cattle was estimated at upwards of ten thousand. In the Falkland Islands it is stated by Admiral Sullivan that those in the southern districts are white, with the feet, ears, or the entire head black; but in other parts they were either brown or mouse-coloured. The wild cattle of New Zealand, according to Herr von Lendenfeld, are white spotted with brown. In Australia the herds are of great extent, and are difficult to approach within shooting distance, on account of the wariness of the animals. In Argentina the cattle are very wild, but take little notice of a mounted man. If, however, as is seldom the case in a country where everybody rides, they are approached by a person on foot, they gallop around him in circles, with threatening gestures, looking every moment as if about to make a charge, although it does not appear that they ever do so. In company with two ladies, the writer has often wandered among such herds, without any harm, except some alarm on the part of one of his companions. In Colombia wild cattle are found not only on the plains, but likewise high up in the Cordilleras, and herds of considerable size have been met with in the highlands of Central Asia. Here may be mentioned the curious monstrous cattle found in Argentina and known as niatas or natas. This breed, which has existed for more than a century, bears the same relation to other races as is presented by pug-dogs to ordinary dogs. According to Mr. Darwin, "the forehead is very short and broad, with the nasal end of the skull, together with the whole plane of the upper molar teeth, curved upwards. The lower jaw projects beyond the upper, and has a corresponding upward curvature. The upper lip is much drawn back, the nostrils are seated high up and are widely open, the eyes project outwards, and the horns are large. The neck is short, and in walking the head is carried low. The hind-legs appear to be longer, compared with the front-legs, than is usual. The exposed incisor teeth, the short head and upturned nostrils, give these cattle the most ludicrous, self-confident air of defiance." Niatas appear to be very rare; but the writer had the good fortune to see a pair of them kept in the grounds of the

museum at La Plata in 1893. These were black and white in colour; and the characteristic features of the breed were much more strongly displayed in the bull than in the cow.



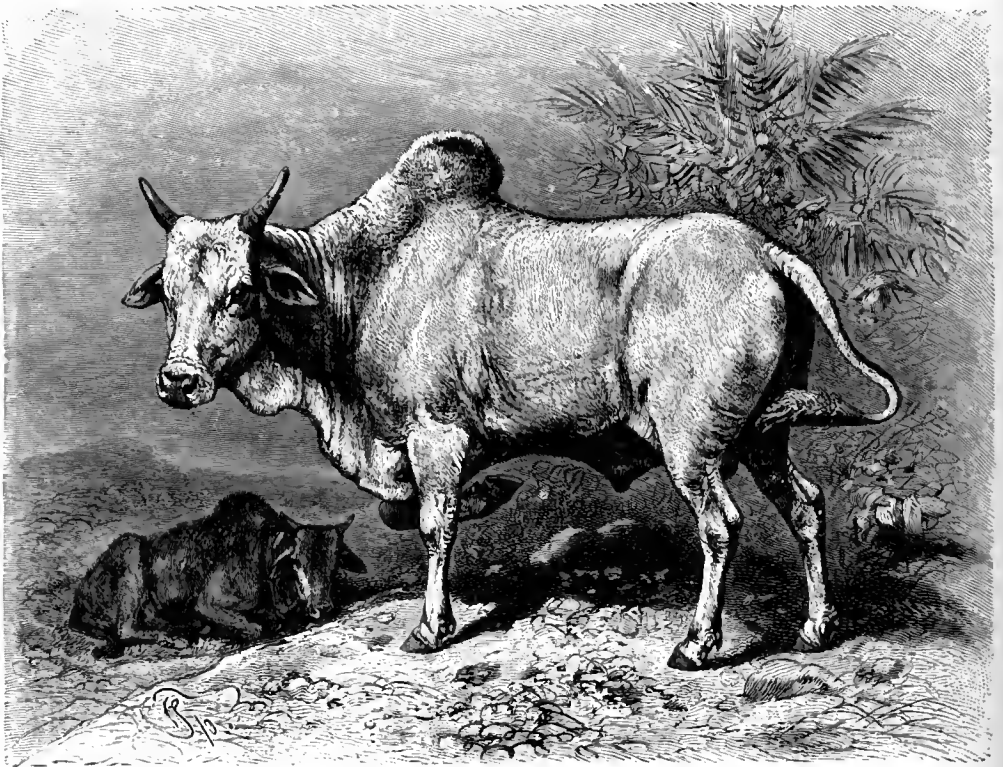
HIND VIEW OF SKULL OF GALLA OX, WITH THE HORN-SHEATHS REMOVED ($\frac{1}{2}$ nat. size). After Rüttimeyer.

HUMPED CATTLE (*Bos indicus*).

The common domesticated cattle of India are distinguished from those of Europe, not only by the presence of the hump on the withers, but likewise by other structural features, as well as by their general coloration, their voice, and their habits. Hence, although they are only known in the domestic state, there can be no hesitation in regarding these humped cattle as constituting a perfectly distinct species. In Europe these animals are generally called zebu, but it does not appear that any such name is known in India.

In addition to the enormous hump on the withers, the Indian humped cattle are characterised by a certain degree of convexity of the forehead, by the upper border of the short horns being uniformly concave (as shown in the figure of the skull of the African variety), by their large drooping ears, and also by the enormous dewlap which hangs in folds along the whole length of the neck. In size and colour these cattle are subject to a considerable amount of variation, but they are very generally characterised by a distinct white ring round the fetlocks. While the largest individuals stand as high as a buffalo, the smallest are but little taller than a calf of a month old. The most common colour is a light ashy grey, which may shade off into cream-colour, or even milk-white; but various tints of red or brown are often met with, and occasionally black individuals are seen. In disposition these cattle are always gentle, and the larger varieties are employed in India for drawing native carriages. The voice of the humped cattle is more of a grunt than a low; and these animals differ from European cattle in habits, inasmuch as they but seldom seek the shade, and never stand knee-deep in water. It need hardly be mentioned that a certain number of privileged bulls are specially protected by

the Hindus, and are allowed to perambulate the bazaars of the Indian towns at will. In certain parts of India humped cattle have run wild; those found on the sea-coast near Nellore, in the Carnatic, have been in this state for a long period, and Jerdon describes them as being extremely shy and wild, their size being large and their horns long.



INDIAN HUMPED BULL ($\frac{1}{2}$ nat. size).

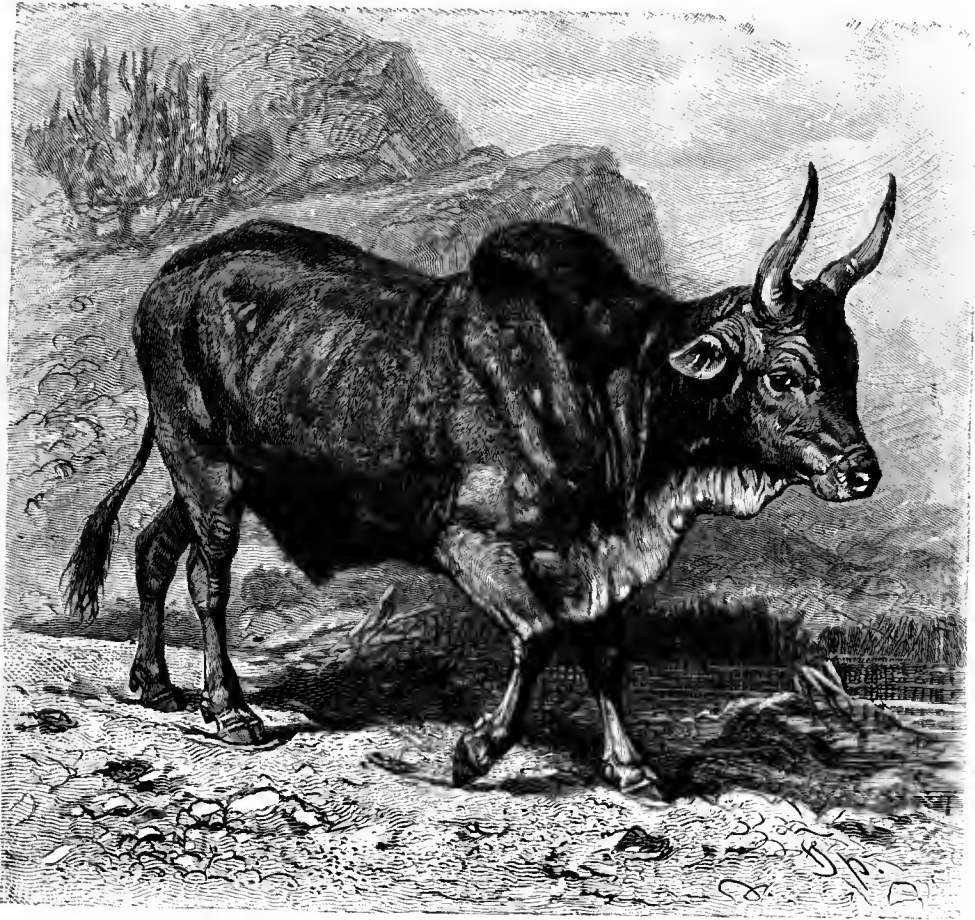
Galla Cattle.

Humped cattle are also found in China, Africa, and Madagascar; and Blyth was of opinion that the group might have had an African origin. In Central Africa the humped cattle are represented by the Galla ox or sunga, characterised by the enormous size and thickness of the horns, as shown in the figure of the back of the skull on p. 173. In this breed the forehead of the skull lacks the convexity characteristic of the Indian humped cattle; and as the curvature of the horns is somewhat similar, Professor Rüttimeyer believes that the Galla ox is most nearly related to the Asiatic banting mentioned later on.

Extinct Species.

In concluding our notice of the typical oxen it may be mentioned that several species occur fossil in India. Among these is the magnificent Narbada ox (*B. namadicus*), of the gravels of the valley of the Narbada, which was fully equal in size to the aurochs, and in the typical form had horns with a cylindrical section. It is, however, noteworthy that in one race of this species the horns were somewhat flattened, and thus approximate to those of the living wild cattle of India. In the somewhat older deposits of the Siwalik

Hills there occurs the gigantic sharp-fronted ox (*B. acutifrons*), distinguished by the sharp ridge running down the middle of the forehead, and the enormous length of the horns, which swept upwards and outwards in a bold curve, and were probably but little short of 10 feet in span.

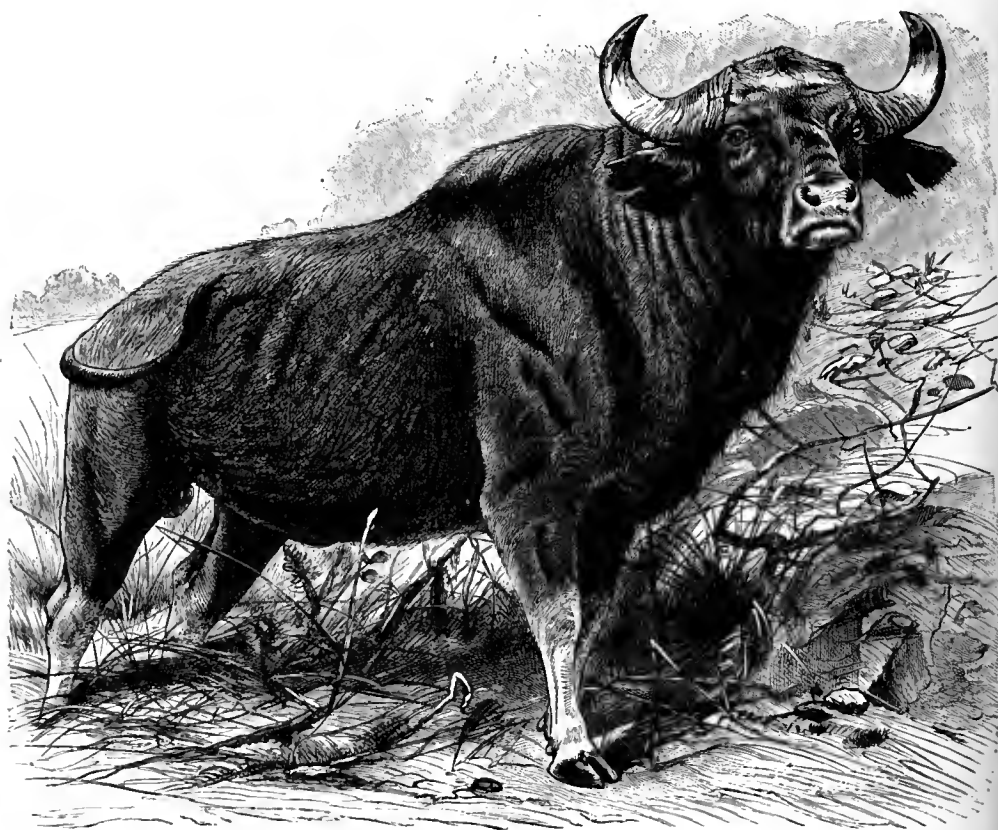


GALLA BULL ($\frac{1}{12}$ nat. size).

THE GAUR (*Bos gaurus*).

With the magnificent animal known as the gaur, but generally misnamed by Indian sportsmen the bison, we come to the first of three species from South-Eastern Asia, nearly allied to one another, and broadly distinguished from those already noticed. These animals, which include the handsomest existing representatives of the genus, are collectively characterised by the following features. The horns are flattened to a greater or less degree from front to back, more especially at their bases, where they present an elliptical cross-section: this character being more strongly marked in the bulls than in the cows. The tail is shorter than in the typical oxen, and reaches but little if at all below the hoeks. A third feature is presented by the distinct ridge running from the shoulders to the middle of the

back, where it ends in an abrupt drop, which may be as much as 5 inches in height. This ridge is caused by the great height of the spines of the vertebræ of the fore-part of the trunk as compared with those of the loins; but it is a character much less developed in the banting than in either of the other two species. The three species have also a characteristic coloration, the adult males being dark brown or nearly black, the females and young males being either paler or reddish brown, while in both sexes the legs from above the knees and hocks to



BULL GAUR ($\frac{1}{2}$ nat. size).

the hoofs are white or whitish. The hair is short, fine, and glossy, and the hoofs are narrow and pointed.

The gaur is a strong and massively-built species, easily recognised by the high convex ridge on the forehead between the horns, which bends forwards, and thus causes a deep hollow in the profile of the upper part of the head. The ridge on the back is very strongly marked, and there is no distinct dewlap on the throat and chest. The flattening of the horns at the base is very decided, and the horns are regularly curved throughout their length, and are bent inwards and slightly backwards at their tips. The ears are very large, the tail only just reaches the hocks, and in old bulls the hair becomes very thin on the back.

In colour the adult male gaur is dark brown, approaching black in very old

individuals; the upper part of the head, from above the eyes to the nape of the neck, is, however, ashy-grey, or occasionally dirty-white, the muzzle is pale-coloured, and the lower part of the legs pure white. The cows and young bulls are paler, and in some instances have a rufous tinge, which, according to Mr. Blanford, is most marked in individuals inhabiting dry and open districts. The colour of the horns is some shade of pale green or yellow throughout the greater part of their length, but the tips are black.

The gaur appears to be the tallest of all the oxen, old bulls sometimes reaching as much as 6 feet (18 hands) at the shoulder, or even, it is said, exceeding these dimensions by an inch or more. The more usual height is, however, from 5 feet 8 inches to 5 feet 10 inches; while the cows do not exceed 5 feet. Mr. Blanford gives the average size of the horns of bull gaur as from 20 to 24 inches along the outer curve; but specimens have been recorded with a length of 39 inches and a basal girth of 19 inches. This girth has, however, been exceeded by horns of which the length was less, a pair from the Malay Peninsula having a circumference of 22 inches, with a length of 32 inches. The horns of the cows are smaller, measuring in large examples from 23 to 24 inches above the curve, with a girth of about 13 inches.

Distribution. The geographical range of the gaur is extensive, comprising all the larger forest regions of India from Cape Comorin to the foot of the North-Eastern Himalaya, but excluding Ceylon. To the north-west its limits in India are marked, according to Mr. Blanford, by the valley of the Narbada River; while in the grass-jungles of the Ganges Valley the gaur is met with only along the skirts of the Himalaya. Eastwards the range of the gaur extends from Nipal through the hilly districts on the south of Assam into Burma, and thence as far south as the Malay Peninsula, where it is known to the natives as the *sladong*. It has been stated that the gaur occurs in Siam, but this requires confirmation.

Habits. The gaur prefers hilly districts to the plains, and in India is more generally found at elevations of from two thousand to five thousand feet than in the low country. While aged bulls are generally or invariably solitary in their habits, gaur, as a rule, collect together in small herds of about a dozen individuals, although the number may be increased to twenty or thirty, and one instance is recorded where the number in a herd was estimated at not less than one hundred head. Such an unusual gathering was, however, probably but temporary, and due to the scarcity of pasture. Each herd is governed by an old bull; the other members of that sex present being always younger animals. The best account of the habits of the gaur is by G. P. Sanderson, from whose work the following extracts are taken, with the substitution of the word gaur for bison.

The gaur living in herds "are shy and retiring in their habits, and retreat at once if intruded upon by man. They avoid the vicinity of his dwellings, and never visit patches of cultivation in the jungle. The gaur is thus an animal which would soon become extinct before the advance of civilisation were the latter rapid, or were the jungles in which he roams limited in extent; but his exemption from serious diminution, except in isolated positions, is secured by the existence of the continuous jungles of the Western Ghats and other forest ranges. Gaur, though

found in the low-country jungles, are very partial to high and well-wooded tracts, and their activity in hilly ground is astonishing. A herd scrambles up a steep hillside almost with the facility of a troop of deer, or thunders down a slope into the thicker cover of a valley, when alarmed, at a rapid trot or free gallop."

The food of the gaur, according to the same writer, consists mainly of grass, but also comprises the leaves and young shoots of bamboo, as well as the bark of certain trees. Gaur "feed till about nine in the morning, or later in cloudy and rainy weather; they then rest, lying down in bamboo-cover or light forest till the afternoon, when they rise to graze and drink; they also invariably lie down for some hours during the night. Although certainly quick in detecting an intruder, gaur can scarcely be considered naturally wary animals, as they seldom encounter alarms in their native haunts. Unsophisticated herds will frequently allow several shots to be fired at them before making off, and even then probably will not go far. But if subjected to frequent disturbance they quickly become as shy as deer, and if alarmed by the approach of man they retreat without loss of time." Except when wounded, and in such a position as to be unable to escape, Sanderson states that he has never known gaur belonging to a herd attack human beings. Gaur are very similar in their general habits to elephants, and herds of both may at times be found feeding in proximity. "Both seek the deep and ever-verdant valleys, watered by perennial streams, during the hot months, or from January to May, where they are safe from the jungle-fires which sweep the drier localities. With the early rains of April and May a plentiful crop of succulent young grass springs from beneath the black ashes, and the gaur and elephants then roam forth to feed and enjoy their emancipation from the thralldom of the season of scarcity. About September the grass in the hill-ranges has become so coarse, and the annoyance from insects during continued rain so great, that the herds move into more open country, and especially into forest tracts at the foot of hill-ranges where suitable cover exists." In such localities the grass is not more than a yard high at the most, and insects are comparatively few. In contradistinction to elephants, gaur never forsake the forest districts for the open plains; but when in the lowland districts are in the habit of visiting the numerous salt-licks.

It must be remembered that the foregoing description applies solely to the gaur of Southern India, and that in the more northern portions of their range, where the seasons are different, there is a corresponding alteration in their habits. When in the lowlands, gaur are apt to catch various diseases prevalent among domestic cattle, and sometimes the herds are decimated from this cause. In Peninsular India the calves are generally born during August and September, although a few are produced from April to June.

The cries of the gaur are three in number. The first is a loud reverberating bellow, used as a call; the second a low mooring cry, uttered when in alarm, or when the curiosity of the animals is excited; while the third is a kind of whistling snort, heard when the frightened creatures dash off into thicker cover. In India proper the gaur has never been domesticated; and it is but recently that a living example—a young one—has been exhibited alive in England. The hill-tribes of the north-eastern portion of India have, however, succeeded in taming these animals.

Solitary gaur are always very old bulls, which have been driven from the

herds by their younger rivals after deadly combats, the marks of which are to be seen on their scored and seamed flanks, as well as in their slit and frayed ears and their battered horns. Mr. Sanderson says that these solitary bulls always have the finest heads and horns, and offer the most noble object of pursuit to the sportsman. The morose and savage disposition commonly attributed to these outcasts is regarded by the same writer as not altogether authenticated. It is true, indeed, that men are sometimes killed by a sudden rush from one of these solitary bulls, but that this is generally owing to the circumstance that the animal has been suddenly surprised, and thereupon starts up and rushes forwards without considering what may be in its path.

Hunting. Gaur-shooting, from the nature of the ground, is invariably undertaken on foot, and, next to elephant-shooting, is considered to be the finest sport with the rifle in India. Good trackers are essential to its success; but these are fortunately to be found among the non-Aryan hill-tribes of Southern India, who are unsurpassed in the keenness and accuracy with which they follow a trail. The emergence of an old solitary bull-gaur on an open glade, among the tall bamboo forests of the hills of Southern India, is described as being one of the finest sights with which the toils of the sportsman can be rewarded. When killed, the gaur affords excellent meat, the great delicacy being the marrow-bones roasted on the camp fire.

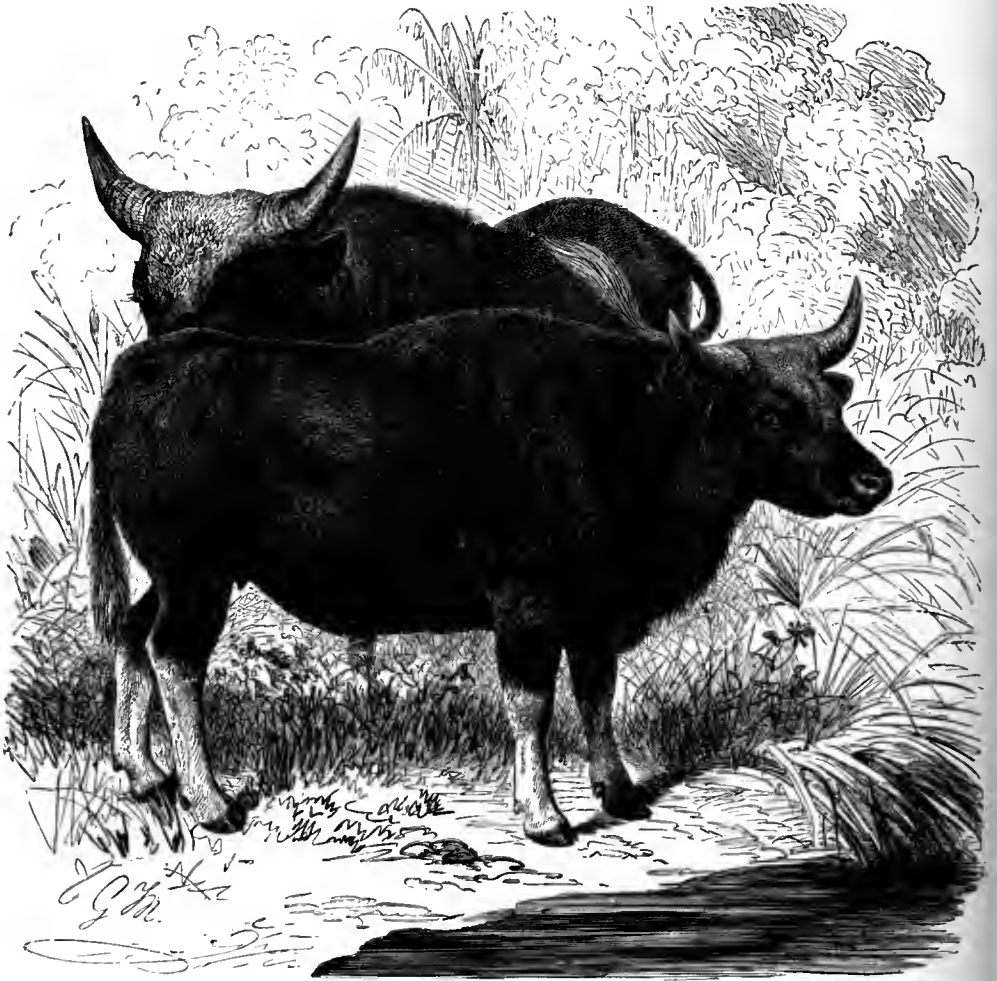
THE GAYAL (*Bos frontalis*).

Well known for many years as existing in a semi-domesticated condition in the hilly districts of North-Eastern India, it is but recently that the gayal has been determined to be a truly wild species, although we have yet no definite information of its habits or the limits of its range in this condition.

The gayal, or, as it is frequently termed the mithan, is nearly allied to the gaur, from which, however, it differs in several important particulars. In the first place, it is a somewhat smaller animal, with proportionately shorter limbs, a minor development of the ridge on the back, and a larger dewlap on the throat of the bulls. The head is also shorter and broader, with a perfectly flat forehead and a straight line between the bases of the horns. The horns, which are very thick and massive, are less flattened and much less curved than in the gaur, extending almost directly outwards from the sides of the head, and curving somewhat upwards at the tips, but without any inward inclination. Their extremities are thus much farther apart than in the gaur. The colour is very nearly the same as in the latter, the head and body being blackish-brown in both sexes, and the lower portion of the limbs white or yellowish. The horns are of uniform blackish tint from base to tip. Some domesticated gayals are parti-coloured, while others are completely white.

The gayal stands much lower at the withers than the gaur. In the skull of an old wild bull measured by Mr. Blanford the horns reached 14 inches both in length and basal girth; but these dimensions are exceeded by those of many domesticated specimens. The cow gayal, as shown in our illustration, is a much smaller animal than the bull, and has scarcely any dewlap on the throat.

Distribution. It has been ascertained by Mr. Blanford that the gayal occurs in a wild condition in Tenasserim; but in a more or less domesticated condition large herds of these animals are kept by the Kuki tribes on the hill-districts of Tipperah. It is, moreover, certain that some of the domesticated cattle kept by the hill-tribes on both sides of the Assam Valley in the districts of Manipur, Cachar, Chittagong, and the Lushai Hills, are gayal, although others are



COW GAYALS ($\frac{1}{2}$ nat. size).

gaur. From indications afforded by certain skulls it is not improbable that these tame gayal and gaur occasionally interbreed. Mr. Blanford observes that the tame herds of gayal "are kept for food, and, according to some authorities, for their milk, though this is doubtful, as most of the Indo-Chinese tribes who keep mithans never drink milk. The animals appear to be never employed in agricultural labour, nor as beasts of burden. They roam and feed unattended through the forest during the day, and return to their owner's village at night."

Habits. Like the gaur, the gayal is essentially an inhabitant of hill-forests, and the facility with which it will traverse rocky country is little short of marvellous for an animal of such bulky proportions.

Gayal have been exhibited in England alive, but none of them were fully-grown bulls, and consequently failed to give an adequate idea of the magnificent proportions attained by that sex. Adult bulls have, however, been shown from time to time in the Zoological Gardens at Calcutta, and were most splendid animals, with glossy coats of the deepest shade of brown. Gayal will breed with the humped cattle of India, and the product of such a union born in the London Zoological Gardens was again crossed with a bull American bison. A pure-bred gayal calf produced in the same menagerie was of a light brownish red colour, with the throat, chest, and the inner sides of the legs white.

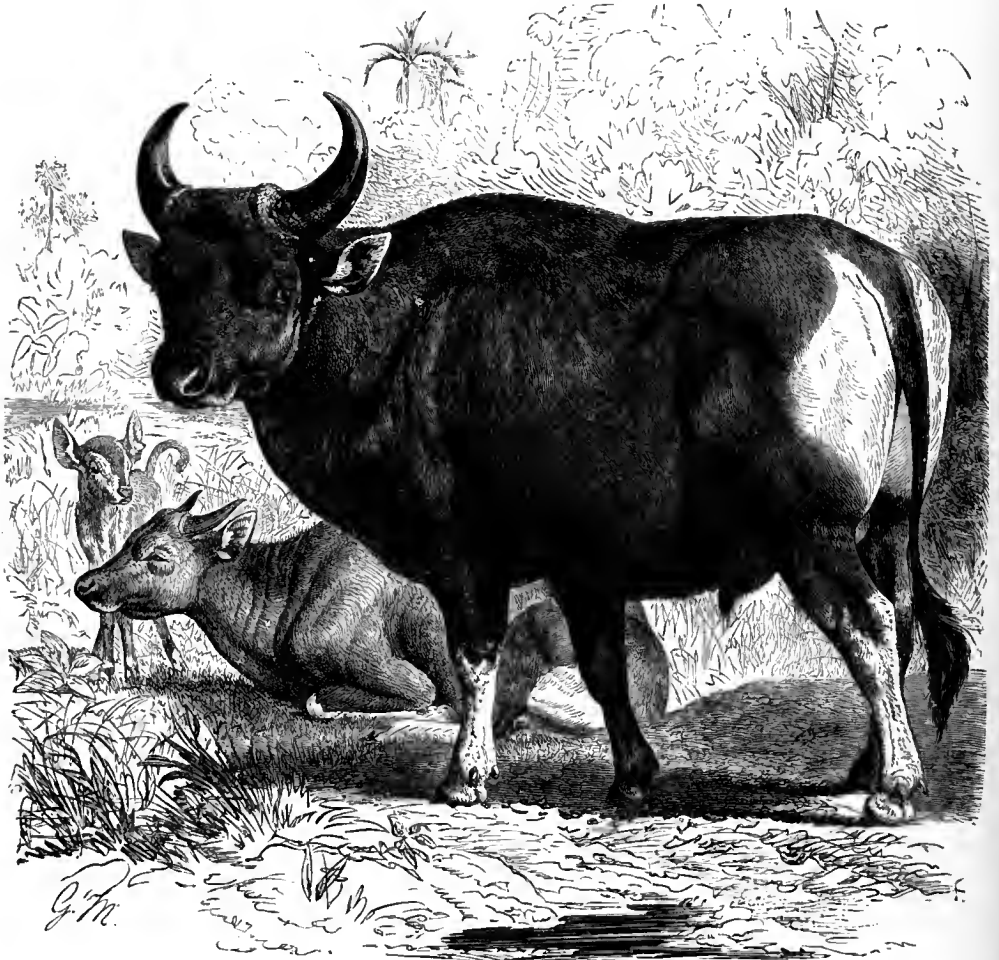
THE BANTING (*Bos sondaicus*).

The banting, or Javan ox, differs very considerably from both the preceding species, and serves to connect them with the typical oxen. The most distinctive feature of this ox is the large white patch on the hind-quarters, which extends upwards to the root of the tail, although not surrounding it. Another peculiarity of the banting is that the cow has the head, body, and upper portions of the limbs of the same reddish brown, almost chestnut colour as the calves. The general build of the animal is slighter than that of the gaur, the ridge on the back is much less developed, and the legs are proportionately longer. The head is also more elongated and pointed; while the horns, which are cylindrical in the young, are relatively smaller. In the adult bull they are flattened at the base, and are much curved, the direction being at first outwards and upwards, while towards the tips they incline inwards and somewhat backwards. The tail descends below the hocks; and the dewlap is of moderate size. The old bulls are black, with the exception of the white patch on the buttocks and the legs, from the knees and hocks downwards. The young calves, like those of the gayal, have the whole length of the outer surface of the limbs chestnut; and they are also distinguished by a dark streak down the back. A full-grown bull banting from Java measured 5 feet 9½ inches at the withers; but Mr. Blanford states that the largest example recorded from Burma was only 5 feet 4 inches in height.

Distribution. The banting is exclusively confined to the regions lying to the eastwards of the Bay of Bengal, occurring throughout Burma, and probably extending as far north as the hills to the eastwards of Chittagong, while it also inhabits the Malay Peninsula, and the islands of Java, Bali, Borneo, and probably Sumatra. That it also occurs in Siam is almost certain, but its exact range in the Indo-Chinese countries has still to be determined. Large herds of domesticated banting are kept by the Malays in Java, and also in the small island of Bali, lying to the south-east. The herds in Bali are replenished by importation from Java. The Malays speak of a wild ox under the name of the sapio, which may prove to be a variety of the banting with ferruginous red instead of white on the legs.

It has already been noticed that the original colour of the wild ox or aurochs

of Europe was probably white mixed with reddish brown; and the fact that the calves of all the three species of the present group are reddish brown points to the conclusion that this was the ancestral coloration. Now the fact that the female banting permanently retains this ancestral coloration, which is transient in the gaur and gayal, indicates that the present species is a less specialised form than either of the other two; the dark colour being acquired only in the male sex.



THE BANTING ($\frac{1}{2}$ nat. size).

This is confirmed by the structure of the banting, which departs less widely from that of the typical oxen than is the case with the other two species of this group.

Habits. Although the accounts of the habits of the banting are not very full, yet it appears that in these respects this animal is very similar to the gaur. Mr. Blanford suggests, however, that from its relatively longer legs the banting is less addicted to climbing among rocky hills than are either of the other members of the group, and that it is accordingly more restricted to the plains of tall grass. The domesticated race breeds freely with the Indian humped cattle.



DOMESTIC YAK.

It is stated by Blyth that in old bulls the skin between the bases of the horns becomes enormously thickened, and assumes a horny and rugged condition; this development beginning to take place before the coat has commenced to change from the light to the dark colour.

The extinct Etruscan ox (*B. etruscus*) from the Pliocene of the European continent, appears to have been allied to the banting, but with the horns placed low down on the skull near the eyes.

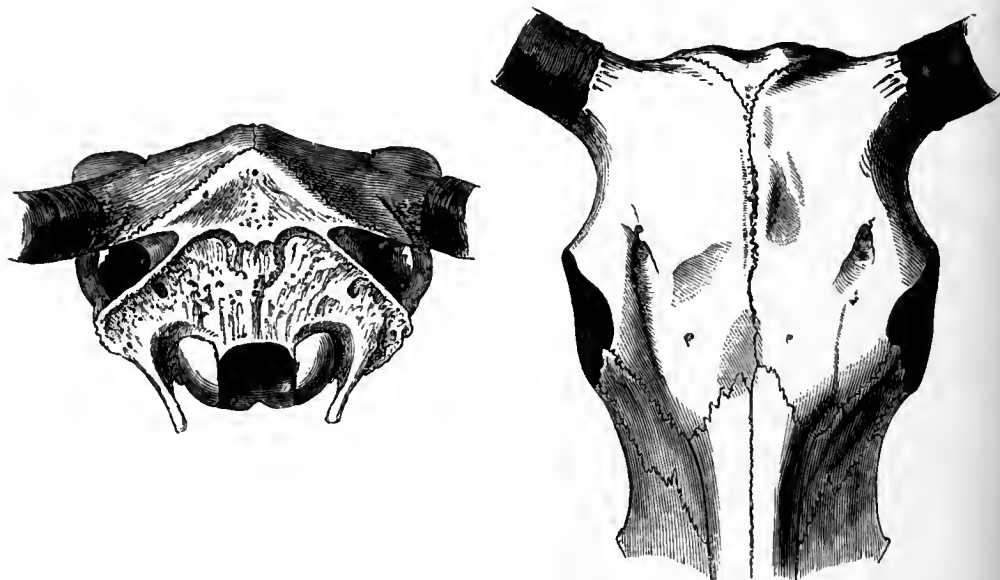
THE YAK (*Bos grunniens*).

The yak is one of the numerous mammals peculiar to the elevated plateau of Tibet, and differs markedly from all the other members of the ox tribe, although to a certain extent it forms a connecting link between the preceding group and the bisons. The most distinctive peculiarity of the yak, so far as external features are concerned, is the mass of long hair with which the flanks, limbs, and tail are clothed, and which makes the general appearance of the animal so very different from that of other oxen. On the head and upper-parts of the body the hair is short and nearly smooth, and the long hair only commences on the lower part of the sides where it forms a fringe of great depth, extending forwards across the shoulders and backwards on to the thighs. On the tail the long hair is developed on the lower half, where it expands into an enormous tuft which does not generally reach below the hocks. There is also a tuft of long hair on the breast. The colour of the hair is a uniform dark blackish brown, sometimes tending to a rusty tint on the flanks and back, and with a grey grizzle on the upper part of the head and neck in very old individuals. Around the muzzle there is a little white. We frequently find the yak represented as a brown and white, or even a pure white animal, but all such specimens are domesticated, and mostly hybrid individuals.

In build the yak is massively formed, with short and stout legs. The shoulders are high, but there is not the distinct ridge on the back characteristic of the gaur, and the whole back is nearly straight throughout, without any falling away at the hips. Both the ears and the muzzle are small; and the dewlap is totally wanting. The head is long and narrow, with a nearly flat forehead, and the eyes are approximated to the horns. The horns, which are very large in the bull, are smooth, and nearly or quite cylindrical, with the first curvature of their upper border concave, as in the gaur and banting. They curve at first upwards and outwards, then sweep boldly forwards, after which they incline upwards and inwards, and in some cases slightly backwards. The hoofs are relatively large and rounded. In height, it is stated that old bulls occasionally stand nearly 6 feet at the shoulder; but 5 feet 6 inches may be taken as the average. The weight of bulls is said to be about 1200 lbs. Average-sized horns vary in length from 25 to 30 inches measured along the curve; but a pair has been recorded measuring 40 inches in length, with a basal girth of nearly 19 inches. The horns of the cows are always smaller and thinner than those of bulls.

Such are the leading external characteristics of the yak; but there are also certain features connected with the skeleton which are worthy of notice. In the

first place, there are fourteen pairs of ribs, whereas, in all the oxen hitherto noticed, the number is but thirteen; and in this respect the yak resembles the bisons. In the skull, the region between the eyes and the occiput is relatively shorter and wider than in the typical oxen, and the horns are set on somewhat below the plane of the extreme summit. In consequence of this, the front view of a yak's skull exhibits a small prominence between the horns formed by a boss of bone at the top of the occiput; the crest or summit of the occiput itself being invisible from the front, and the shape of the whole occiput forming an inverted V. The difference in the shape of the occiput from that obtaining in the true oxen may be seen by comparing the accompanying figure with that of the skull of the Galla ox given on



FRONT AND BACK VIEWS OF THE SKULL OF DOMESTICATED YAK.—After Rüttimeyer.

p. 173. In regard to the position of the horns and some other features of the skull, the yak approximates to the bisons.

Distribution. Yak, as we have said, inhabit the plateau of Tibet, probably extending northwards as far as the Kuen-Luen range, while eastwards they range into the Chinese province of Kansu, and westwards enter the eastern portions of Ladak, especially the regions in the neighbourhood of the Chang-Chenno valley and the great Pangkong lake. The greater portion of the country comprised within this extensive area is desolate and dreary in the extreme, but yak confine themselves to the wildest and most inaccessible portions of these regions, and are found only at great elevations, ranging in summer from about fourteen thousand to upwards of twenty thousand feet, and perhaps even more, above the level of the sea. They are at all times extremely impatient of heat, and delight in cold.

Habits. Writing of the yak, General Kinloch observes that, "although so large a beast, it thrives upon the coarsest pasturage, and its usual food consists of a rough wiry grass, which grows in all the higher valleys of Tibet,

up to an elevation of nearly twenty thousand feet. On the banks of the streams in many places a more luxuriant grass is met with, and it is particularly plentiful in the valleys of Chang-Chenmo and Kyobrung, forming the attraction which entices the yak from the still wilder and more barren country further north. Yak seem to wander about a good deal. In summer the cows are generally to be found in herds varying in numbers from ten to one hundred; while the old bulls are for the most part solitary or in small parties of three or four. They feed at night and early in the morning, and usually betake themselves to some steep and barren hill-side during the day, lying sometimes for hours in the same spot. Old bulls in particular seem to rejoice in choosing a commanding situation for their resting-place, and their tracks may be found on the tops of the steepest hills, far above the highest traces of vegetation. The yak is not apparently a very sharp-sighted beast, but its sense of smell is extremely keen, and this is the chief danger to guard against in stalking it. In the high valleys of Tibet, where so many glens intersect one another, and where the temperature is continually changing, the wind is equally variable. It will sometimes shift to every point of the compass in the course of a few minutes, and the best-planned stalk may be utterly spoiled."

The yak found in the Chang-Chenmo valley are chiefly or entirely stragglers from Chinese territory, and, owing to incessant pursuit, very few are to be met with at the present day in these regions. Native travellers report, however, that on the upper Indus, to the eastward of Ladak, yak are to be found in vast numbers, and that there they do not exhibit the extreme wariness characterising those which wander into Ladak. In Northern Tibet yak have been also met with in great numbers by the Russian explorer, Prejewalski. Here the old bulls were found alone, and the cows and younger males generally in small herds; although, where the pasture was good, the herds were sometimes very large. These herds wandered more or less regularly over wide tracts of country, and, according to native reports, were found in summer in grassy plains, where they were quite unknown in winter. As in Southern Tibet, they were especially partial to the tracts bordering the streams, where grass was more abundant than elsewhere. On the other hand, the solitary bulls were reported to inhabit the same districts throughout the year. Where the herds were largest, their numbers are said to be reckoned by hundreds, and even thousands. When alarmed or expecting danger, the cows and older bulls place themselves in the van and on the flanks of the herds, with the calves in the centre; but on the near approach of a hunter, the whole herd will take to flight at a gallop, with their heads down and their tails in the air. A wounded yak, whether cow or bull, will, according to General Kinloch, not unfrequently charge.

Domestication. A peculiarity of the yak is its grunting voice, from which it derives its Latin title. Domestic yak are kept by the inhabitants of the higher regions of Tibet as beasts of burden, and for the sake of their flesh; and are absolutely essential for crossing many parts of that desolate region. Some of the pure-bred animals kept by the Tartar tribes, living on the Rupsu plateau, to the south of the Indus in Ladak, are magnificent beasts of large size and uniformly dark colour. When they have not been used for a considerable period they are

very wild, and apt to break loose and throw their loads; but after a few days' march they sober down. In other parts the yak are smaller, and vary greatly in colour, being sometimes entirely white, while the tail is very generally of that hue. There are also many crosses between the yak and ordinary cattle, some of the breeds being without horns. These half-breeds have the advantage of being able to withstand much higher temperatures than the pure yak; and they may be met with carrying burdens in the hot valley of the Indus, between the town of Leh and Kashmir.

Although yak are admirable beasts of burden on account of their endurance and strength, and the facility with which they will traverse glaciers and swim icy torrents, they have the great disadvantage that they will not eat corn. This frequently necessitates the pushing on of the party by forced marches to prevent their beasts from perishing of hunger. The following description of a march with yak, for the truthfulness of which the present writer can vouch from his own personal experience, is from the pen of General Macintyre. "For more than six weary hours," writes the general, "did we toil up against the almost blinding snow and piercing wind that chilled us to the very marrow, although the distance to the summit was only six or seven miles. It was truly wonderful to see the way in which the yaks struggled through the deep snow, and scrambled over places which were often difficult and sometimes dangerous to traverse. Nothing could have exceeded the powers of endurance evinced by these animals, which were game to the backbone, and as sure-footed as goats. One of them, notwithstanding, lost its footing on a steep slope of *névé*, and went rolling and sliding down until it was fortunately stopped by a friendly rock; otherwise it must have disappeared for ever under the glacier. On regaining its feet the creature merely shook itself, and on being disentangled from its load soon clambered up again."

All who have visited a Tibetan monastery, or lamasery, must have been struck with the number of yak-tails suspended as streamers from tall poles fixed in the ground before the entrance. The more general use of these appendages throughout the East is, however, in the form of *chowris*, or fly-whisks. For this purpose pure white tails are preferred; and they are frequently mounted with the twisted horn of a black-buck as a handle. In China yak-tails dyed red are affixed to the roofs of the summer residences as pendants.

THE EUROPEAN BISON (*Bos bonassus*).

The European bison, wisent, or zubr is one of two species representing a distinct and peculiar group of the genus *Bos*. These animals resemble the yak in their cylindrical horns and the relative shortness of the forehead of the skull, and also in the large number of their ribs, of which there may be fourteen or fifteen pairs. They differ, however, in having the horns placed more below the plane of the occipital region of the skull, so that in a front view the crest of the occiput itself is seen at the summit of the skull. A further distinctive feature is to be found in the extreme convexity of the forehead of the skull; while the sockets of the eyes are very prominent, and assume a tubular form. Moreover, the pre-maxillary bones, forming the extremity of the skull, are separated from the very

short nasal bones by a much longer interval than in the yak and the gaur; and are thus very widely different from those of the typical oxen, which are prolonged upwards to join the elongated nasals.

Bison are further characterised by the great excess in the height of the withers over the hind-quarters, owing to the great length of the spines of the vertebræ in the fore-part of the trunk, as displayed in the figure of the skeleton on p. 158. This produces a distinct hump on the shoulders, which passes, however, gradually into the line of the back without the sudden descent characterising the gaur. The great development of the fore-quarters appears to be intensified by the mass of dark brown hair with which the back of the head, neck, shoulders, and chest are covered, and which extends far down on the fore-limbs. The long hair is likewise continued as a kind of crest along the middle of the back nearly to the root of the tail; the tail itself being tufted at the end, and reaching some distance below the hooks. The remainder of the body is covered with short curly hair of a somewhat lighter tint than that clothing the fore-quarters. In summer the long hair over all the body is shed in large patches, thus showing the nearly bare skin clothed with short mouse-coloured hair, as exhibited in our coloured illustration. Both the European and the American bison are very closely allied, and we shall reserve our notice of their distinctive differences till we come to the second of the two species. Owing to a confusion of terms, the name aurochs, which properly belongs to the extinct wild ox of Europe, has been very generally applied to the European or true bison, but it may be hoped that this misapplication will soon be a thing of the past.

Distribution. The European bison is a forest-dwelling animal, having been always absent from the open plains of Southern Russia, which in many respects resemble the habitat of its North American cousin. Formerly this species, as attested both by historical documents and by its semi-fossilised remains, was abundant over a large area of Europe, but it is now restricted to the forests of Bialowitza in Lithuania, to the Caucasus, and, it is said, to portions of Moldavia and Wallachia. Fossil remains of the bison are met with in the caverns and superficial deposits of England, France, Switzerland, Germany, and Italy; the earliest deposits in which they occur being the brick-earths of the Thames valley, where they are associated with those of the mammoth, and in the still older "forest-bed" of the Norfolk coast. The fossil race was, indeed, of larger dimensions, and had longer and rather straighter horns than its existing representative; but these differences cannot well be regarded as of specific importance. From Britain the bison disappeared at a much earlier date than the aurochs, none of its remains occurring in the fens and turbaries, where those of the latter are so common. Northwards the range of the bison formerly extended into Siberia; while its remains have also been obtained from the frozen soil of Eschholtz Bay in Alaska.

Habits. The bison now living in Lithuania are specially protected by the Russian Government and are under the charge of a staff of keepers, but those of the Caucasus are thoroughly wild. Although living at a greater altitude, and thus exposed to a more intense cold, the bison of the Caucasus are less thickly haired than are those of Lithuania. Bison were abundant in the Black Forest in the

time of Julius Cæsar, and as late as the ninth and tenth centuries were sufficiently numerous in parts of Switzerland and Germany to be used as food. In a recent summary of the history of the species, Mr. F. A. Lucas states that "up to 1500 the European bison seems to have been common in Poland, where it was looked upon as royal game, and hunted in right royal manner by the king and nobility, as many as two thousand or three thousand beaters being employed to drive the game. In 1534 the animal was still so numerous in the vicinity of Girgau, Transylvania, that peasants passing through the woods were occasionally trampled to death by startled bison, and hunts were undertaken by the nobles in order to reduce the number of the animals. In spite of this local abundance, it is probable that about this time the bison was in a great measure restricted to Lithuania; and although so late as 1555 one was killed in Prussia, it is almost certain that this was merely a straggler from the main herd. In 1752 a grand hunt was organised by the Polish king, Augustus III., and in one day 60 bison were killed. . . . For some time after the above event little seems to have been recorded concerning the zubr, so that Desmarest, writing in 1822, says that if any remain in Lithuania they must be very few in number. There were, however, over 500 bison in Lithuania at that time, for in 1820 there were that number, this being a considerable increase since 1815, when there were estimated to be only 300. About this time active measures must have been taken for the protection of the Lithuanian herd, for in 1830 it comprised over 700 individuals. In 1831 a local revolt occurred, the game laws were set at naught, and the number of bison reduced to 637. Order having been restored, the bison began to recuperate, and according to the official enumeration at the end of each decade, there were in 1840, 780; in 1850, 1390; and in 1860, 1700. Political troubles were, however, the bane of the bison, and just as the prosperity of the Lithuanian herd seemed assured, the Polish uprising of 1863 took place. Many bands of insurgents sought refuge in the forests; the bison were left to take care of themselves, and were so rapidly killed off that the next official count showed only 847. For a short time after peace was restored the herd increased to a slight extent, but later on it began to decrease, the enumeration of 1880 showing but 600, a number that has since been lessened, the herd being still on the wane." The herd is divided into about a dozen distinct bands, inhabiting different regions of the forest. In the Caucasus the bison is protected by the rugged nature of the country, as well as by special laws. Recently an English sportsman—Mr. Littledale—has been bison-shooting in the Caucasus, and a male and female which fell to his rifle are now exhibited in the British Museum.

The European bison, so far as can now be ascertained, appears to have always associated in small bands. In Lithuania these bands comprise from fifteen to twenty individuals during the summer, but in winter two or more of them unite to form a herd of from thirty to forty head. The very old bulls are solitary. In spring and summer the bison seek the thickest and deepest portions of the forest, but during winter frequent drier and more elevated cover. Whereas the nutriment of the American species consists wholly of grass, the European bison feeds largely upon the leaves, twigs, and bark of trees. Although active during both day and night, bison feed chiefly during the morning and evening. Large

trees are stripped of their foliage and bark as high up as the animals can reach, while smaller ones are broken down or uprooted.

In spite of their size and bulk, bison are active animals, and can both trot and gallop with considerable speed. In galloping the head is carried close to the ground and the tail high in the air. Generally they are shy and retiring in disposition, more especially when young; but in the Lithuanian forest an old bull has been known to take possession of a road and challenge all comers. During the breeding-season, which takes place in August or the early part of September, the bison are in the best condition. At such seasons the bulls engage in terrific conflicts, which occasionally end fatally, for the leadership of the herd. These combats are at first entered upon somewhat playfully, but soon take place in earnest, when scenes like the one depicted in our coloured illustration may be witnessed. The old solitary bulls then return to the herds, and after having either driven away or killed their younger rivals, once more resume the leadership. Not only are the younger bulls sometimes killed in these conflicts, but the same fate occasionally overtakes the cows. At the conclusion of the breeding-season the old bulls revert to their solitary life. The calves are born in May or the early part of June, and are dropped in the most secluded parts of the forest. The cows apparently do not calve more frequently than once in three years, so that the rate of increase is necessarily slow. In defending their offspring against the attacks of bears and wolves, the females display great courage, and seldom allow them to be carried off except at the sacrifice of their own lives. Occasionally when full-grown bulls get half-buried in deep snow they are pulled down by wolves.

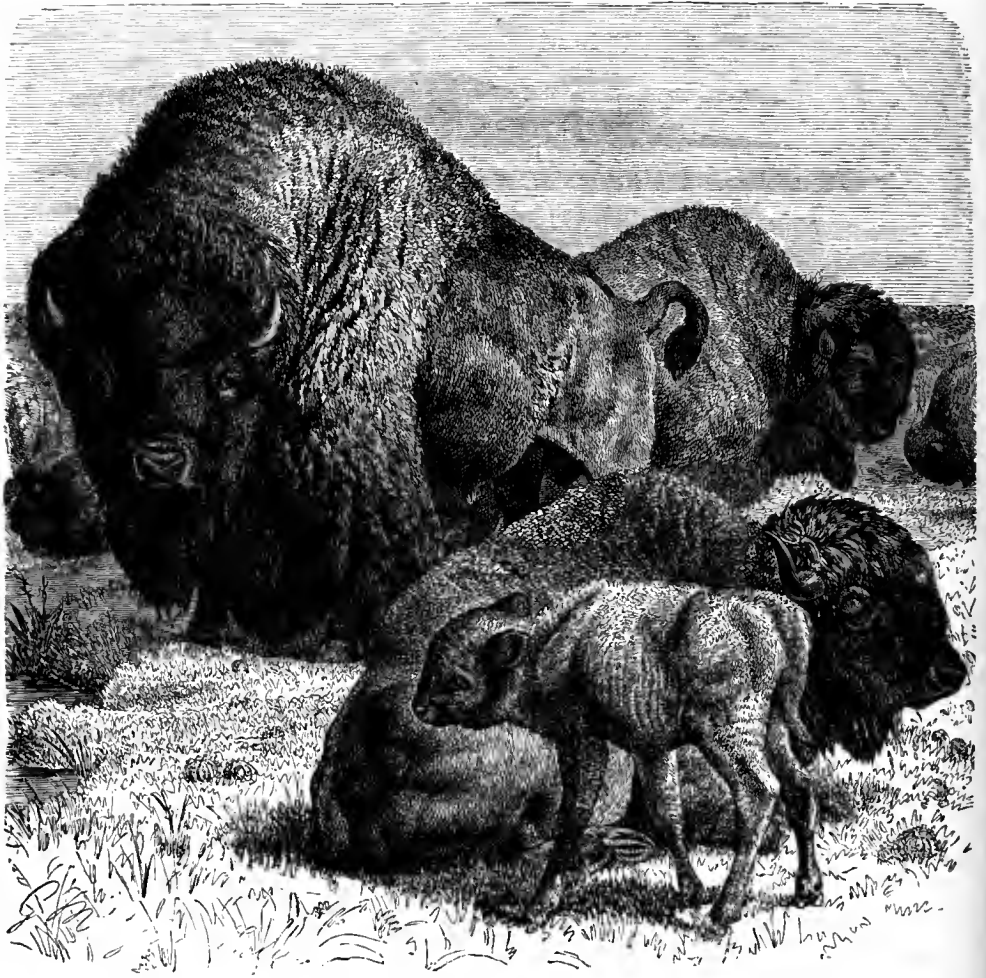
THE AMERICAN BISON (*Bos americanus*).

As the gaur in India has usurped the name of bison, while the European bison has been frequently called the aurochs, so the American bison in its native country is almost invariably misnamed the buffalo.

The American bison, which is now, unfortunately, practically exterminated, differs from its European cousin not only in certain structural features, but likewise in habits, being essentially an inhabitant of the open plains, where it formerly congregated in vast herds, comprising thousands of individuals, and living entirely on grass. According to Mr. Hornaday, to whom we are indebted for a full account of the species, the American bison differs from the European kind in the following features. Firstly, the mass of hair on the head, neck, and fore-quarters is much longer and more luxuriant, and thus gives the animal the appearance of possessing greater size than is really the case. As a matter of fact, the American species is lower, and has a smaller pelvis and less powerful hind-quarters than its European cousin, although its body is, on the whole, more massively built. Moreover, the horns are shorter and more curved, while the front of the head is more convex, and the sockets of the eyes less tubular. The tail is shorter and less bushy. An unusually fine bull American bison measured 5 feet 8 inches at the withers, but the average is considerably below this.

Mr. Hornaday regards this species as the finest and most striking in appearance of all the oxen, and remarks that "the magnificent dark-brown frontlet and beard,

the shaggy coat of hair upon the neck, hump, and shoulders, terminating at the knees in a thick mass of luxuriant black locks, to say nothing of the dense coat of finer fur on the body and hind-quarters, give to our species not only an apparent height equal to that of the gaur, but a grandeur and nobility of presence which are beyond all comparison among ruminants." Good horns measure from 16 to 17



AMERICAN BISON (♂, nat. size).

inches, but a pair with a length of $20\frac{7}{8}$ inches and a girth of 15 inches have been recorded.

Distribution. The range of the American bison originally extended over about one-third of North America. "Starting almost at tide-water on the Atlantic coast," writes Mr. Hornaday, "it extended westward through a vast tract of dense forest, across the Alleghany Mountain system to the prairies along the Mississippi, and southward to the delta of that great system. Although the great plain country of the West was the natural home of the species, where it flourished most abundantly, it also wandered south across Texas to the burning plains of

North-Eastern Mexico, westward across the Rocky Mountains into New Mexico, Utah, and Idaho, and northward across a vast treeless waste to the bleak and inhospitable shores of the Great Slave Lake itself." Its maximum development was probably reached about a century and a half ago, when the greater part of North America was practically an unknown country so far as Europeans are concerned. And Mr. Hornaday is of opinion that, if left to itself, the bison would have crossed the Sierra Nevada and coast-ranges to reach the Pacific slopes; while it would ultimately have developed into several distinct races according to the climate of the different regions it inhabited. An example of the formation of such a race is afforded, indeed, by the variety known in the States as the mountain, or wood, buffalo. The gradual opening up of the interior of North America, with the advance of civilisation, soon, however, put an effectual stop to further increase of the species, and eventually led to its practical extermination.

Numbers and Extermination. In regard to its former numerical abundance, Mr. Hornaday¹ observes that "of all the quadrupeds that have ever lived upon the earth, probably no other species has ever marshalled such innumerable hosts as those of the American bison. It would have been as easy to count or to estimate the number of leaves in a forest as to calculate the number of bison living at any given time during the history of the species previous to 1870. Even in South Central Africa, which has been exceedingly prolific in great herds of game, it is probable that all its quadrupeds taken together on an equal area would never have more than equalled the total number of buffalo in this country forty years ago." As an instance of these enormous numbers, it appears that, in the early part of the year 1871, Col. Dodge, when passing through the great herd on the Arkansas, and reckoning that there were some fifteen or twenty individuals to the acre, states from his own observation that it was not less than twenty-five miles wide and fifty miles deep. This, however, was the last of the great herds; and Mr. Hornaday estimates that the number of individuals comprising it could not be reckoned at less than four millions. Many writers at and about the date mentioned speak of the plains being absolutely black with bison as far as the eye could reach; and Mr. W. Blackmore tells of passing through a herd for a distance of upwards of one hundred and twenty miles right on end, in travelling on the Kansas Pacific Railroad. Frequently, indeed, trains on that line were derailed in attempting to pass through herds of bison, until the drivers learned it was advisable to bring their engines to a standstill when they found the line blocked in this manner.

Col. Dodge, writing of his experiences on the Arkansas alluded to above, observes that "the whole country appeared one great mass of bison, moving slowly to the northward; and it was only when actually among them that it could be ascertained that the apparently solid mass was an agglomeration of numerous small herds, of from fifty to two hundred animals, separated from the surrounding herds by greater or less space, but still separated. The bison on the hills, seeing an unusual object in their rear, started at full speed directly towards me, stampeding and bringing with them the numberless herds through which they passed, and pouring down upon all the herds, no longer separated, but one immense compact mass of plunging animals."

¹ When quoting from Mr. Hornaday and other writers we have substituted the word bison for buffalo.

Many similar accounts attesting the vast swarms of bison which formerly roamed the prairies might be quoted, but the foregoing are sufficient for our purpose. Evidence of the numbers of these animals is still to be seen in the huge stacks of skulls piled up at many of the railway stations in the States awaiting transport.

The main cause which led to the extirpation of the bison was the advance of railways. With the progress of civilisation the bison was, indeed, foredoomed to



HEAD OF AMERICAN BISON.

disappear: but its end was hastened by the reckless way in which the unfortunate animals were shot for the sake of their hides or tongues; by the want of protective legislation on the part of the Government; by the preference for the flesh and skin of cows, by the marvellous stupidity and indifference to man of the animals themselves, and by the perfection of modern firearms.

It appears that although the bison had for more than a century been subject to a merciless persecution, both by Indians and Whites, yet up to the year 1830, beyond a certain restriction in its area of distribution, this desultory warfare had not made any very serious inroads on the numbers of the animals; and that as late

as 1870 there were certainly several million head still living. During the period from 1730 to 1830 the desultory warfare had, however, completely driven away the bison from the eastern portion of the United States, and also from the districts to the westward of the Rocky Mountains, where they were never very numerous. With the year 1830, Mr. Hornaday considers, began the era of the systematic slaughter of the bison for the sake of its flesh and hides; and the ever-increasing demand for "buffalo-robos," as the dressed skins are termed, soon began to tell on its numbers. Up to the year 1869 the bison occupied one large and continuous area; but the completion in that year of the Union Pacific Railway cut this area in twain, and at the same time divided the great herd into a northern and southern moiety. The headquarters of the southern herd were somewhere about the situation where Garden City, Kansas, now stands. Although the area occupied by this herd was greatly inferior in size to that of the northern herd, yet the number of bison on it was vastly greater, being estimated in 1871 as at least three, and probably nearly four, millions. That year saw the completion of the Kansas branch of the Union Pacific, and the great slaughter which thereupon commenced attained its height in 1873. At the latter date the destruction of these animals was so wasteful and so wanton that it is believed every hide which came into the market represented four individuals killed. The destruction was of course greatest along the lines of railways, and on one of the three railways penetrating the southern bison-country, nearly a quarter of a million skins, more than a million and a half pounds of meat, and fully two and a quarter millions of pounds of bones, were carried during the year in question. At this time the whole country was poisoned with the effluvia from the decaying carcasses; and it was a common practice to drive away the animals when they came to drink till they became so maddened with thirst that they would come within easy shooting distance. Mr. Hornaday states that it is probably a safe estimate to say that not "fewer than fifty thousand bison have been killed for their tongues alone, and the most of these are undoubtedly chargeable against white men, who ought to have known better." Over three and a half million individuals are estimated to have been slaughtered in the southern herd between 1872 and 1874. In the latter year the hunters became alarmed at the great diminution in the number of the bison, and by the end of 1875 the great southern herd had ceased to exist as a body. The main body of the survivors, some ten thousand strong, fled into the wilder parts of Texas, where they had been gradually shot down, till a few years ago some two or three score remained as the sole survivors of the three or four millions of the great southern herd; and in the year 1880 bison-shooting was finally abandoned, as being no longer a profitable trade.

With regard to the northern herd, of which the number in 1870 was approximately estimated at a million and a half, distributed over a very wide tract of country, it appears that the portion living in British North America was the first to be exterminated. Before the year 1880 the numbers of the herd had been greatly reduced in Dakota and Wyoming by the Sioux Indians; but the commencement of the final destruction was heralded by the opening in that year of the Northern Pacific Railway, which traversed the heart of the bison-country. The herd was, indeed, hemmed in on three sides by Sioux armed with breech-loading

rifles; and the price of robes having risen greatly in 1881, a rush from all sides was made on the devoted herd, and in the hunting-season, commencing in October 1882 and terminating in the following February, the annihilation of the great northern herd was practically completed; only some straggling bands, numbering a few thousands, surviving. This event appears to have come like a thunder-clap on the hunters, who actually fitted out expeditions in the autumn of 1884, only to find that their quarry had disappeared for ever. Mr. Hornaday states that to the south of the Northern Pacific Railway, a band of about three hundred settled permanently in and around the Yellowstone National Park, but in a very short time every animal outside of the protected limits of the park was killed; and whenever any of the park buffaloes strayed beyond the boundary, they too were promptly killed for their heads and hides. Those remaining in the Yellowstone are now protected by Government, and there are a few scattered bands still lingering in the more remote and inaccessible portions of the country, but otherwise the American bison has ceased to exist as a wild animal.

Habits.

Turning to the development and habits of the species, it appears that the breeding-season is from the beginning of July to the end of September, and that the calves are generally born from April to June, although occasionally as late as August. The cow does not breed till three years old, and sometimes produces two calves at a birth. For the first two months of its existence the calf has the pelage of a brownish yellow colour; and even at that period has indications of the long hair covering the fore-quarters of the adult. Young calves can be tamed with facility. In yearling bison the horns are in the form of a straight conical spike, of from 4 to 6 inches in length; and these spike-like horns, with a curve at the base in older individuals, continue till the end of the fourth year, during which period the young males are termed "spike-bulls." In these young bulls the horns are jet-black; but from scaling of the exterior, and the accumulation of dirt, they tend to grey in the adult. With advancing age the outer layers of the horn begin to break off near the summit, until the whole horn becomes short, thick, and blunted, "with only the tip of what was once a neat and shapely horn showing at the end. The bull is then known as a 'stub-horn,' and his horns increase in roughness and unsightliness as he grows older."

Towards the end of winter the coat of the bison assumes a faded and bleached appearance from the effects of the wear and tear of the elements; and towards the end of February, or somewhat later, the coat begins to change, but the whole process occupies more than half the year. The shedding is accomplished both by the new hair growing into and forcing off the old, and also by the latter falling off and leaving the skin bare in great patches, as shown in our coloured illustration of the European species. During the shedding process the animal presents an unsightly appearance, but by the end of June the whole of the old hair has fallen off and the body is bare, although the new dark hair is well grown on the head. During the summer the naked skin is scorched by the sun and bitten by flies, and the animal consequently protects itself by wallowing, and thus coating itself with a plaster of dried mud. By the beginning of October the new coat of hair has, however, attained a considerable length, and between the 20th of November and the 20th of December the bison is in the full glory of his apparel; and the contrast

presented by his condition at this time to that during the summer must be seen to be fully appreciated. The height attained by the bull bison has been already mentioned. In regard to weight, Mr. Hornaday states that an adult bull shot by his party scaled 1727 lbs., but as the animal was by no means fat it is probable that this weight is in some cases exceeded.

It was during the breeding-season that the small bands which had been previously distributed over a wide area of country collected in the huge herds above alluded to; and at such seasons the bulls were occupied either in chasing the cows or in combats among themselves. The concerted roaring of the bulls at these times is described as resembling thunder, and audible at distances of from one to three miles, or even, exceptionally, at five miles. At the conclusion of the breeding-season the herd again broke up into small bands. In these periodical journeys across the country in search of water regular tracks were formed by the bison, and as the water was approached several tracks united, with the result that in some places tracks of about twelve inches in width, and from six to seven in depth, may be seen following the level of the valleys; the bison in these journeys having always marched in single file. These old bison-tracks still remain as a memento of a vanished race, and are now used by the domestic cattle which have supplanted the monarchs of the prairie. After reaching the watering-place, the herd, instead of returning to its original feeding-ground, would wander right and left in search of fresh pastures. When undisturbed in good pasture, bison were always in the habit of lying down for a few hours during the middle of the day; and they were at certain seasons fond of rolling either in dust or mud. In districts where salt lakes occurred, the bison would resort to them in great numbers. All the great herds were in the habit of moving southwards for a distance of from two hundred to four hundred miles with the approach of winter; and during such journeys it frequently happened that numbers were lost in crossing quicksands, alkali-bogs, muddy fords, or on treacherous ice. It is stated that in 1867 upwards of two thousand bison out of a herd of four thousand were lost in a quicksand; and that an entire herd of about one hundred head perished when crossing the ice on a lake in Minnesota.

Bison would boldly face the cutting blizzards of the north-west, instead of turning tail to them after the manner of domestic cattle; although they would at the same time seek such shelter as might be obtainable by retiring to the ravines and valleys. In heavy falls of snow, which lay long on the ground, the bison were often compelled to fast for days, or even weeks, together; but they suffered most when the surface of the snow was covered with a thin crust of ice after a slight thaw, as their ponderous weight would drive their feet deep into the snow, and leave them at the mercy of the Indians, by whom they were slain by hundreds when thus helpless.

Hunting.

Space does not admit of anything more than bare mention of a few of the modes in which the bison was hunted. The method of stalking, or "still-hunting," where the hunter creeps up to a herd and shoots one after another of its members, appears to be one of the most deadly, owing to the crass stupidity of the animals themselves. The plan adopted was first to shoot the leader, when the remainder of the herd would come and stupidly smell round the

body, till another animal assumed the post of leader, and was shot down when it was about to make a move; the same process being repeated almost without end. Riding down, surrounding, impounding, or hunting in snow-shoes were, however, other equally effective methods of destruction.

Domestication. In captivity the American bison breeds freely, not only with its own kind, but also with other species of cattle. In the United States a herd has been established by crossing bull bison with domestic cows; the cow bison not producing a hybrid offspring. This hybrid race is perfectly fertile, either with itself or when again crossed with domestic cattle; and it is considered that a strain of bison-blood will lead to the cattle in the North-Western States being better enabled to withstand the blizzards of those districts.

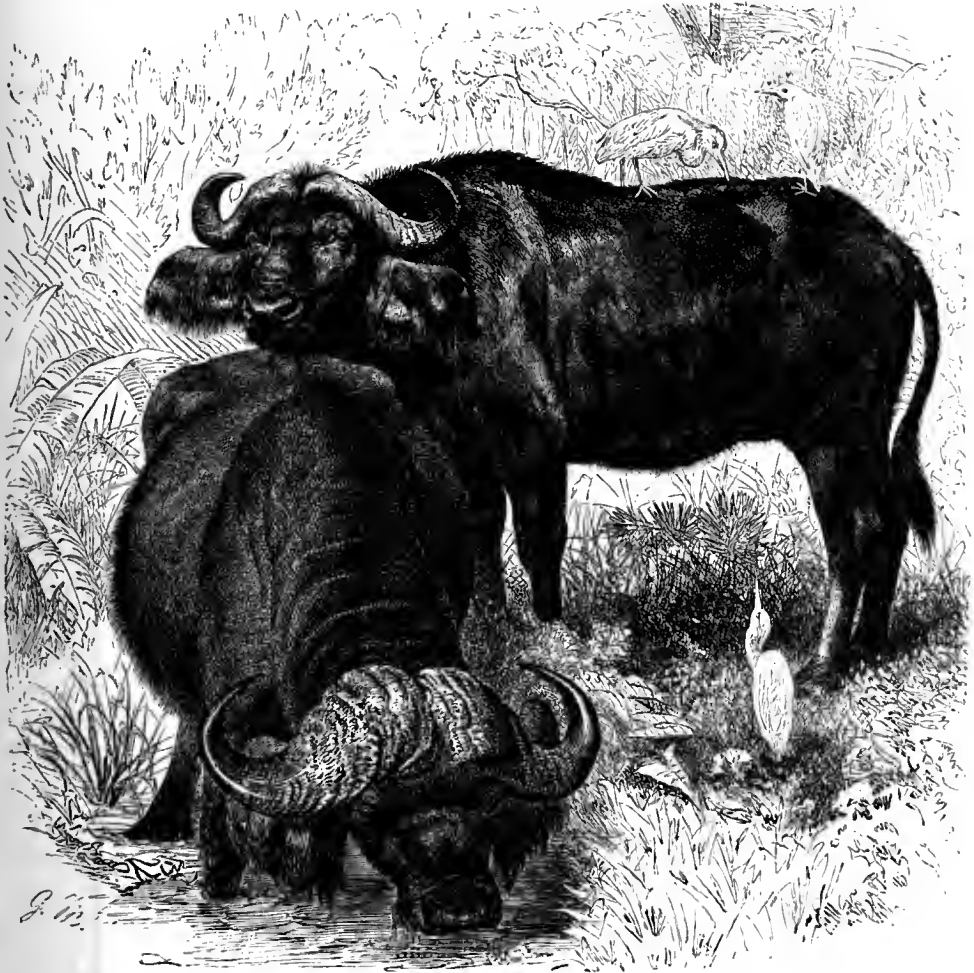
Extinct Bison. Subfossil remains of the American bison are found in various parts of North America, while in Texas there occur those of the extinct broad-fronted bison (*B. latifrons*), distinguished by its superior size, and its stouter and less backwardly-inclined horns.

THE CAPE BUFFALO (*Bos caffer*).

The Cape buffalo is our first representative of a group of oxen distinguished by several well-marked characters. They are all heavily-built animals, with thick and strong limbs, moderately long tails, tufted at the end, short necks, very broad muzzles, and large ears. The hair covering the body is always thin, and in old age leaves the skin almost entirely naked. The horns, which are generally large and massive, are more or less distinctly flattened and angulated, at least at the base, where their cross-section is triangular. They are placed on the skull a considerable distance below the plane of the occiput; and their upper border is concave, with the tips curved inwards, the curvature being generally at first outwards and backwards, and then outwards and upwards. In the skull the forehead is more or less markedly concave, and the premaxillary bones reach upwards to join the nasals, as in the typical oxen. The number of ribs is thirteen pairs.

The Cape, or black African buffalo is the largest and fiercest member of the group found in the continent, from which it takes its name. This species is characterised by its blackish colour, and the great massiveness of the relatively short horns, which are much flattened at the base, where they are expanded, so as to form in old bulls a kind of helmet-like mass, covering the whole of the upper part of the head, and with only a narrow line between them. From this expanded base the curvature of the horns is at first outwards, downwards, and backwards, and then forwards, upwards, and inwards; their smooth extremities being nearly cylindrical. The skull is characterised by its shortness, and also by the deep concavity of the profile below the horns; the nasal bones being extremely short, and the sockets of the eyes not particularly prominent. The head has a very large and expanded muzzle, and a characteristic hollow below the inner angle of the eye. The enormous flapping ears are thickly fringed on their lower border with hair; their upper border being sharply truncated before the descent to the pointed extremity. With the exception of the ears and the tip of the tail, the hair is very

sparse, and it is only on the head and limbs that old bulls can properly be said to be haired at all. In the cows and young bulls the hair is, however, thicker; and its colour in these is dark brown, with a more or less marked reddish tinge. A well-grown bull buffalo will stand between 4 feet 7 inches and 4 feet 8 inches at the shoulder. The horns vary in shape with the age of the animal. In regard to their size, Mr. Selous states that the largest pair he obtained had an extreme span,



CAPE BUFFALO ($\frac{1}{2}$ nat. size).

from bend to bend, in a straight line, of 3 feet 8 inches, with a depth on the forehead of 15 inches; the total length of each horn along the curve being 3 feet. In another example the same three dimensions were respectively 3 feet 6 inches, 17 inches, and 2 feet 11 inches.

Habits.

The typical Cape buffalo is usually found in reedy swamps from the Cape as far north as the Equator; but some individuals distinguished, according to the Hon. W. H. Drummond, by their blacker hair and more spreading horns inhabit forests. From the Equator northwards to Abyssinia the

species is represented by a variety of lighter build, and with horns less thickened on the forehead, and separated in the middle line by a considerable interval. This variety was formerly regarded as indicating a distinct species, under the names of *B. equinoctialis* and *B. centralis*; but intermediate gradations connect it so closely with the ordinary Cape form that this view has been abandoned.

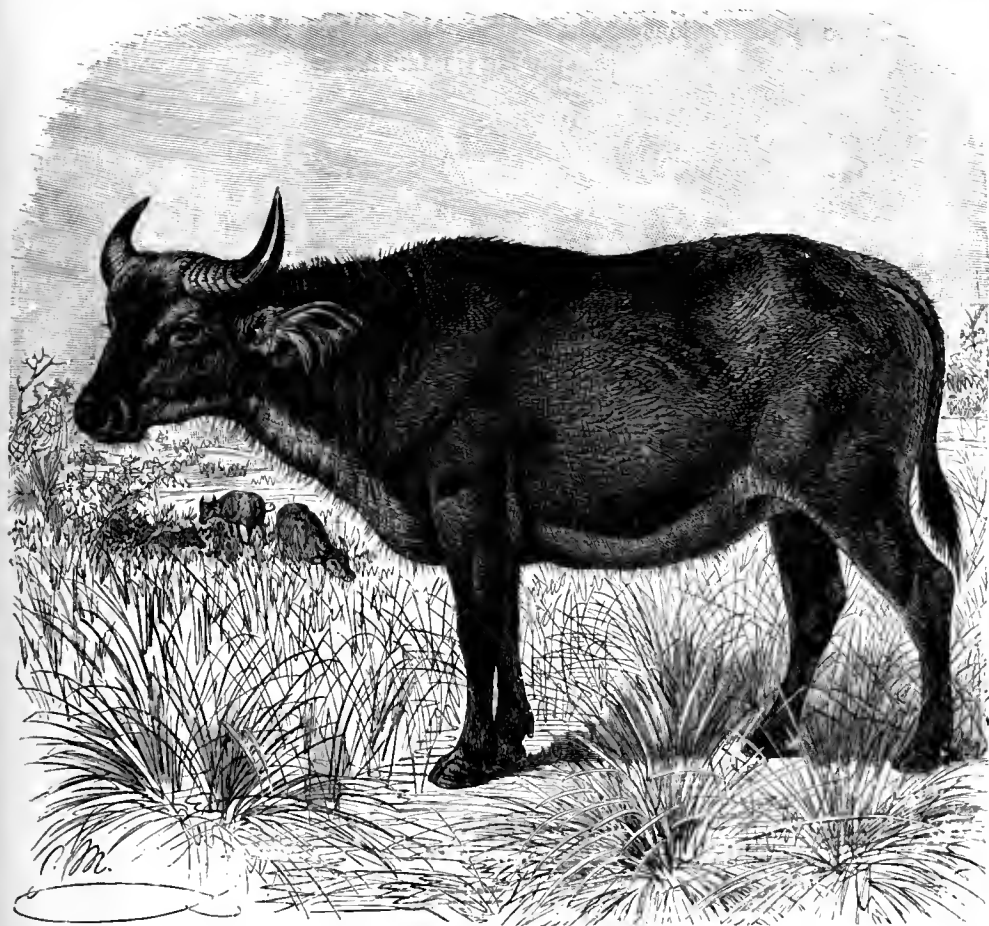
In regions where their numbers have not been thinned by the sportsman's rifle, the Cape buffalo, according to Mr. Selous, is usually found in herds of from fifty to two hundred, or even three hundred, individuals. Old bulls are frequently met with alone, although they more usually associate in parties of two, three, or four, while occasionally from eight to ten may be seen together. These small parties of bulls are said to be much less wary, and, consequently, much more easy to approach than large herds of cows; and solitary bulls are not regarded by Mr. Selous as more dangerous than other members of the species. The same writer observes that for animals of such heavy build and bulk these buffaloes are remarkably swift; and it requires a good horse to keep ahead of a charging buffalo even in the open; while in cover, unless very fleet, the horse stands a good chance of being overtaken. Cape buffaloes are commonly represented in pictures as charging with their heads lowered to the ground and their tails raised high in the air. This, however, according to Mr. Selous, is wholly incorrect, since, when charging, they "invariably hold their noses straight out, and lay their horns back over their shoulders. They lower their heads just as they strike."

Mr. Drummond writes of the habits of this species as follows:—"About sunrise they drink a sufficient quantity of water to last during the long, hot day, and then make their way to wherever they may have determined to sleep. This in summer is generally on the highest and most breezy spot to be found, under the shelter of two or three trees; in winter, in the thick jungle. They do not live farther from water than possible, as the moment the sun goes down, often before, they go straight to refresh themselves with a bath and drink before feeding, which they continue to do till soon after midnight, making the most horrible maze of track imaginable. They then rest and chew the cud for some time, getting up and continuing grazing until it is time to revisit the river or hole, and so onward to their lair."

The Cape buffalo breeds during the African summer, the young being born from January to March, and there being apparently never more than one at a birth. The calf is hidden in long grass; and for about ten days after its birth the cow separates from the herd, and remains within a short distance of her offspring, which she visits at intervals. In regard to the age to which the animal lives, Mr. Drummond states that old, solitary bulls have been known as such for twelve years, and he considers it probable that the full age may be about thirty years.

The buffalo has but two enemies—the lion and man; and the combined assaults of these two have in some districts so reduced its numbers that, according to Mr. Drummond, writing as far back as 1875, where there were formerly herds of from ten to one hundred in number, not ten head are to be found. A combat between three lions and a bull buffalo has been mentioned in our notice of the lion. The bulls frequently engage in fights between themselves; and Mr.

Drummond gives the following account of one such combat which he had the good fortune to witness:—"On looking through the edge of the last thicket which concealed them I saw two buffalo bulls standing facing each other with lowered heads, and, as I sat down to watch, they rushed together with all their force, producing the loud crash I had before heard. Once their horns were interlocked, they kept them so, their straining quarters telling that each was doing his best to force the other backwards. Several long white marks on their necks showed



SHORT-HORNED BUFFALO, SIERRA LEONE VARIETY ($\frac{2}{3}$ nat. size).

where they had received scratches, and blood dripping down the withers of the one next me proved that he had received a more severe wound. It was a magnificent sight to see the enormous animals, every muscle at its fullest tension, striving for the mastery. Soon one, a very large and old bull, began to yield a little, going backwards step by step, but at last, as if determined to conquer or die, it dropped on its knees. The other, disengaging his horns for a second, so as to gain an impetus, again rushed at him, but did not strike him on the forehead, but on the neck, under the hump, and I could see that with a twist of his horns he inflicted a severe wound." Instead, however, of following up his advantage, this

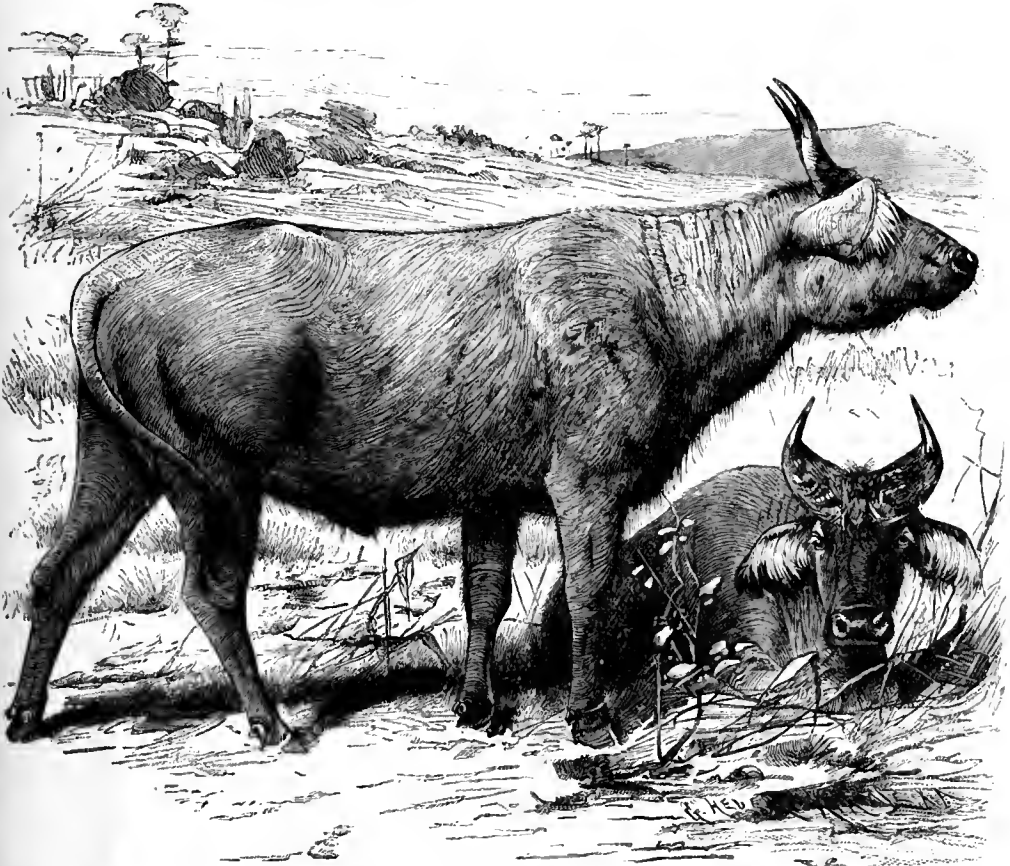
bull recoiled and hesitated, and was eventually charged by his adversary full in the shoulder, after which he declined to continue the contest.

The Cape buffalo has been described as the most dangerous of all South African animals, but both Mr. Drummond and Mr. Selous deny that this is really the case. It is true that more fatal accidents occur in buffalo-shooting than in any other sport, but this is discounted by the circumstance that more of these animals are killed than any other large game. Although there are exceptions, buffalo do not generally charge unless wounded; but cows with calves, or individuals wounded by lions are more irritable, and more prone to charge than ordinary. At the same time, the pursuit is far from being unaccompanied by danger; and Sir J. Willoughby states that of all the animals met with by him in Eastern Africa "the buffalo is probably the most cunning and dangerous to attack; they become very savage when wounded, and usually take to the thick bush, where they lie in wait for their foe. The greatest care should be taken in following them up, as, on account of the denseness of the bush, it is next to impossible for the hunter to avoid the sudden charge that is almost sure to ensue if the buffalo sights him first. A cow can be killed by a bullet anywhere on the forehead or behind the ear; but a bull is practically invulnerable in the head, although it may be dropped by a lucky shot striking above the eyes in the narrow line of division between the horns."

THE SHORT-HORNED BUFFALO (*Bos pumilus*).

The short-horned, or red buffalo, of which one variety is represented in the figure on p. 201, and a second in the accompanying illustration, is a smaller animal than the Cape species, from which it is further distinguished by its smaller and much less massive horns, as well as by its more abundant and lighter-coloured hair. This buffalo is a West African species, and is known to the natives as the niari, and to the Europeans of the west coast as the bush-cow. It is found in most of the tropical regions where the Cape buffalo is unknown, and is essentially a forest-dwelling animal. The height of the animal is, as a rule, inferior to that of the Cape buffalo. The colour of the hair is generally some shade of yellow or red, but more rarely brown, although some individuals are much darker and nearly black. The specimen figured in the illustration on p. 201, which came from Sierra Leone, and was exhibited in the Zoological Gardens at Antwerp, in 1875, was light yellow above but reddish on the under-parts, with a sharp line of demarcation between the two areas. It will be observed from the figure that the horns are but little flattened, and are separated from one another by a wide interval on the forehead, and have a simple curvature; these features being apparently distinctive of all the specimens from the north-western portion of the creature's range. On the other hand, when we pass southwards into the Congo district, we find that these buffaloes, as shown in our second illustration, have the horns much more flattened and expanded at their bases, where they are closely approximated in the middle line. Their tips are also curved sharply upwards and inwards, terminating in a point. This variety, which is also of rather larger size than the other, was described as *B. centralis*, and approximates to the northern variety of the Cape buffalo.

Indeed with some of the specimens from Central Equatorial Africa it is difficult to find constant characters by which they can be distinguished on the one hand from the typical niari, with widely-separated and slightly-flattened horns, and on the other from the northern variety of the Cape buffalo. Hence it is probable that the present species is in reality nothing more than a geographical race of the latter, reduced in size and otherwise modified by the difference in its habitat. We have indications of the commencement of such a modification in the case of the "wood-bison" of North America, and there is no reason why such modifications



SHORT-HORNED BUFFALO, CONGO VARIETY ($\frac{1}{2}$ nat. size).

should not have been carried still further in the present instance. Horns of the typical short-horned buffalo range from 11 to 21 inches in length, with a basal girth of from 10 to 13 inches. The short-horned buffalo is found both in the plains and in the mountains of Western Africa, and appears to be far from uncommon. It possesses a speed almost equal to that of the larger antelopes; and when in thick cover is very difficult to drive out, except with the aid of dogs. Otherwise there does not appear to be anything specially noteworthy in its habits.

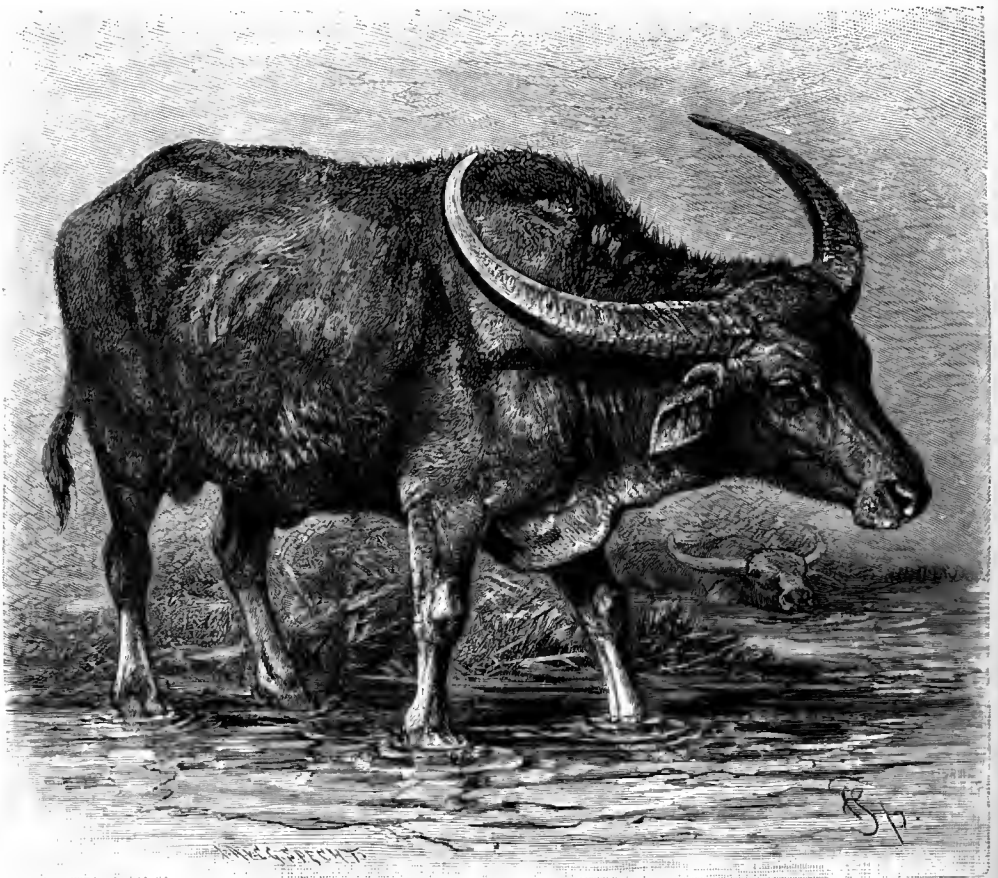
Extinct Forms.

It may be mentioned here that both in Algeria and at the Cape there are found in the superficial deposits skulls of buffaloes allied to

the Cape species, but with far longer horns, which did not, however, meet in a helmet-like mass on the forehead. In an Algerian specimen the length of the bony horn-cores measured along the curve is fully 11 feet, while in one from the Cape the length is estimated at upwards of 14 feet. When covered with their horny sheaths, the horns would of course be still longer.

THE INDIAN BUFFALO (*Bos bubalus*).

The Indian buffalo, or arna, as the male is called in India, is a very different animal in appearance from either of the African species. It is characterised by the



THE INDIAN BUFFALO, FERAL RACE ($\frac{1}{2}$ nat. size).

much greater proportionate length of the head, of which the profile is nearly straight and the centre of the forehead markedly convex. In the skull the sockets of the eyes are very prominent, and the nasal bones are of much greater length than in the African species. The ears are also much smaller and less open, with only a very slight fringe of hair on their edges. Still more distinctive are the horns, which are very long, much flattened, and angulated throughout the greater part of their length, with strongly-marked transverse wrinkles, and a

distinctly triangular section. They taper gradually from root to tip, and generally curve regularly upwards, outwards, and a little backwards from the line of the face in nearly a single plane; the tips bending inwards and slightly forwards. This is the type represented in our illustration; but in a variety, which is mainly or entirely from Assam, the horns are directed straight outwards for the greater part of their length, and then suddenly curve upwards. In the cow the horns are considerably longer and thinner, with a much less marked angulation in front, than in the bulls; and it is in this sex, so far as our experience goes, that the horns with the straightest direction outwards are met with. The body becomes almost bare in old animals, and the general colour is ashy-black, although the legs may be whitish, or even, in domestic races, quite white below the knees and hoofs. There is, however, a dun-coloured variety of this species, described by Mr. Blanford from upper Assam, in which the forehead is more convex than ordinary, and the nasal bones of the skull are much shorter.

According to General Kinloch, it is doubtful if the bull of this species ever exceeds 5 feet 4 inches (16 hands) at the withers; and in one specimen, of which he gives the dimensions, the height was 5 feet, the length from the nose to the root of the tail 9 feet 7 inches, that of the tail 3 feet 11 inches, and the girth 8 feet 3 inches. In the same specimen the length of the horns, measured from tip to tip along the greater curve, was 8 feet 3 inches. A skull in the British Museum has horns measuring 12 feet 2 inches from tip to tip along the curve; while a detached horn in the same collection has a length of 6 feet 6½ inches, which indicates a span of about 14 feet from tip to tip in the pair.

Distribution. In a truly wild state the Indian buffalo is only known definitely in the country from which it takes its name, the herds which are found in a wild state in Burma and the Malay Peninsula and adjacent islands, being not improbably descended from animals escaped from captivity. Our illustration is taken from an individual of one of these feral races in Java, where they are known by the name of karbu.

In India wild buffaloes are found on the plains of the Bramaputra and Ganges, from the eastern end of Assam to Tirhut; they also occur in the "terai" land at the foot of the Himalaya, as far as Rohileund, as well as on the plains near the coast in Midnapur and Orissa, and in the eastern portions of the Central Provinces, as well as in the north of Ceylon. Domesticated buffaloes are found not only over the whole of India and Burma, and the greater part of the Malayan region, but have likewise been introduced into Asia Minor, Egypt, and Italy.

Habits. The haunts of the wild Indian buffalo are the tall grass-jungles found in many parts of the plains of India, and generally in the neighbourhood of swamps; but it may be also found more rarely in the open plains of short grass, or among low jungle, and occasionally even in forest. Those who have never had the opportunity of seeing an Indian grass-jungle can have but little conception of its height and density, but some idea may be formed of it from the following statement of General Kinloch, who writes that in such cover "frequently, although a herd of buffaloes may be roused within a score of yards, the waving of the grass, and perhaps the glint of a polished horn-tip, is the only ocular evidence of the presence of the animals; the probably nearly noiseless rush

might be caused by other animals; and where the horns have not been seen it is only by the strong, sweet bovine scent—similar to, but much more powerful than, that of cows—that one can be absolutely certain of what is in front of one." In such jungles, needless to say, shooting (or indeed advancing at all) on foot is out of the question, and the only method of procedure is by beating with a line of elephants.

In their wild state these buffaloes are always found in herds, which may comprise fifty or more individuals. Mr. Blanford states that "they feed chiefly on grass, in the evening, at night, and in the morning; and lie down, generally in high grass, not unfrequently in a marsh, during the day; they are by no means shy, nor do they appear to shun the neighbourhood of man, and they commit great havoc amongst growing crops. Sometimes a herd or a solitary bull will take possession of a field and keep off the men who own it. In fact buffaloes are by far the boldest and most savage of the Indian *Bovidae*, and a bull not unfrequently attacks without provocation, though (probably on the principle that a council of war never fights) a herd, although all will gallop to within a short distance of an intruder and make most formidable demonstrations, never, I believe, attacks anyone who does not run away from them. A wounded animal of either sex often charges, and has occasionally been known to knock an elephant down. Buffaloes retain their courage in captivity, and a herd will attack a tiger or other dangerous animal without hesitation, and, although gentle with those they know and greatly attached to them, they are inclined to be hostile to strange men and strange animals. Whether wild or tame they delight in water, and often during the heat of the day lie down in shallow places with only parts of their heads above the surface." The same author remarks that few animals have changed less in captivity than tame buffaloes, which never interbreed with the humped Indian cattle. The calves are born in summer, and there are not unfrequently two at a birth. In walking, the Indian buffalo always carries its head low down.

Fossil Indian Buffaloes. Remains of the Indian buffalo occur fossil in the gravels of the Narbada valley, and likewise in parts of the Punjab. The broad-horned buffalo (*B. platyceros*) of the Siwalik Hills of Northern India, was, however, a perfectly distinct extinct species, characterised by the broad triangular horns being placed closer together on the forehead, and directed rather forwards than backwards, so that the forehead is nearly flat; they are also placed more below the plane of the occiput. Other extinct Siwalik buffaloes (*B. occipitalis* and *B. acuticornis*) were of smaller size, and their skulls like those of the tamarao and anoa; the horns rising upwards in the plane of the face, with but slight divergence or curvature, and their cross-section either triangular or pear-shaped.

The Tamarao. The tamarao of the Philippines (*B. mindorensis*) is a sturdily-built dwarf buffalo, connecting the preceding with the following species. It stands about $3\frac{1}{2}$ feet in height, and has coarse thick blackish brown hair. The horns, although massive, are comparatively short, and rise upwards in the plane of the face with a lyrate curvature; they are distinctly triangular, with the largest face in front, and are somewhat roughened. In its massive horns, thick legs, and uniform coloration, this species comes nearer to the Indian buffalo than to the anoa.

The Anoa.

The anoa of Celebes (*B. depressicornis*) is the smallest and most slenderly built of the oxen, and, although allied to the buffaloes, comes nearest in structure to the antelopes. In size it is inferior to a Highland cow, its height being about 3 feet 3 inches, with the hind-quarters rather higher than the withers. The horns are ringed and triangular at the base, of considerable length, sharply pointed, and rising upwards in the plane of the face, with but a small divergence and curvature. They are situated far below the plane of the occiput, and consequently rise near the eyes; in old males they may be as much as



THE ANOA ($\frac{1}{10}$ nat. size).

24 inches in length, but in cows they are always small. The hinder part of the skull is more like that of an antelope than a buffalo, having no distinct crest on the occiput. The ears are small, haired at the base, but naked at the tips, with a bunch of white hairs internally; and the skull narrows towards the muzzle. The tail about reaches to the hocks. The general colour of the hair is dark brown, lighter below, but there are two small spots of white on the sides of the head below the eyes, while the lower part of the legs, and often the back, have also white markings. In the young animal the hair is of considerable length and thickness, but it tends to become thin with age, and in very old individuals the skin is nearly bare. In young animals the hair is reddish yellow. The largest known horns have a length of nearly $12\frac{1}{2}$ inches. The anoa has a considerable resemblance to a

young Indian buffalo, and it agrees with the members of that group in its triangular horns, in the short and sparse hair of the adult, in the large and naked muzzle, and the barrel-like form of its body. It likewise resembles those animals in its bovine smell, its fondness for water and shade, and its habit of drinking by long draughts instead of by short gulps. On the other hand, the anoa approximates to the antelopes in its slender build, the structure of the hinder part of its skull, the upright direction and straightness of its horns, the spots on the head, body, and limbs, and its small size. In connection with the aforesaid fossil species from the Siwalik Hills, the anoa clearly indicates a close connection between the antelopes and the buffaloes; and from these primitive antelope-like buffaloes the other more specialised groups of oxen may have been developed.

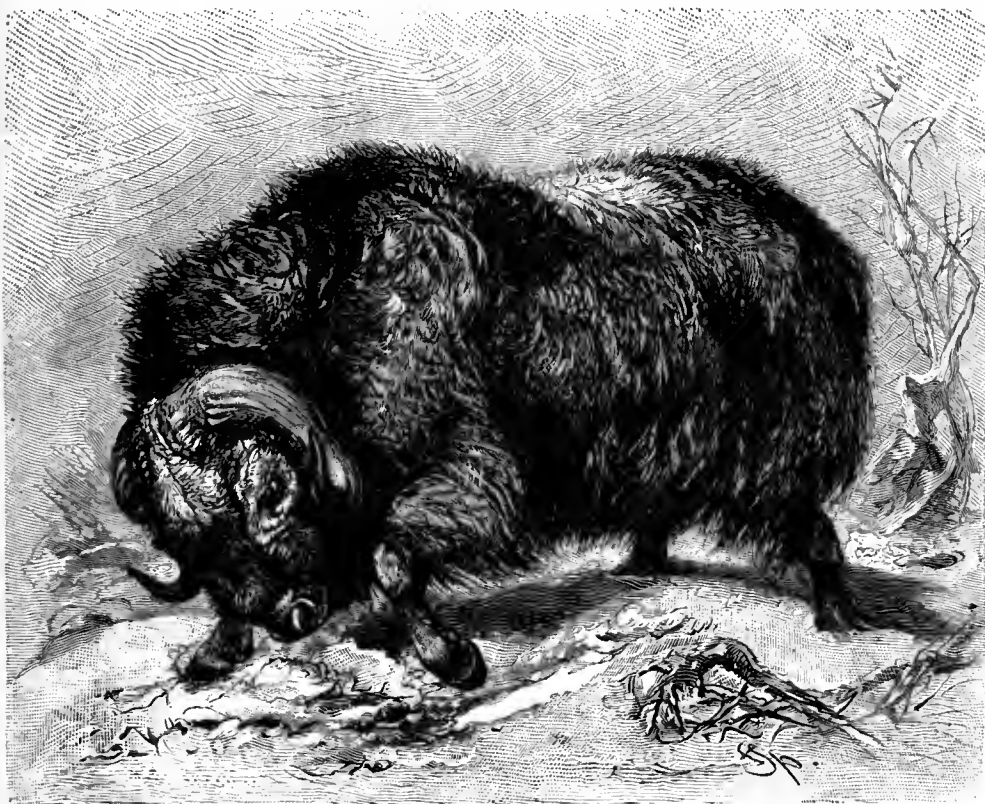
THE MUSK-OX.

Genus *Ovibos*.

In the desolate regions of the far north of the Western Hemisphere, where even in summer the surface of the ground scarcely thaws, is found the curious musk-ox (*Ovibos moschatus*), which although presenting a certain superficial resemblance to the oxen, is in reality far more nearly allied to the sheep. It derives its name from the peculiar musky flavour with which the flesh is tainted, and it forms the single living representative of a distinct genus.

The musk-ox is about two-thirds the size of the American bison, but from its long coat of hair looks larger than it really is. In appearance the animal has been compared to a large hairy ram; and it resembles the sheep in the marked convexity of the profile of the face and the hairy muzzle. The head is broad, with the small and pointed ears almost concealed by the hair; the latter being long and thick, and generally of a dark brown colour, although paler in the spring. Though matted and curling on the back, the hair on the throat and flanks is straight and reaches down to the middle of the legs; it also entirely hides the very short tail. Beneath the hair is a coat of fine soft wool, of a light brown colour. The most striking peculiarity of the animal is, however, to be found in its horns. In the bulls the horns have very wide and flattened bases, covering a large portion of the forehead, and meeting one another in the middle line; at first they curve sharply downwards, becoming at the same time gradually narrower and less expanded, and then curving sharply upwards and forwards, terminating in front of the eyes. The bases of the horns are very rough, and of a yellowish-white colour, but they gradually become less rough, and at the same time darker, till at the tips, where their section is cylindrical, they are smooth and black. In the young rams and the cows the horns are much smaller, and separated from one another by a considerable interval in the middle line. The limbs are short and massive; and the feet are peculiar in that while the outer hoof of each is rounded the inner one is pointed; there is a considerable growth of hair between the hoofs, which aids the animal in obtaining a sure foothold on the ice. The molar teeth of the musk-ox are like those of the sheep, and thus quite different from those of the oxen. Average-sized horns are about 24 or 25 inches in length, but they may reach 27 $\frac{1}{4}$ inches.

Distribution. The range of the musk-ox in Arctic America is limited to the southward by the 60th degree of latitude, but extends northwards to the 83rd degree in Grinnell Land. It abounds on both the east and west coasts of Greenland, and in Arctic America its range is bounded to the eastward by the Mackenzie River, flowing from the Great Slave lake in about longitude $67^{\circ} 30'$, while westwards it extends nearly to the Pacific. In former years the range of the animal reached considerably farther south, it having been found, in the year 1770, near Fort Churchill, on the west coast of Hudson Bay, in latitude $58^{\circ} 44'$.



THE MUSK-OX ($\frac{1}{16}$ nat. size).

In prehistoric or Pleistocene time the musk-ox also ranged to the north-west into Alaska, its fossilised remains having been found in the frozen soil of Kotzebue Sound in Behring Strait, and also in the upper part of the Porcupine River in Canada. At a still earlier period—probably when the whole of North America was far colder than at present—the musk-ox ranged as far south as Kansas and Kentucky, where its remains have been found between the 35th and 40th parallels of latitude. The remains from these localities have, however, been regarded as indicating an extinct species. Passing eastwards from Alaska across Behring Strait into Asia, musk-ox bones are found in the frozen soil of Siberia, as far eastwards as the Obi River. The animal doubtless once ranged right across Russia, since there is evidence of its former existence in Germany as far south as Würtem-

berg. Thence it extended into France, but the Pyrenees and Alps seem to have marked the southern limits of its range. In England remains of the musk-ox have been found in superficial deposits, and its skulls have been dredged from the Dogger Bank. Although the alteration in climatic conditions affords a sufficient reason for the northward retreat of the musk-ox, we are at present quite in the



HEAD OF BULL MUSK-OX.

dark why it has disappeared from the Eastern Hemisphere, while the reindeer still has a circumpolar distribution.

Habits. The regions inhabited by the musk-ox are of the most barren and inhospitable nature. It has been considered that the animal migrated southwards during the coldest part of the year, but this is denied by Mr. H. Biederbeck, who is one of the few explorers who have seen it in its wild state. It was met with by his party in Grinnell Land in March, when the snow is deepest

and the temperature lowest, and it inhabits that country and North Greenland throughout the year. "The musk-oxen travel in herds, and it is but an exception when one of them is found alone. This herding gives them a better chance to defend themselves against their one enemy, the Arctic wolf, and also gives them through close contact, additional warmth and protection against cold and winds."

Hunting. Occasionally, we are also informed by Mr. Biederbeck, the Eskimo undertake an expedition into the interior for the purpose of hunting the musk-ox for the sake of its warm pelage, which is used either for their own bedding, or as an article of barter. The animals are hunted by means of dogs, each hunter taking two or three of these animals with their sledge-traces attached, and thus allowing himself to be pulled along till within a short distance of the quarry.



AT BAY.

The difficulty is then to slip the dogs at the right moment without allowing their traces to drag behind them, and thus be liable to be trodden on by the bayed musk-oxen; but clever hunters obviate this by tying the traces in a bundle on the backs of the dogs just before they are slipped. When bayed and surrounded, the members of the herd are shot down by the score, the great object being to kill each animal outright, as otherwise there is great danger of its struggles inducing a stampede among the herd, which would involve another hunt. Sometimes, however, the herd, even after having made a bolt, will return to the spot where their comrades have fallen. When scenting danger, the musk-oxen, says Mr. Biederbeck, "always retreat to some elevation near by, and upon the approach of the enemy they form in a perfect line, their heads toward their foe; or, if attacked at more than one point, they form a circle, their glaring, blood-shot eyes restlessly watching the

attack ; and I think it would go hard with the man or beast who, under such circumstances, might come within reach of their broad horns or hard hoofs."

In spite of its coarse grain, the meat of the musk-ox is described as being juicy and tender, that of the young animals being especially so, but in order to obviate the musky flavour it is essential that the carcase should be dressed as soon as killed.

SHEEP.

Genus *Ovis*.

Although nearly allied to the musk-ox, the sheep form a group distinguished by several important characters from the oxen, but passing almost imperceptibly



SKELETON OF MOUFLON.

into the goats. They are of smaller size than the majority of the oxen, and although comparatively short-necked, carry their heads higher above the level of the back. Both males and females are furnished with horns ; but whereas those of the former are large, and frequently extremely massive at the base, those of the latter are small and narrow. In the males the horns are generally more or less

triangular in section, and marked by parallel transverse wrinkles, while their colour is greenish or brownish; they are directed outwardly from the sides of the head, their upper border being at first always convex, and the curvature generally taking the form of an open spiral, with the tips turned outwards. The face has generally, but not always, a small gland below the eye, and there is a corresponding depression in the skull for its reception; and the muzzle differs from that of the oxen in being pointed and covered with short hair. Another distinctive feature of the group is the presence of a small gland in each foot between the hoofs; and the females have but two teats in place of the four of the oxen. The males of all sheep are devoid of any strong odour; neither have they any beard on the chin. As a rule, in wild species, the tail is very short; but in one case it reaches just below the hocks. The ears are of moderate length; and the hair, in wild species, is short and stiff, although it may be elongated on the throat and fore-quarters. The upper molar teeth differ from those of the oxen in having narrow crowns without any additional column on the inner side. The feet have only the upper ends of the lateral metacarpal and metatarsal bones remaining.

As regards the characters of their molar teeth, the sheep resemble the gazelles, and it is accordingly not improbable that they may trace their descent to extinct antelopes more or less nearly allied to that group. Oxen, on the other hand, having molar teeth nearly similar to those of the sable antelope and oryx, may be more nearly allied to the ancestors of that group.

Distribution. Sheep are represented at the present day by eleven wild species, which are mostly inhabitants of Europe and Asia northwards of the outer range of the Himalaya; although one species occurs in the Punjab and Sind, a second in Northern Africa, and a third in North America. They associate either in parties of two or three individuals, or in flocks of considerable size; and are essentially mountain animals. Very generally, however, sheep inhabit the more open mountain districts, rather than the craggy and steeply-scarped regions selected by the goats.

Most of the species are very nearly related to one another, and in several instances it is difficult to determine whether certain forms ought to be regarded as distinct species or merely as local races. Geologically, the sheep are even a more modern group than the oxen, none of them being definitely known to occur before the epoch of the so-called forest-bed of the Norfolk coast, which belongs to the upper part of the Pliocene or the lower part of the Pleistocene period.

THE AMERICAN AND KAMSHATKAN WILD SHEEP (*Oris canadensis* and *O. nivicola*).

The American wild sheep or "bighorn" (*O. canadensis*) and the Kamshatkan wild sheep (*O. nivicola*) are two very closely-allied species, differing in several important respects from the other members of the genus. The most distinctive



BONES OF THE LEFT
FORE-FOOT OF THE
SHEEP. — FROM
Dawkins.

characteristic of these species is to be found in their horns, which, while very large and massive, are distinguished by the slight development of the wrinkles on their anterior surface, and the great prominence of the outer anterior angle, and the rounding-off of the inner one. In the skull the depression for the gland below the eye is extremely shallow; and both in this respect and in the smoothness of their horns, these species show an approximation to the goats.

American Wild Sheep. The American wild sheep is a large animal, with the summer coat of a light brown colour, often showing a reddish tinge, while in winter it is bluish grey on the upper-parts. The under-parts, as well as portions of the legs, are white; and there is a large and conspicuous white patch on the rump, which extends upwards on either side of the tail. The back has a more or less distinct dark stripe, reaching to the tail; the latter being very short, and



SKULL OF KAMCHATKAN WILD SHEEP. (From Guillemand's *Cruise of the Marchesa*.)¹

black in colour. The end of the muzzle is light-coloured. Beneath the hair there is a shining white under-wool. Very old males may become very light coloured throughout. The rams attain a height of about $3\frac{1}{2}$ feet at the withers; and their average weight is about 350 lbs., or rather less. The ewes stand about 3 feet in height, and weigh about a third less than the rams. The length of horns in good specimens, measured along the curve, varies from 33 to 36, or even 40 and 41 inches; the broken tips frequently rendering them shorter than they would be, if perfect. A horn measuring 33 inches in length had a basal girth of 16 inches; while in one belonging to Mr. Otho Shaw, of which the length is 40 inches, the basal girth is only $15\frac{1}{4}$ inches.

Distribution. According to Mr. G. O. Shields, the geographical range of the American wild sheep extends from Mexico to Alaska, and from the eastern flanks of the Rocky Mountains to the Pacific coast; although there are some mountain ranges within this area upon which it has never been observed. Along the valleys of the Missouri and Yellowstone Rivers it extends, however, some

¹ We are indebted to Dr. Guillemand and Mr. Murray for this figure, and also for the one of the head of the same species.

four hundred miles to the eastwards of the Rocky Mountains, inhabiting the so-called "Bad Lands" of these districts.

Varieties. According to the observations of Col. J. Biddulph there are two distinct varieties of this sheep, the one inhabiting the northern, and the other the southern portion of its distributional area. The southern variety is characterised by its large skull and very massive horns; the tips of the latter being generally broken and directed forwards. The ears are large, broad, pointed, and deer-like, with hair of only very moderate length. In the northern race, on the other hand, the skull is smaller, and the horns less massive, with their tips generally



THE AMERICAN WILD SHEEP OR BIGHORN ($\frac{1}{15}$ nat. size).

entire, and directed outwards, as in the skull of the Kamschatkan species represented in the figure on p. 214. The ears are small and thickly furred, with blunted extremities; and there is a tuft of long hair between the ears at the back of the horns. There are, moreover, certain differences in the coloration of the legs in the two races; and it does not appear that the southern one ever assumes the dark winter coat frequently found in the northern variety.

Habits. The American wild sheep is described as one of the wildest and most wary of all the large mammals of North America; and since it appears to inhabit more difficult and rugged ground than many of the other species, its successful pursuit is proportionately difficult. Mr. J. Muir writes that "in spring and summer the full-grown rams form separate bands of from three to

twenty, and are usually found feeding along the edges of glacier-meadows, or resting among castle-like crags of the high summits; and whether quietly feeding, or scaling the wild cliffs for pleasure, their noble forms, and the power and beauty of their movements, never fail to strike the beholder with lively admiration. Their resting-place seems to be chosen with reference to sunshine and a wide outlook, and most of all to safety from the attacks of wolves." It is stated that flocks of these sheep have, on more than one occasion, been known to leap down a precipice of one hundred and fifty feet in height.

This species was formerly found in large flocks, but is now rapidly diminishing in numbers; so that, according to Mr. Shields, where it was at one time found in bands of several hundred individuals it is now rarely that more than fifty are seen together. Sentinels are posted in prominent positions to give notice to the herd of the approach of danger; and the agility of these animals in making their way over glaciers and crags is said to be unsurpassed. In summer these sheep will occasionally ascend as high as twelve thousand feet; but in the spring they wander into the valleys in search of fresh pasture or salt lakes. The lambs, which are occasionally two at a birth, but usually one, are produced in May and the beginning of June, and when but a few days old will follow their mothers up apparently inaccessible cliffs. The flesh of this sheep is said to be equal in flavour to the best venison. The Indians hunt the bighorn by tying a pair of horns on their heads, when they are able to creep within range.

**Kamschatkan
Wild Sheep.**

The Kamschatkan wild sheep, of which the head is represented in the accompanying woodcut and the skull in the figure on p. 214,



HEAD OF THE KAMSHATKAN WILD SHEEP.
(From Guillemard's *Cruise of the Marchesa*.)

is so very closely related to the northern variety of the American species, that it may be a question whether it is really anything more than a geographical race of the latter. Thus both have the comparatively small skull, and relatively slender horns with entire and outwardly directed tips; while in both there is the same tuft between the small hairy ears. The ears of the Kamschatkan sheep are, however, rounded instead of blunt; and the white patch on the rump is smaller, and does not extend above the tail, while there is no trace of a dark stripe down the back.

Distribution.

The Kamschatkan sheep is found in the Stanovoi Mountains to the north of the Sea of Okhotsk, as well as in the peninsula of

Kamschatka, and since it may also extend somewhat to the eastward, it is obvious that its range is separated by little more than Behring Strait from its American cousin in Alaska. Hence it is evident that such difference as there is between the two is merely due to their isolation from one another since the period when there was a free communication between North-Eastern Asia and Alaska. Dr. Guillemard found these sheep abundant on the eastern coast of Kamschatka, about fifty miles to the north-east of Petropaulovsky; his party having shot fourteen adult rams in two days. He describes them as standing about 3 feet 4 inches at the shoulder on the average; and the largest horns he obtained measured 38 inches along the curve, with a basal girth of 14 inches. "The general colour," writes Dr. Guillemard, "is a brown-grey, the head and neck rather greyer than the rest of the body. Both tail and ears are remarkably short. The coat in those that we shot was very long and thick, almost like that of a reindeer; but autumn was well advanced, and I have no doubt that in summer it is much thinner. It was curious that we should not only never have shot, but never even have seen, the females. All those that fell to our rifles were rams of (as far as we could judge) from three to six years old. Whether the females always herd together or only at certain seasons it is difficult to say, and we were unable to get any information from the natives upon this point. The taste of the meat when quite fresh was slightly rank, but upon the second day the unpleasant flavour had entirely disappeared."

THE MONGOLIAN AND TIBETAN ARGALIS (*Ovis ammon* and *O. hodgsoni*).

The magnificent wild sheep of Mongolia known as the argali (*O. ammon*), and a very closely-allied species (*O. hodgsoni*) found in Tibet, are readily distinguished from the American and Kamschatkan members of the genus by the characters of their skull and horns. The skull has a much deeper pit for the gland below the eye; and the enormous horns have the wrinkles on the anterior surface very strongly marked, and their outer anterior angle much less prominent, the inner one being more distinct.

The two species, or perhaps varieties, are so closely related that one description will do for both; but the true argali appears to be distinguished by the absence of a ruff on the throat, while in one specimen in the British Museum there is no distinct light-coloured patch on the rump. The argalis may be compared in size to a large donkey; and have short, coarse, and close hair, small ears, and a very short tail. In the males of the Tibetan species the hair on the sides and under-part of the throat is lengthened so far as to form a white ruff, and there is also a shorter crest of dark hair running along the back of the neck to the shoulders. The colour is greyish brown above, but whitish beneath; and in the males there is, as a rule, a large white patch surrounding the tail and embracing a considerable portion of the rump, while the throat, chest, and under-parts, as well as the inner sides of the legs, are likewise white. The crest of hair on the neck and a stripe down the outer side of the legs are dark, and there is also a dark mark above the tail. In very old rams the fur of the back becomes greyish by the admixture of white hairs; and Mr. Blanford considers it probable that in winter the whole colour is paler than in summer. In the ewes the long hair on the back and throat character-

istic of the Tibetan argali is but little developed, or absent; and the light patch on the rump is indistinct. The massive and closely-wrinkled horns of the rams are light brown in colour, with their edges much rounded, and their lateral surfaces considerably deeper than the one in front; they form a spiral curve, with the tips diverging but slightly outwards, and the whole twist falling somewhat short of a complete circle. As in the American wild sheep, the horns of the ewes are small, thin, widely separated, and nearly erect, with a slight outward and backward curvature. The adult ram of the Tibetan argali stands from $3\frac{1}{2}$ to 4 feet at the shoulder; but the weight does not appear to have been ascertained. The horns of fine specimens generally measure from 36 to 40 inches along the curve, with a basal girth of 16 or 17 inches; but these dimensions are sometimes exceeded. The horns of a specimen in the collection of Mr. Otho Shaw have a length of $47\frac{1}{2}$ and a girth of 17 inches; and in another pair the length has been stated to be 48 inches, with a girth of 20 inches. Some degree of doubt attaches, however, to an alleged length of 53 inches, and a girth of 24 or 25 inches, which have been given as the dimensions



FRONT AND SIDE VIEWS OF SKULL AND HORNS OF TIBETAN ARGALI. (From Sir V. Brooke, *Proc. Zool. Soc.*, 1875.)

of one example. In ewes the horns are seldom more than 18 inches, but it is stated that they may occasionally reach 24 inches.

Distribution. The range of the true argali appears to have been much restricted at the present day, owing to the animal having been driven from many parts of Northern Siberia by the Cossack hunters. Formerly occurring in the Altai, it is now found over Northern Mongolia, and, according to Brehm, some portions of Southern Siberia. The sheep from Mongolia to the north of Peking, described as *O. jubata*, is probably not specifically distinct from this species; and the same remark will apply to the *O. nigrimontana* of Turkestan. The term argali is the Mongolian name of this sheep, but it is known to the Kirghiz as the arkal.

The Tibetan argali—the nyan (female nyanmo) of the Ladakis—inhabits the Tibetan plateau from Northern Ladak to the districts northwards of Sikhim, and probably still farther to the east. It is unknown to the southward of the main axis of the Himalaya, and in summer does not descend below an elevation of fifteen thousand feet, but in winter may occasionally come as low as twelve thousand feet.

Habits. The true argali is stated to inhabit mountains at an elevation of from three thousand to four thousand feet above the sea, which have an abundance of naked rocks, but have their slopes thinly covered with forest, and

their valleys wide and open. Here these sheep dwell throughout the year, rarely travelling from one mountain range to another; a single flock, when undisturbed, frequently inhabiting one and the same mountain for many successive years. Up to the breeding-season the rams and ewes keep separate from one another, the former generally going in parties of from three to five individuals, while the latter are found singly; but shortly before that time the two sexes assemble together in flocks of from ten to fifteen in number. They appear to be essentially diurnal in their habits, feeding in the morning and evening on the mountain slopes and valleys, and retiring to rest about midday. Both when feeding and sleeping, sentinels are placed to warn the flock of danger. In summer the argalis feed on grass and various herbs, but in winter they are compelled to subsist on moss, lichen, and dry grass. At such seasons they resort to the more exposed portions of the mountains, as it is there only that the wind has blown away the snow from the lichens and other herbage. According to Prejewalski, the pairing-season of the argalis in Mongolia is in the month of August; but Brehm was informed by the Kirghis that in Southern Siberia it does not take place till October. The younger ewes almost invariably give birth to only a single lamb at a time, but the older ones frequently have two.

As with the American wild sheep, it has been frequently asserted that the argali when taking a long leap will break its fall by alighting on its horns. In both instances this statement has however been contradicted by the most reliable authorities. Prejewalski states he has seen these sheep leap down from a height of from eighteen to thirty feet and alight on their feet without harm.

The country inhabited by the Tibetan argali is of the most barren and desolate nature, scorched in summer during the day by the untempered rays of the sun, and swept during the night and throughout the winter by blasts of icy coldness. For days the traveller may journey through these arid regions without seeing a trace of a bush, although he may here and there come across some low bush-jungle in the more sheltered valleys. As a rule, the elevations are undulating and shelving, and the valleys wide and open. In such exposed situations animals naturally become extremely wary, but this wariness is carried to the highest degree in the rams of the present species, which are considered by General Kinloch to be more difficult to stalk than any other kind of Indian or Tibetan game. The females and young rams, on the other hand, are not difficult to approach, and in Ladak may not unfrequently be met with in considerable numbers. In spite, however, of their general wariness, adult rams will occasionally approach within rifle-shot; the present writer on one occasion having seen a ram accompanied by two ewes cross a pass and deliberately descend the valley to within a short distance of the spot where he himself was lying concealed. During the summer the old rams are generally found in small parties of from three to four to upwards of some fifteen individuals of their own sex, and quite apart from the ewes; but the above-mentioned instance shows that they may occasionally be accompanied by them. The breeding-season is in the winter, when these sheep collect in the lower and more sheltered valleys; and the young are born in May or June. The flesh of the nyan, as the author can testify from personal experience, is most excellent, being dark-coloured, fine-grained, and well-flavoured. In Ladak the chief haunts of this

splendid sheep are the Chang-Chenmo valley and the neighbourhood of the Pang-kong lake, and thence into Chinese Tibet. A wild hybrid between a male of this sheep and a female of the under-mentioned urial, was shot in Zanskar, and described as a distinct species under the name of *O. brookei*; while there is also a record of a hybrid between the male urial and the female nyan.

Fossil Argali. A fossil argali occurs in the forest-bed of the Norfolk coast, and remains of other species have been obtained from the superficial deposit of the continent.

THE PAMIR WILD SHEEP (*Ovis poli*).

Although discovered by the great Venetian traveller as long ago as the latter part of the thirteenth century, it is only since the year 1873 that the great Pamir wild sheep has been fully known to science. In that year it was described by the Russian naturalist Severtzoff, under the name of Karelin's sheep (*O. karelini*); while specimens of the skin and horns obtained during the second expedition to Yarkand, under the late Sir Douglas Forsyth in 1873-74, were soon afterwards received in England. It is true, indeed, that the species was named by Mr. E. Blyth in 1840, but it was then only very imperfectly known. Since 1873 our knowledge has advanced rapidly; and this magnificent sheep has been shot by two Englishmen—Mr. St. George Littledale and Major C. S. Cumberland—who travelled to the Pamir for the express purpose of securing skins and horns.

The Pamir sheep, although furnished with longer horns, does not appear to attain quite such large dimensions as the Tibetan argali, from which it is mainly distinguished by the form of the horns, and also by coloration. In the male the horns, when viewed from the side, are seen to form a spiral of about a circle and a quarter; and when adult they are much longer than those of the argali, but are less massive at the base. In fine specimens the horns may measure from 50 to 60 inches in length along the curve, with a basal girth of about 15 inches; a specimen has, however, been recorded measuring 63 inches in length, while one pair attained the enormous length of 73 inches, with a basal girth of 16 $\frac{3}{4}$ inches; and another 75 inches, with a girth of 16 inches. Females, as shown in our illustration, have small upright horns like those of the female argali. The colour of the fur on the upper-parts of the rams is light brown, with a more or less marked reddish tinge; but there is a dark line of longer hair extending from the nape of the neck to the withers, which in the female is sometimes continued as a stripe down the back. The muzzle, together with the fore-part of the neck, the chest, the under-parts, the rump inclusive of the tail, and the legs, are white. The patch of white on the rump is of irregular contour; and sometimes, as in our figure, there may be a small black mark on the upper surface of the tail. In summer it is probable, according to Mr. Blanford, that the colour is darker and browner. The ewes differ by the absence of any white on the throat. In addition to the long hairs on the nape of the neck, the old males have a more or less marked ruff on the throat. In an adult male measured by Mr. Blanford, in which the horns had a length of 48 inches, the height at the withers was 3 feet 8 inches, and the length from the horns to the tip of the tail 5 feet 2 inches, of which 5 $\frac{1}{2}$ inches was taken up by the tail itself. As

is the case with the argali, the ewes are but little inferior in size to the rams. Dr. Severtzow estimates that an adult ram would weigh about 500 lbs.

To support the enormous weight of the horns great strength in the neck and fore-parts of the rams is essential; and this is afforded by the great depth of the neck and chest, as is well shown in our illustration.

Distribution. The Pamir sheep takes its name from inhabiting the elevated district in Central Asia known as the Pamirs, or "Roof of the World." It is also found on the table-lands to the westward and northward of Eastern



THE PAMIR WILD SHEEP ($\frac{1}{7}$ nat. size).

Turkestan; while its range extends northwards across the Thian Shan range to the Semiretchinsk Altai. It has been obtained from the head-waters of the Amu Darya, and to the north and south of the Gobi desert; while to the westward it extends as far south as the Shimshal Pamir just north of Gilgit, and thus comes within the limits of the territory under the influence of the Government of India. On the average, this sheep may be said to live at an elevation of about twelve

thousand feet, but in some districts it ascends higher, while in others it is found at much lower levels.

The typical and larger form of this sheep is the one inhabiting the Pamirs, while the rather smaller variety described as *O. karelini* is from the Thian Shan; it has been shown, however, that the one form passes imperceptibly into the other. A sheep described by Dr. Severtzow, under the name of *O. heinsi*, is probably also not specifically separable.

In the neighbourhood of Wakhan the rams of the Pamir sheep are known by the name of kuchkar, while the ewes are termed mesh; but in the Turki language, as spoken in Eastern Turkestan, the males are called kulja or gulja, and the females arkar.

Habits. The habits of this sheep appear to be almost or exactly similar to those of the Tibetan argali. It inhabits, however, a far less barren country than the latter; the undulating slopes of the Pamirs being covered in summer with a continuous carpet of rich grass. The breeding-season of this species



SKULL AND HORNS OF PAMIR SHEEP. (From Sir V. Brooke, *Proc. Zool. Soc.*, 1875.)

occurs in the winter, during the months of December and January; and at that period some of the herds may be very large.

Describing the nature of the country inhabited by the Pamir sheep, Col. H. Trotter, who was attached to the expedition under Sir D. Forsyth, observes that after passing a place called Chakmak, on the southern slopes of the Thian Shan range, the road for twenty-five miles "continues gently ascending along the course of the frozen stream, passing through volcanic rocks to Turgat Bela, a little short of which the country alters, and the precipitous hills are replaced by gently undulating grassy slopes, abounding with the *O. poli*. These extensive grassy slopes, somewhat resembling the English downs, are a very curious feature of the country, and not only attract the Kirghiz as grazing-grounds for their cattle, but are equally sought after by the large herds of gulja, in one of which Dr. Stoliczka counted no less than eighty-five."

In the Semiretchinsk Altai, according to Dr. Severtzow, these sheep are found wherever there are good meadows and rocky places, at elevations of two thousand, or three thousand feet; and the same writer states that owing to the open nature of the country, and the good grazing-grounds which they frequent, they are more easily driven from their haunts by the Kirghiz than are the ibex, which inhabit rocky and less accessible regions. In other parts of the Thian Shan, as the upper

Naria valley, these sheep are found in summer at elevations of ten thousand or even twelve thousand feet above the sea.

THE URIAL OR SHA (*Ovis vignei*).

The Asiatic wild sheep known in the Punjab as the urial, but in Ladak as the sha, belongs to a group distinguished from all the preceding species by their smaller size and less massive horns. It was long considered that the urial of the Punjab and other districts of North-Western India was specifically distinct from the sha of Ladak, but the investigations of Mr. Blanford have shown that the two forms pass into one another, and must consequently be regarded merely as varieties of a single species.

The typical urial of the Punjab stands about 2 feet 8 inches in height at the shoulder, but the Ladak variety is rather taller, its height being as much as 3 feet, or even, it is said, rather more. The horns are strongly wrinkled, and have their lateral surfaces not much broader than the front one; while their outer front angle is much more rounded off than in the argali. The two horns rise very close together, and curve round in a regular circular sweep, sometimes keeping almost entirely in the same plane, but at others forming a spiral; their curve very seldom exceeding one complete circle. In the ewes the horns are very short, and nearly straight. The average length of the horns of the rams varies from 24 to 30 inches along the curve, with a basal girth of about 10 inches; but Mr. Blanford states that a specimen has been obtained in which the length of the horns was upwards of $37\frac{3}{4}$ inches, and their basal girth $11\frac{1}{2}$ inches. In the sha or Ladak variety the horns are generally thicker at the base than in the true urial, their basal girth in some instances varying between 11 and 12 inches, whereas in the latter it does not exceed 10 inches; the horns frequently, moreover, form a wider circle, and their outer front edge is still more rounded off.

The adult ram of the urial is characterised by having a large ruff of long hair on the throat, commencing on either side of the chin in two distinct moieties, which soon unite and extend down the throat to the chest. In the Ladak variety the ruff is generally much less developed. In colour the fur of the urial is rufous grey or fawn on the upper-parts in the summer dress, but in winter becomes greyish brown; the under-parts, together with the rump, tail, and legs, are whitish; while in old rams the ruff is generally white in front, passing behind into black, although in some cases it may be entirely black. There is a dark brown or black patch behind the shoulder; and sometimes a blackish line dividing the white of the under-parts from the darker area, as well as blackish markings on the limbs. The ewes and young rams are of a uniform greyish brown colour.

Distribution. The geographical range of the urial is more extensive than that of any other Old World sheep, and includes districts with exceedingly different climatic conditions. The large variety known as the sha extends from Northern Tibet through Ladak and Zanskar, where it is generally found at elevations of from twelve thousand to fourteen thousand feet, through Astor and Gilgit (where it is locally known as the uria) to Afghanistan. The true urial inhabits the Salt range of the Punjab, the Suliman range, the Hazara hills, and

the neighbourhood of Peshawur, whence it ranges all through Sind, Baluchistan, and Afghanistan into Eastern Persia. The variety found in Baluchistan and Kelat is characterised by the very open spiral formed by the horns, so that the tips diverge much more than usual; this variety was at one time regarded as a distinct species under the name of *O. blanfordi*.

Habits. Regarding the different habitats of the urial, Mr. Blanford observes that in Ladak this sheep inhabits open valleys; in Astor and Gilgit it keeps to grassy ground at moderate elevations below the forest; in the Salt range of the Punjab, and in Sind, Baluchistan, and Persia, it is found on undulating or hilly ground cut up by ravines, and is more often seen on stony and rocky hillsides than amongst bushes and scrub. The herds vary usually from three or four to twenty or thirty in number; the sexes are generally together, but the males often keep apart in summer. These sheep are wary and active; although not such masters of the art of climbing amongst precipices as the goats, tahr, or bharaal, they get over steep places with wonderful ease. Their alarm-cry is a shrill whistle, their usual call a kind of bleat. In the Punjab the breeding-season is in September, but it must be considerably later in Astor, where the lambs are born early in June. There are either one or two young at a birth; and the species will freely interbreed with domestic sheep. The Punjab and Sind urial inhabits a hotter area than any other species of wild sheep; and it is remarkable that a single species should have been able to adapt itself to climates so different from one another as are those of the Punjab and Ladak.

In the Salt range of the Punjab the urial may occasionally be seen grazing with domestic sheep; but they are soon disturbed by the sight of a European. The broken nature of the ground, with numerous sharp ridges, separated by deep and narrow ravines, renders, however, urial-stalking a comparatively easy sport.

THE ARMENIAN AND CYPRIAN SHEEP (*Ovis gmelini* and *O. ophion*).

The Armenian sheep brings us to the first of a group of three comparatively small species distinguished from the urial by the total absence of horns in the ewes, the want of a distinct ruff on the chin of the rams, and the much finer wrinkles on the front of their horns, as well as by the tail being always dark-coloured. The Armenian sheep, which inhabits Eastern Persia and Asia Minor, and is especially common in the Cilician Taurus, is the largest of these three species, the rams generally standing about 2 feet 9 inches at the shoulder. The colour of the upper parts of the body in the rams is russet-yellow, the fore portion of the head being whitish, and the under-parts, insides of the limbs, and the whole of the lower portions of the legs, as well as a streak on the buttocks, white. There is a dark mark on the front of the fore-legs above the knee, and the fringe of long hair on the lower part of the throat is also dark, as is the end of the tail. The horns have a peculiar backward and inward curvature, so as nearly to meet behind the neck, and as a rule they do not exceed 26 inches in length, but a single pair has been recorded measuring upwards of 40 inches. The females have a characteristic white saddle-mark on the back.

In the Troodos mountains of Cyprus this species is represented by the

smaller but closely-allied Cyprian sheep, which may indeed be nothing more than a geographical race of the other, diminished in size and modified by the small area of its habitat and its long isolation. This elegant species is, indeed, the smallest of all the wild sheep, the rams standing only just over 26 inches at the shoulder, and their horns not exceeding 23 inches in length. According to Col. J. Biddulph, it is distinguished from the typical form of the Armenian sheep by the horns being more slender, with their outer front angle almost completely obliterated, and their tips directed upwards instead of downwards. The fringe on the throat is also less developed



HEAD OF CYPRIAN SHEEP.
(From Biddulph, *Proc. Zool. Soc.*, 1884.)

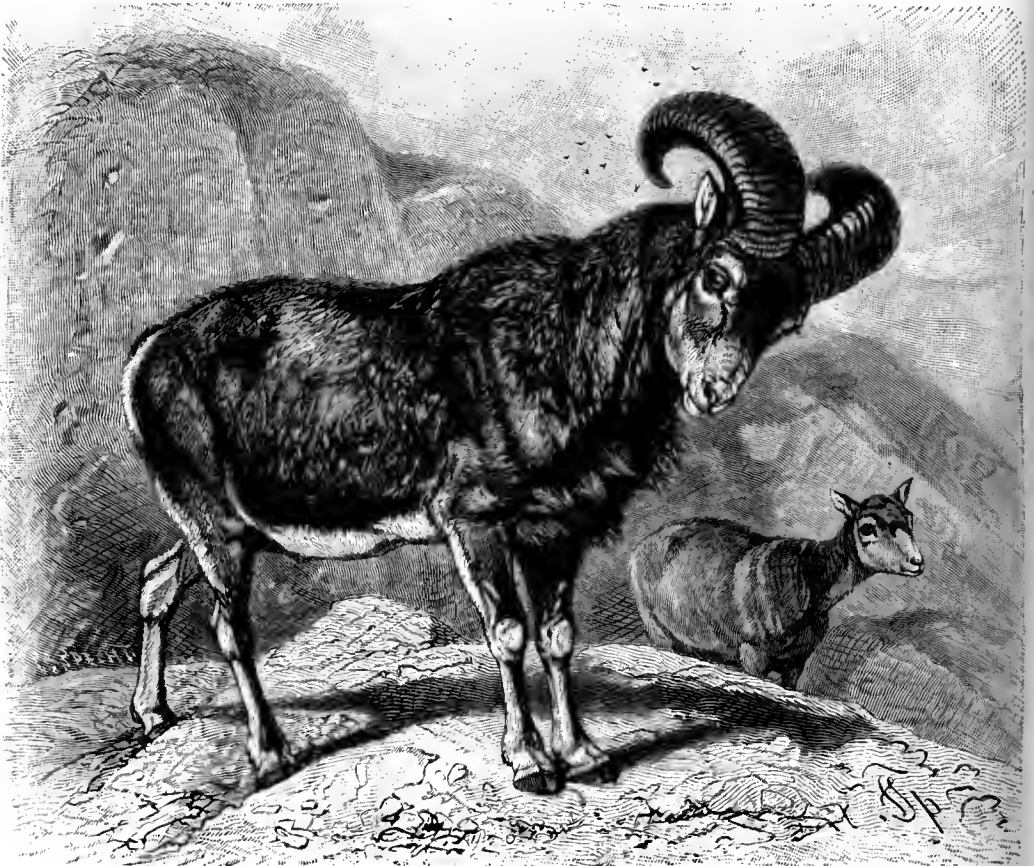
and there is a much more distinct dark line dividing the white of the belly from the rufous of the flanks. There is, however, a variety of the Armenian sheep in which the horns approximate in form to those of this species.

THE MOUFLON (*Ovis musimon*).

The European mouflon, now confined to the islands of Sardinia and Corsica, is the last member of the typical group of wild sheep. In height the rams stand about 27½ inches at the withers; the build of the animal being very compact and neat. The hair is short and close on the body, with an abundant under-wool, but in the rams is elongated into a short mane on the neck and a fringe on the lower part of the throat. With the exception of a dark brown line down the back, and a conspicuous light grey saddle-like patch on the sides of the rams, the general colour of the upper-parts is foxy red, passing into ashy grey on the head, while the muzzle, a streak on the rump, the sides of the tail, the feet, and portions of the lower parts of the legs, and the under-part of the body are white. The horns curve forwards by the side of the face, and vary in length from 20 to 28 and 29 inches.

Distribution. Although reported to have occurred formerly in parts of Greece and the Balearic Isles, it does not seem certain that the mouflon was ever an inhabitant of these countries; while Brehm is doubtful if its alleged former occurrence in Spain is a fact. At one time the mouflon was extremely numerous in Corsica and Sardinia, accounts being extant of the slaughter of four hundred or five hundred head during a single hunt. At the present day it is, however, far less numerous, so that instead of being met with in large flocks, it is now only seen in companies of from four to five up to seven individuals; while in the largest "drives" not more than forty or fifty head are ever killed at one time.

Habits. In Sardinia the mouflon, instead of being found on all the mountain ranges, are restricted to certain chains, and there they frequent only the highest ridges, generally confining themselves to such peaks as command a view of the whole of the surrounding country. The flocks of mouflon are led by an old and powerful ram; but at the pairing-season the large flocks used to split up into small parties, consisting of one ram and several ewes. The rams engage in fierce conflicts among themselves for the supremacy; and during the months of December and January the mountains re-echo with the



THE MOUFLON ($\frac{1}{2}$ nat. size).

sound of the blows as one ram rushes against the head of another. The lambs—either one or two at a birth—are produced during April or May; and are able in a few days to follow their dams everywhere. Mr. E. N. Buxton states that the Sardinian mouflon is one of the most difficult animals to approach with which he is acquainted. He observes that “when they are alarmed, or at ‘gaze,’ they have a habit, or at least the rams have, of placing themselves in the middle of a bush of macquia, or in the shadow which it casts. The ewes, who are naturally less conspicuous, do this in a less degree. The mouflon are assisted by the wonderful alertness of their eyes.” Later on Mr. Buxton writes that “one of their favourite

devices is to seek for spots on the lee-side of a ridge where the currents of air meet. Here, in otherwise favourable positions, they are quite unapproachable." Occasionally wild mouflon will desert their own kin to live among tame sheep; while sometimes also a motherless domestic lamb has been known to seek companionship among a flock of mouflon. Evidently, therefore, the wild sheep are very closely related to our domesticated breeds.

DOMESTIC SHEEP (*Ovis aries*).

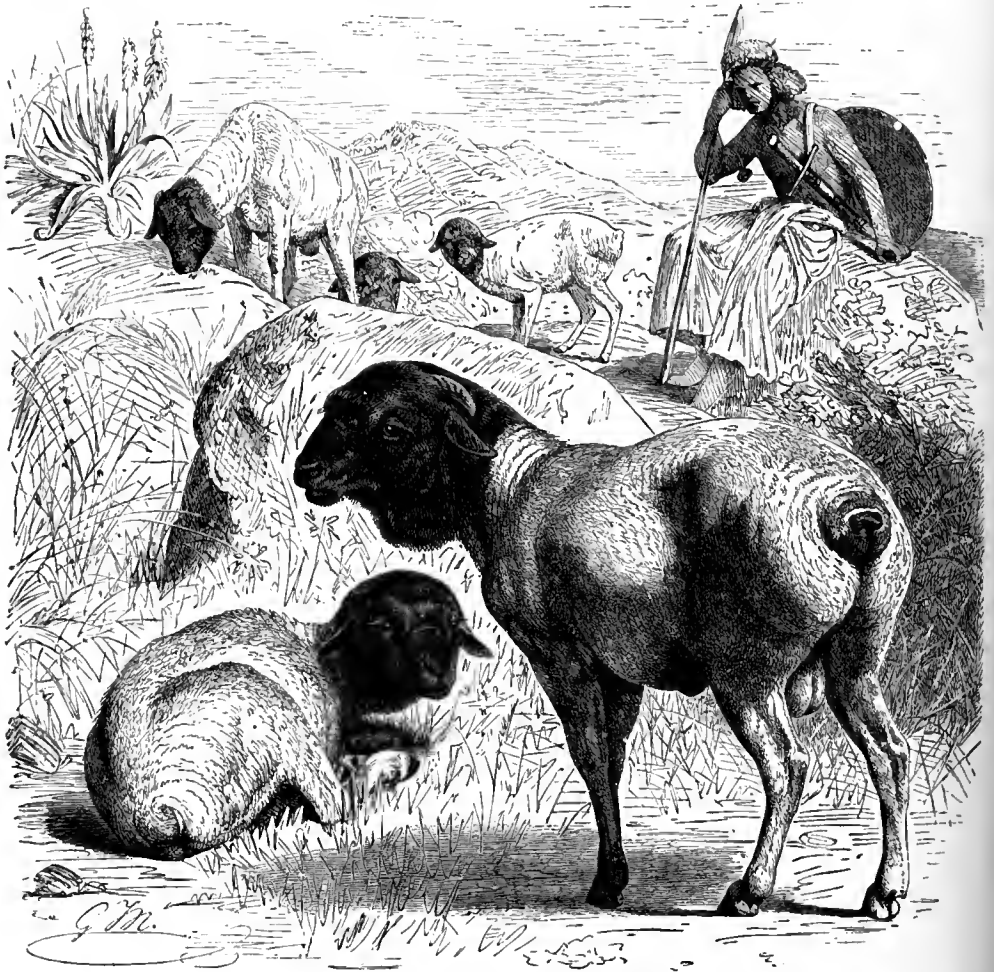
Although from the similarity in the form and structure of their horns there can be no doubt that the domestic races of sheep are more nearly allied to the mouflon, Armenian wild sheep, and urial, than to those mentioned hereafter, yet we are at present quite in the dark as to their origin; and it is an open question whether we ought to regard the various domesticated breeds as derived from a single, or from several, original wild stocks. The most important features by which most domestic races of sheep differ from their wild cousins are the length of the tail, and the substitution of a coat of wool for one of hair. No wild sheep except the under-mentioned Barbary sheep, which has horns of a totally different type, is furnished with a long tail; but it has been suggested that the long tails of the domestic breeds are due to a kind of degeneracy, although, it must be confessed that this does not much advance matters. Unfortunately, geology does not help us much in this investigation; although it is ascertained that the inhabitants of the ancient Swiss lake-villages were possessed of a breed of sheep characterised by their small size, long thin legs, and goat-like horns.

Domestic sheep vary greatly in the character of their horns. Thus while in the Dorset breed these appendages are present in both sexes, and of nearly equal size in each, in some forms only the males are provided with horns, while in other breeds, like the Southdown, they are absent in both sexes. On the other hand, there is a tendency among some breeds to produce additional pairs of horns, so that we may have four-horned, and even eight-horned, sheep. When there is more than one pair of horns, they arise from a peculiar elevated crest on the frontal bones. In the Wallachian breed the horns of the rams, as Mr. Youatt remarks, spring almost perpendicularly from the frontal bone, and then take a beautiful spiral form; in the ewes they protrude nearly at right angles from the head, and then become twisted in a singular manner.

Flat-tailed Sheep. One of the most remarkable types of domestic sheep is characterised by the tail being flattened, and either of great length or abnormally shortened. It has been considered that these sheep indicated a distinct aboriginal form, but against this view may be quoted Mr. Darwin's observation that their drooping ears are indicative of long domestication. On the other hand, the nature of the pelage in the Eastern and Ethiopian varieties of these breeds, is suggestive of a more intimate relationship with a wild ancestral stock.

In Asia Minor, Syria, and parts of Arabia, the flat-tailed sheep have their tails of enormous size, sometimes reaching a weight of from 40 to 50 lbs. So long, indeed, is the tail, that it actually trails upon the ground, and is frequently supported by little sledges in order to prevent it from incommoding its owner.

On the other hand, in the countries to the eastward of the Caspian Sea, such as Persia and many parts of Central Asia, as well as in North-Eastern Central Africa, we find that the flat tail becomes short or rudimentary, and the fat accumulates on either side of the haunches in two great protuberances. Hence this breed is designated *O. aries steatopyga*. This breed, as shown in our illustration, is of large size, and differs from most domesticated sheep in its completely hairy



THE BLACK-HEADED SHEEP ($\frac{1}{2}$ nat. size).

pelage. The coat of the adult resembles, indeed, very closely that of many wild sheep, generally consisting of short and close hair, and yielding no wool capable of being spun or woven. The lambs have, however, a perfectly woolly coat. In Abyssinia Mr. Blanford states that the fat-tailed sheep kept in the highlands differ from the ordinary breed in being covered with wool. They have also frequently well-developed and handsomely-curved horns. In our figured example of the hairy breed of these sheep, the hair is white on the body but black on the head and front part of the neck. The horns are small and curved. These sheep are kept in great

numbers by the nomad tribes of the Asiatic steppes; some preferring those which are entirely black, while others cultivate a pure white breed. A large number of lambs of the black breed are killed at a very early age for the sake of their skins, which are covered with fine curly wool, and constitute the astrachan of commerce.

The Fezzan sheep, which is brown and white in colour and has a long and round tail, has the pelage entirely in the form of hair.

It would be impossible within the limits at our disposal to mention the various breeds of round-tailed domestic sheep met with in various parts of the world; and we must, therefore, content ourselves with a brief mention of those cultivated in the British Islands.

Shetland Breed. The Shetland and Orkney breeds are characterised by their fleece being composed of fine soft wool largely intermixed with hair. They are of small size and hardy disposition, with horns frequently present in both sexes, although often wanting in the ewes; and their colour may be either black, brown, grey, or white.

Scotch Breeds. The older soft-woolled sheep of Scotland are a small-horned breed, with lank bodies and short wool, which is deficient in the property of felting. They are nearly extinct.

Welsh Sheep. Of the Welsh sheep there are two races, both of small size. The first is the higher mountain-breed, characterised by the presence of horns in both sexes, their generally dark colour, and the intermixture of a large proportion of hair among their soft wool. The second breed is hornless, with soft wool, which is deficient in the property of felting. These sheep are hardy, and noted for the excellence of their flesh; when removed from their native pastures they are impatient of restraint.

Irish Breeds. The Irish Wicklow sheep were almost identical with the Welsh mountain sheep, but have been much altered by crossing. There are, however, several other Irish breeds, among which the Kerry is the best known. These are larger than the Welsh sheep, with the horns frequently absent in the ewes, and the fleece moderately soft, but irregular, and mixed with hair. They are late in reaching maturity, and wild in disposition.

Heath Breed. The black-faced Heath breed, which are natives of the chain of mountains and moors extending northwards from Derbyshire, are the hardiest and boldest of all the British races. Both sexes are horned, and their faces and limbs are dark-coloured, and their fleeces coarse and shaggy. When taken to lower grounds, their wool becomes finer.

Cheviots. The Cheviot breed, originally confined to a small tract of grassy hills in the north of England, are rather heavier, although less robust than the last. Both sexes are hornless, their faces and limbs are white, and they produce wool of moderate fineness.

Norfolk Breed. The old Norfolk breed, of the eastern counties of England, are strong and active sheep, with horns in both sexes, which are thick and spiral in the rams. The body and limbs are long, the head carried is high, and the face and legs are black; while the wool is silky and of medium length.

Moor Breeds. The Dartmoor and Exmoor sheep may be taken as samples of the breeds of the older forests, commons, and chases. They frequently have dark or grey faces and limbs, and may be with or without horns; while their size is small. The two races mentioned differ from the others in having wool of medium length, instead of extreme shortness.

Southdowns. The well-known Southdown breed, derived from the chalk hills of Sussex, are characterised by the absence of horns, their dark brown faces, ears, and limbs, and their short felting wool. Their size and weight are



HEAD OF MERINO RAM.

subject to local variation; but their heads are always comparatively small, their lower jaws thin and fine, and the space between their ears well covered with wool. A good Southdown carries more meat in proportion to offal than does any other of the short-woolled varieties.

Dorsets. The Dorset and pink-nosed Somerset breed, are indigenous to the south-west of England, and are easily recognised by their long limbs, the presence of horns in both sexes, and their white limbs and faces, the muzzle being often flesh-coloured. The wool is of medium length, and the lambs are produced unusually early. There is a variety of the Dorset breed in Dean Forest and on the Mendip Hills, small, compact animals that thrive on the poorest soil. The Portland sheep are an allied but smaller breed.

Merino. The small merino sheep, in which the males have long spiral horns while the females are usually hornless, may have either white or grey faces and limbs, and are distinguished from all other breeds by the great length and fineness of their wool. Originally a native of Spain, the breed has

spread over many parts of Europe, and has been introduced into South Africa, America, and Australia; but, for several reasons, has not found much favour with English farmers.

Long-woolled Breeds. Finally, we have the various strains of long-woolled sheep, under which heading are comprised the new Leicester, and the varieties more or less intermixed with it in blood, such as the Lincolnshire, the Romney Marsh, the Cotswold, the Devonshire, the Notts, and the long-woolled Irish breeds. They are all of large size, destitute of horns in both sexes, and bear long wool, which, while unsuitable for felting, is eminently adapted for the manufacture of worsted yarn. These sheep are stated by Mr. Low to be "more especially adapted to the plains and the districts where artificial food can be reared in the necessary quantity. They have been continually increasing in number with the extension of tillage and the general improvement of agriculture. Of the several varieties, the new Leicester breed occupies the first class with respect to form, and the aptitude to fatten readily."

THE BHARAL (*Ovis nahura*).

With the bharal, or blue sheep of Tibet, we come to the first of two wild species differing markedly from all the others in the characters of their horns and skulls, and approximating in these respects to the goats. As regards the horns, the male bharal has these appendages nearly smooth, and rounded or subquadrangular at the base, while their curvature assimilates more to a letter S than to the spiral characteristic of the typical sheep. They are marked with fine transverse striæ, and rise very close together on the head; their direction is outwards, at first upwards, then downwards, and at the extremities backwards. The females have short horns, curving upwards and outwards. There is no gland on the face, and consequently no pit in the skull below the eye. The tail is relatively longer than in any of the wild species yet noticed. The fur is of uniform length throughout, without any trace of a mane on the neck or fringe on the throat, and is remarkable for its smoothness and compactness. As regards coloration, the adult male bharal is a decidedly striking animal. Thus, whereas the general colour of the upper-parts is brownish grey, becoming more distinctly brown in summer, and tending to slaty grey in winter, the under-parts, the inside and back of the limbs, as well as the rump so far as the root of the tail, are white. The front of the face, the chest, a stripe down the front of the limbs, interrupted by white at the knees, and a stripe along the side dividing the white of the belly from the dark of the upper-parts, as well as the last two-thirds of the tail, are black. The black markings on the face, chest, and flanks, are wanting in the females.

The male bharal stands about 3 feet in height at the withers, and good-sized horns have a length of 24 or 26 inches along the curve, with a basal girth of some 11 inches. Specimens have, however, been recorded measuring 30½ and 32 inches in length, and 13 inches in girth. The female bharal is altogether a smaller animal.

Distribution. The bharal is essentially a Tibetan species, ranging, according to Mr. Blanford, from near Shigar in Baltistan and the neighbourhood of Sangu, south-east of Yarkand, as far eastwards as Moupin in Eastern Tibet;

while in a north and south direction it embraces the area lying between the main axis of the Himalaya (or a few of the higher ranges to the south) and the Kuen-Lun and Altyn Tagh ranges.

Affinities. Structurally the bharal is as much a goat as a sheep, but in the absence of a beard and of a strong odour in the rams, as well as in general appearance, it is more like a sheep, and is consequently placed in the same genus. It exhibits, however, a marked difference from other species of the same general size in refusing to breed with domestic sheep; and its relationship to the goats is so strong that, were it not for convenience, there are considerable grounds for including both sheep and goats in a single genus.

Habits. In conformity with its structure, the bharal, as Mr. Blanford remarks, is intermediate in its habits between the sheep and the goats. Like the former it is found on undulating ground, and frequently lies down during the day on its feeding-ground, though generally amongst stones; but, like the latter, it is a splendid climber, perfectly at home on precipitous cliffs, and wont, when alarmed, to take refuge in ground inaccessible to man. It is found in herds of from eight or ten to fifty or even a hundred; the males and females being generally found apart in the summer, but frequently associating together at all seasons. The herds keep to high open ground above forest and never even enter bush. They feed and rest alternately during the day. Owing to their colour it is peculiarly difficult to make them out when they are lying down amongst stones." It appears that these animals are never found below an elevation of ten thousand feet above the sea-level, while in summer they range up to fourteen thousand and sixteen thousand feet. Bharal are by no means difficult of approach in districts where they have not been much disturbed, and on one occasion in Ladak the present writer came suddenly upon a flock of five rams lying asleep in an unfrequented path. They are generally well represented in the Gardens of the London Zoological Society, where they have bred freely.

THE BARBARY SHEEP (*Ovis tragelaphus*).

The Barbary, or maned sheep, which is the only wild representative of the group met with in Africa, while agreeing with the bharal in the general character of its horns and skull, is distinguished by the great mass of long hair clothing the throat, chest, and fore-limbs, and likewise by the great length of the thickly-haired tail, which reaches slightly below the hocks. Although commonly referred to in works of natural history under the name of aoudad, it does not appear that this title is recognised by the inhabitants of its native country, to whom this sheep is known as the arui.

The Barbary sheep attains a height of rather over 3 feet, and is of a nearly uniform pale rufous yellow colour, with the individual hairs differently coloured in different parts of their lengths. The females are distinguished from the males by the much shorter hair on the fore-quarters, but have horns nearly or quite so long. The horns do not generally exceed 25 inches in length, but may reach 26 or a little more, and although finely wrinkled in the young are nearly smooth in the adult.

BHARAL





Distribution. These sheep are generally found alone or in parties of two or three, and are sparsely distributed over the more precipitous regions of the arid southern slopes of the Atlas range, from the Atlantic to Tunis. They are unknown in the interior of the range near the coast, always keeping within sight of the desert, and capable, according to Arab reports, of going several days without water. Their colour harmonises admirably with the limestone rocks of their native mountains.

Habits. Mr. E. N. Buxton observes that the Arabs are in the habit of pitching their tents near the scanty springs frequented by these sheep, and daily lead their goats high up the mountains. Consequently, the arui



THE BARBARY SHEEP ($\frac{1}{4}$ nat. size).

have "no means of escaping from them, as every mountain within reach of water is similarly infested. They are constantly within sight and hearing of the Arabs and their goats, and as they cannot get away they have developed the art of hiding themselves to an extraordinary extent, and they have unlimited confidence in their own invisibility. This was demonstrated by me one evening when I sat for twenty minutes carefully spying the surrounding country. The knoll on which I sat commanded a small shallow hollow. In this there was not a vestige of cover except a few thin thuya bushes which looked as if they could not hide a rat. It was not till I rose to shift my position that a female arui and two yearlings started

from these bushes. They had been lying within sixty yards of me, and must have been fully conscious of my presence all the time. The arui, in this habit of hiding, is very like the Pyrenean ibex, which lives in rather similar ground, and also trusts to concealment in preference to flight."

In Algeria the rams of this species are distinguished as *fechtal*, the ewes as *massa*, and the lambs as *charuf*.

THE GOATS.

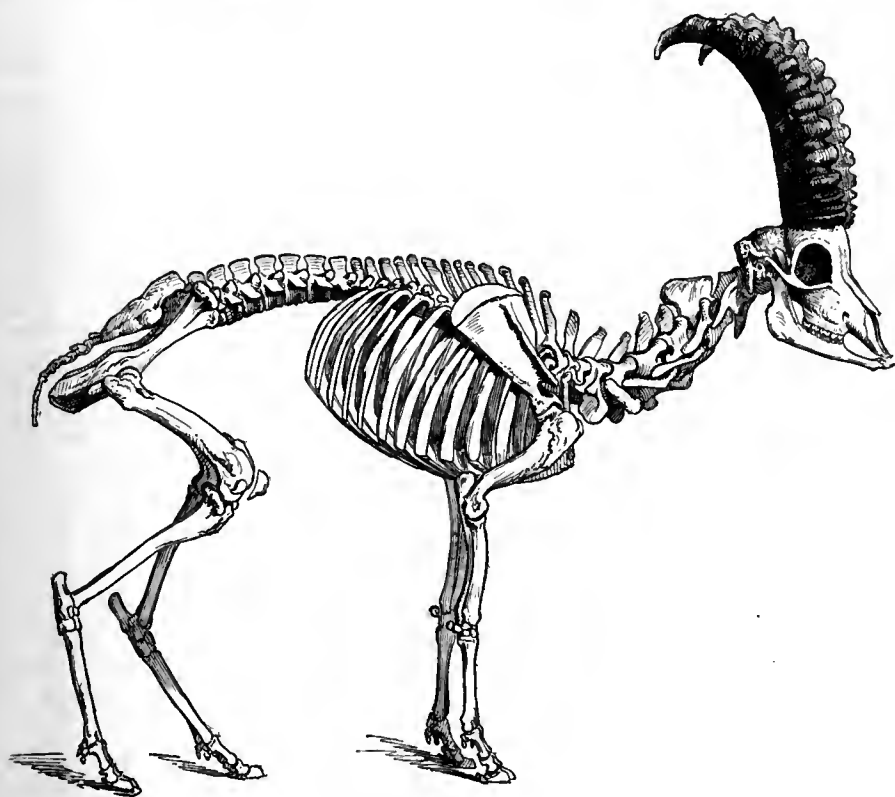
Genus *Capra*.

The two preceding species of sheep connect the more typical representatives of that group so intimately with the goats that there is some difficulty in drawing up a list of characters which will satisfactorily distinguish between the two. The males of all the goats are, however, characterised by the possession of a peculiar strong odour, while they very generally have a beard on the chin. None of them have any gland on the face below the eye (in which respect they resemble the bharal and Barbary sheep); and they differ from all the sheep in the absence of any glands between the hoofs of the hind-feet, while in some cases these glands are likewise wanting in the fore-feet. In all cases the tail is short, and there are peculiar hard patches, or callosities, on the knees, and in some instances also on the chest. The skull of a goat differs from that of a sheep in that the plane of the portion behind the horns meets that of the part in front of the same in an obtuse instead of a right angle, while the profile of the face is very concave, and the occipital region rounded instead of nearly flat. The true goats, or those constituting the genus *Capra*, are further distinguished by the great length of the horns of the males. These are situated close together immediately above the eyes, and are continued upwards at first in the plane of the forehead; they may be either scimitar-shaped, with a backward sweep, or spiral, and are generally more or less compressed and angulated, while they are frequently ornamented with knobs or knots in front. In the females the horns are much smaller, and set farther apart at their bases.

Although the term goat is applied to one American ruminant, yet goats in the proper sense of the word are exclusively restricted to the Old World. Moreover, these animals are mainly confined to Europe and Asia north of the southern flanks of the Himalaya. It is true, indeed, that one species occurs in Egypt and another in Abyssinia, but the group is quite unknown in the whole of the remainder of Africa, while the species inhabiting the mountains of Southern India is classed in a genus apart from that containing the true goats. There are about ten species of true wild goats, all of which live in herds, although the males sometimes keep apart from the females, and are occasionally solitary. Like the sheep, the goats are essentially mountain animals, but they generally inhabit more rugged and precipitous ground than do the majority of the former; this is, however, not invariably the case, as the Himalayan ibex ranges on to the open country of the Pamirs. All the members of the group are very active and wary animals, and they are characterised by their tendency to browse on the young shoots and leaves

of such trees and shrubs as they can reach, whereas sheep mainly confine themselves to grazing. On account of these browsing habits goats are extremely destructive to forests, eating off the tops of the young trees and thus preventing all new growth.

Geologically, goats appear to be somewhat older than the sheep, remains of certain species having been obtained from the Pliocene rocks of the Siwalik Hills in Northern India, while those of others occur in the superficial deposits of the plains of Central Europe. The latter belong to a species of ibex, which is a matter of some interest as showing that during a colder epoch these animals could exist



SKELETON OF THE IBEX.

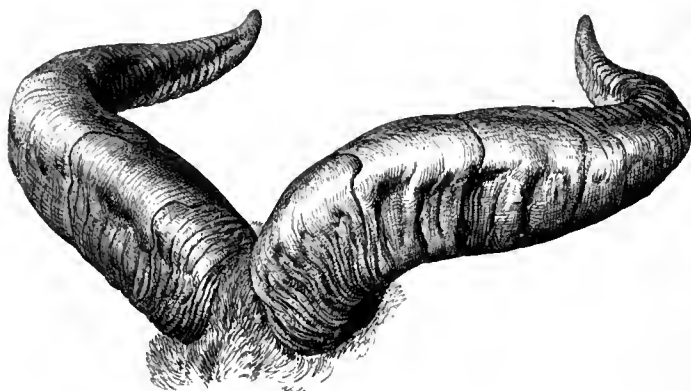
in the lowlands, from whence, with an increase of the temperature, they migrated to the various mountain-chains, where they have differentiated into distinct species from isolation. This explains the occurrence of allied species of wild goats in the Caucasus and the Pyrenees, and in the Alps and the Sinaitic Peninsula.

THE CAUCASIAN WILD GOATS, OR TUR (*Capra cylindricornis*, etc.).

There occur in the Caucasus range three different kinds of wild goats, locally known as tur, which, as being those approaching most nearly to the sheep, naturally come first. These three kinds are commonly ranked as distinct species, but it may be a question whether they are not really only races of one species

exhibiting variations in the structure of its horns analogous to those existing in the Himalayan markhor noticed subsequently.

Pallas's Tur. The goat inhabiting the Eastern Caucasus is known as Pallas's tur (*C. cylindricornis*), and is found to the westward of Kasbeg and throughout Daghestan. It may be described as a goat with horns like those



HORNS OF PALLAS'S TUR.

of the bharal. The horns are black, smooth, and nearly cylindrical, directed outwards and backwards in a somewhat spiral manner, with their tips directed inwards, and sometimes not separated from one another by an interval of more than a foot. The general colour of the animal is light brown, and the height at the shoulder about

3 feet. The reddish brown beard is short and stiff, and curved inwards towards the middle of the chin. Another distinctive feature is to be found in the lower incisor teeth, which have very narrow crowns. Good specimens of the horns may measure some 31 inches along the curve, and occasionally reach $34\frac{1}{2}$ and 36 inches.

Caucasian Tur. In the Central Caucasus, between Elburz and Daghestan, the preceding form is replaced by the true Caucasian tur (*C. caucasica*), which is intermediate between it and Severtzow's. This tur is very similar in appearance to Pallas's, having horns with a spiral curvature, and approaching each other at the tips, but with a nearly square cross-section at the base, and with knobs on the front surface. The colour is very like that of Severtzow's tur, but the head is more reddish, the beard like that of Pallas's, and the under-part of the body darker, while the tail has longer hairs. The incisors are like those of *C. cylindricornis* and the horns vary from 30 to 40 inches in length.

Severtzow's Tur. Severtzow's tur (*C. severtzowi*), inhabits the whole of the Western Caucasus, and presents considerable local variation in colour. It is a very strongly-built animal, standing about 3 feet at the withers. Its general colour is brownish grey with a yellowish tinge, the head and spine being darker, the under-parts a lighter shade of brown, and the limbs dark with a pale stripe on their hinder surface. The brown beard is long and narrow, and the tail very short. The most distinctive feature of this goat is, however, found in its horns. These are very large, black in colour, and directed upwards and backwards in a scimitar-like form, curving almost entirely in a single plane, with their tips widely separated, and generally directed downwards, although occasionally outwards. The section of these horns at the base is triangular, and

they are ornamented in front with more or less distinct knobs, so that they are very like those of ibex, although shorter and thicker. They vary somewhat in their degree of outward inclination—being sometimes separated by as much as 3 feet at the tips—and those in which the outward inclination is most marked and the knobs most developed approach nearest to Pallas's tur. This form is further distinguished by the crowns of the lower incisor teeth being wide and rounded.

If we had only Pallas's tur and Severtzow's tur to deal with there would be no hesitation in regarding them as distinct species, but the Caucasian tur, inhabiting the intermediate area, suggests a passage from the one to the other. The habits of these goats are probably very similar to those of the next species.

THE SPANISH WILD GOAT (*Capra pyrenaica*).

Although often termed an ibex, the Spanish wild goat—the cabramontes of the Spaniards—is much more nearly allied to the turs. It is characterised by the horns of the males having an upward and outward direction, and forming a slight and very open spiral. They are flattened on the inner side and keeled behind, so as to present a pyriform cross-section. When seen from the front, as in the right-hand figure of woodcut on next page, their form is somewhat lyrate, and on their outer side they carry more or less well-marked bosses or knobs, resembling those on the front of the horns of the ibex. There is a small but thick black beard, which may be of considerable length. The general colour of the hair is light brown, but it is much darker around the nose and on the forehead and the back of the head; a triangular patch on the back, a streak on the flanks, and the front of the limbs are black; the upper lips, the cheeks, the sides of the throat, and the hinder surfaces of the legs are greyish, and the remainder of the under-parts are white. There is, however, considerable variation in colour according to the season of the year, and also a certain amount of local variation in this respect. The hair is much longer in winter than in summer, and there is a thick woolly under-fur. The height of the animal is about 26 inches at the shoulder. Horns of old rams average 24 or 25 inches, but may reach 27 or 28 inches in length.

Distribution. The Spanish wild goat inhabits the Pyrenees, some of the mountains of Central Spain, and the higher ranges of Andalusia and Portugal. That the species has existed in the southern portion of its habitat since the Pleistocene epoch is proved by the occurrence of its bones in the caves of Gibraltar, in company with those of an extinct rhinoceros.

It was at one time considered that the wild goat of Andalusia was specifically distinct from the Pyrenean form, but it is now known that the two are only varieties of a single species. It appears from the observations of Mr. A. Chapman that the variety from the Pyrenees is the largest, and is characterised by the horns of very old males tending to assume a smooth form, without distinct knobs, and thus approximating to those of the Caucasian tur. In specimens obtained from the Sierra Nevada, in Andalusia, at elevations of about eleven thousand feet, the horns are frequently as long as those of the Pyrenean variety, but they are generally more flattened, while the size of the animals themselves is considerably less. The wild goats of the Central Spanish Cordilleras are those with the heaviest and most

distinctly knobbed horns, but there is a complete transition from this type to the Pyrenean form.

Habits. During the greater portion of the year the males of the Spanish wild goat live apart from the females, and it is only during the breeding-season that the two sexes come together. Both sexes associate in flocks,



THE SPANISH WILD GOAT ($\frac{1}{2}$ nat. size).

which may be very large, comprising at times from a hundred to a hundred and fifty head. As a rule, the old bucks, heedless of snow and cold, reside on the most exposed and highest peaks of the mountains; but the does, especially in the late spring, frequent the southern slopes, and in the depth of the winter will descend even to the neighbourhood of the villages. When feeding or reposing, sentinels are placed in commanding positions to apprise the flock of approaching danger, which they do by means of a loud snort, upon which the whole company at once takes

to flight. Mr. E. N. Buxton states that these goats are generally found among thick scrub, and he considers that the incurving tips of their horns are thus formed on purpose to admit of easy passage among bushes. The pairing-season takes place in November, when the flocks of opposite sexes come together, and the males engage in combats for the possession of the females. In December the sexes again split up into separate flocks, the males from one to three years of age consorting, however, with the females. The kids are born in April or the beginning of May, from twenty to twenty-four weeks after the pairing-season, and in a few hours after birth are able to follow their mothers over the roughest ground. While the kids are young the mothers confine themselves to the southern slopes and warmer parts of the mountains, and carefully avoid such situations as are exposed to cold and cutting winds. These goats are hunted either by stalking or driving, and in either case display the extreme wariness characteristic of the group.

That the Spanish wild goat is allied to the Caucasian tur is quite evident. The form and curvature of its horns, together with the presence of a keel on their posterior border, is, however, suggestive of a transition from the type of horn obtaining in the ibex to that found in the markhor, and it is thus easy to see how all the varieties of horns found among the goats may have been derived from a single common form.

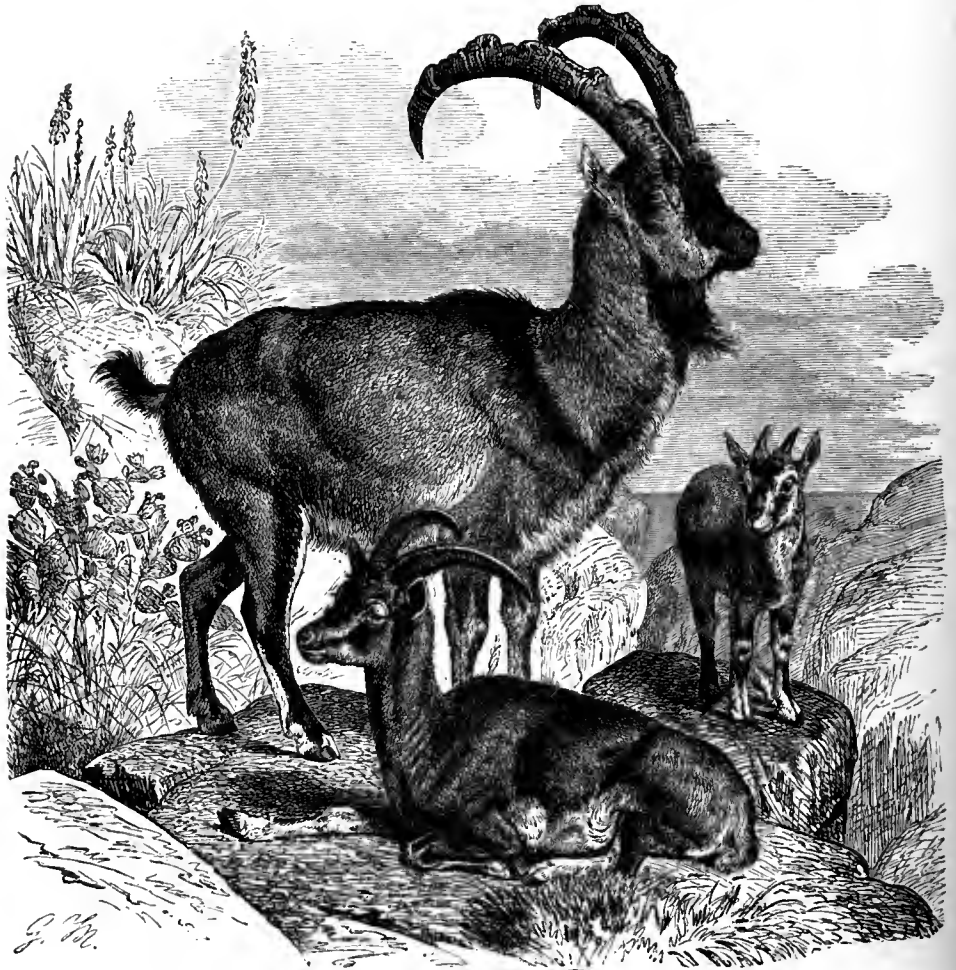
THE PERSIAN WILD GOAT (*Capra wagneri*).

The Persian wild goat—the pasang (rock-footed) of the Persians—is a species of especial interest as being the chief ancestral stock from which the various breeds of domestic goats are derived. This species is characterised by the long scimitar-like horns of the males, which are much compressed, with the front edge forming a sharp keel, marked by irregular prominences and notches, while the hinder edge is rounded, and the outer side more convex than the inner. Generally the tips of the horns are inclined inwards, although they are occasionally divergent. The horns of the does are much smaller, with an even front edge. The male pasang has a small beard on the chin; and in the winter coat the hair on the neck and shoulders is rather longer than elsewhere; and at the same season in the colder portions of the animals' habitat a coat of woolly under-fur is developed beneath the hair. In winter the general colour of the upper-parts is brownish grey, tending in summer to yellowish or rufous brown; the under-parts and the inner sides of the buttocks being whitish or white. In the older bucks, as in the central figure of our illustration on the following page, the general colour is, however, paler; a stripe down the back, the tail, the chin, throat, and beard, the front of the legs, with the exception of the knees, and a stripe along the flanks are dark brown. There is also a certain amount of white on the lower part of the legs.

An adult male, measured by Captain Hutton, stood 37 inches at the withers. Good horns of the pasang measure 40 inches along the curve; but in one specimen killed near Karachi, the length was upwards of 52½ inches, with a basal girth of 7 inches.

Distribution. The range of this species is extensive, and was formerly even more so than it is at the present day. There is evidence that in

classic times this goat was widely distributed over the Grecian Archipelago; although in Europe it is now found only in Crete, the island of Antimelo in the Cyclades, and perhaps also in Giura, to the north-east of Eubœa. Eastwards it is found in the hills and mountains of Asia Minor, being especially common in the Taurus range; and it extends thence through Persia into Baluchistan, Sind, and Afghanistan. In India its range does not extend beyond the western side of Sind,



THE PERSIAN WILD GOAT ($\frac{1}{8}$ nat. size).

as eastwards and north-east of the Bolan Pass and Quetta its place is taken by the markhor. Found in Sind and Baluchistan in hills little above the sea-level, in the mountains of Persia it ascends to elevations of eleven or twelve thousand feet.

Habits. The pasang is an extremely active animal, chiefly frequenting craggy and rocky districts, and taking leaps of great length with unerring precision. Although such a feat has been expressly denied by all competent authorities as occurring among the sheep, it is recorded by a trustworthy

observer, that one of these goats, which had missed its footing, saved itself by alighting on its horns. Writing of this species in Persia, St. John observes that "in spite of the constant persecution to which it is subjected, it exists in vast numbers. On the Kuh-i-barf, a not very lofty or extensive hill, constantly shot over, near Shiraz, I once counted over a hundred in a herd, which had been driven together by two days' consecutive fusilade from half a dozen shikaris. . . . The ibex," as Sir Oliver calls the animal, "is marvellously shy and wary. In my earlier residence in Persia I spent many a weary day after them, but never managed to bag a buck. Even native sportsmen, though admirable shots, and thoroughly familiar with every nook and cranny of the hills, rarely get one by fair stalking; most of those killed being obtained by building a wall of loose stones near water, and shooting the goats when drinking. The males drink in the morning and evening only, but the females, in hot weather, at least, drink also at midday. While putting up the telegraph about sixty miles north of Shiraz, in 1864, I came suddenly upon a herd of twenty or more does and kids, drinking by the roadside, a couple of hundred yards from the foot of the hills. Except when alarmed, bucks and does seem to keep apart."

In Sind and Baluchistan these goats inhabit barren rocky hills, but in parts of Asia Minor they are found on forest-clad uplands. In such localities, according to Mr. E. N. Buxton, they may often be found within hearing of the drovers on the roads, or even of the railways; but this confidence is accompanied by exceeding watchfulness. The number in a flock in these districts is generally from four to ten, and at the time of Mr. Buxton's observations bucks and does were found together. Sentinels are almost always posted to warn the flock, these being relieved at short intervals; and it appears that this sentry-duty is undertaken according to seniority, the youngest animals commencing first, and the oldest buck taking his turn last. In Asia Minor pasang are hunted both by driving and by stalking; but they are so cunning that the former method is not generally very successful. The Cabulis hunt them on the lower grounds of Afghanistan with greyhounds.

In the Caucasus the kids are born in May, but Mr. Blanford believes that in Sind they are produced somewhat earlier. There may be either one or two, and, it is said, occasionally three at a birth.

The bezoar-stone, so highly esteemed in Persia as an antidote to poison and a remedy for several diseases, is a concretion found in the stomach of the pasang, from whence it derives its old European name of Pazen, or Pasen.

Giura Goat. In the island of Giura, near Eubœa, there occurs a wild goat which has been regarded as a distinct species, under the name of *C. dorcas*. There is, however, little doubt but that it is the descendant of tamed goats which have run wild, or of such animals crossed with the pasang.

DOMESTIC GOATS (*Capra hircus*).

It has been already mentioned that the various breeds of domesticated goat have been mainly if not exclusively derived from the Persian wild goat, and they may accordingly be most conveniently considered in this place. In saying that domestic goats are mainly derived from that species, it should, however, be men-

tioned that it is probable that many races may have been crossed with other wild kinds. Domestic goats exhibit great variety in the form of their horns; some retaining the backward scimitar-like sweep of the ancestral pasang, while others assume a spiral form recalling these of the markhor. When, however, such spiral-horned specimens are carefully examined, it will be found that the direction of the twist is precisely the opposite of that which occurs in the markhor.



ANGORA GOAT ($\frac{1}{2}$ nat. size).

The varieties of domestic goats are almost innumerable, and there is such an amount of difference between the more extreme types that it is at first sight difficult to believe that they all belong to a single species. In certain instances the horns may disappear from one or from both sexes, while in other cases those of the female are quite different from those of the male, and occasionally a second pair may be developed. Equal diversity obtains in regard to the length of the hair, which in the long-legged and pendulous-eared Indian breed is no longer than in a deer: while in the Kashmir and Angora goats it reaches nearly to the ground.

The colour, again, may vary from pure white to brownish black; and there are great differences as regards the size and shape of the body. The ears may be either upright or pendent, and when in the latter state sometimes attain an enormous length.

Angora Breed. Goats were domesticated by the prehistoric inhabitants of the Swiss lake-cities, and were likewise well known to the ancient Egyptians. Noticing only a few of the more remarkable modern races, one of the most valued is the Angora goat, a native of a district of Asia Minor, but which has been imported into several parts of Europe. It is a large species, with long, flattened, and spirally-twisted horns in the males; and has been regarded by some writers as a direct descendant of the markhor. The body is low, the legs are stout, the head and neck short, and the ears pendent. The white hair is long, wavy, and silky, and it is used in the manufacture of a peculiar kind of cloth. During the cold weather these goats are kept in stables, but throughout the rest of the year are suffered to roam at large; the flocks are very large, each buck being accompanied by about a hundred does. They are shorn in April; and during the heats of summer their hair is carefully washed and combed in order to prevent its deterioration. Some few are born without horns, and it is stated that in such cases the hair is short and close.

Kashmir Goat. Of equal celebrity with the last is the Kashmir goat, which is a rather small but strongly-built variety, characterised by the presence of a thick under-coat of wool beneath the long hair. The neck is short, the head somewhat thick, the eyes small, and the pendent ears longer than half the length of the head. The horns are long and flattened, with a sharp edge in front, and curved outwards and backwards; their tips being inclined inwards. There is considerable variation in colour; but generally the sides of the head, the upper parts of the body, and the tail are silvery or yellowish white. Some individuals are uniformly coloured throughout, and may be either pure white, yellow, light or dark brown, or even black. Although most abundant in Tibet, the Kashmir goat extends to Bokhara, and the country of the Kirghiz; while of late years it has been introduced into France, Würtemberg, and Austria. These goats are valued for their under-wool, which is combed out during the summer, and is known in Kashmir as *pashm*. From this *pashm* are manufactured the Kashmir shawls, and also a very fine and soft dove-coloured cloth, *pashmina*. A certain quality of *pashm* is also obtained from the Himalayan ibex. Enormous flocks of these goats are kept in many parts of Tibet.

Syrian Goat. The Syrian or mamber goat of Eastern Europe and South-Western Asia resembles the preceding in the length of the hair, but is distinguished from all other breeds by the extraordinary length of its pendent ears, which are half as long again as the head. These goats are of large size and very tall; the horns are usually present in both sexes, and curve in a semicircle; the profile of the face is convex; and both sexes have a small beard. The long black hair is shaggy and silky.

Egyptian Goat. The Nile or Egyptian goat is another allied breed, agreeing in size with the ordinary domestic goat, but with longer legs and shorter horns, and especially distinguished by the small size of the head and the extreme

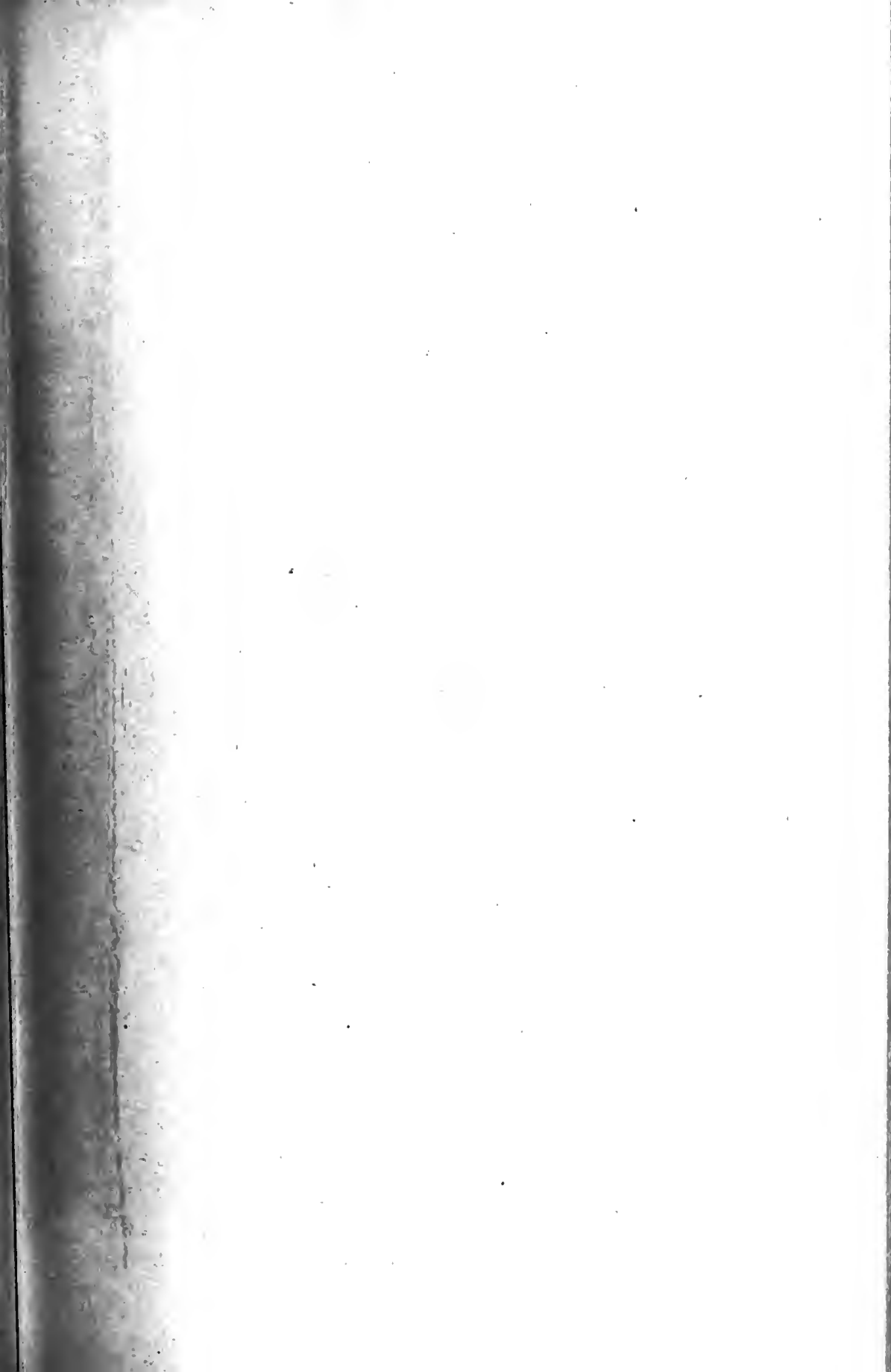
convexity of the profile. The horns are frequently absent in both sexes, and when present are short, thick, and crumpled; while there is generally no beard. The pendent ears are about as long as the head, and are rounded at the tips, and flat. The hair is short, and generally of a reddish brown colour, but inclining to yellow on the legs. Sometimes, however, the colour is slaty grey, or spotted. These goats extend from the countries along the Lower Nile to Central Nubia. The Theban race of this breed has the most marked convexity of profile.

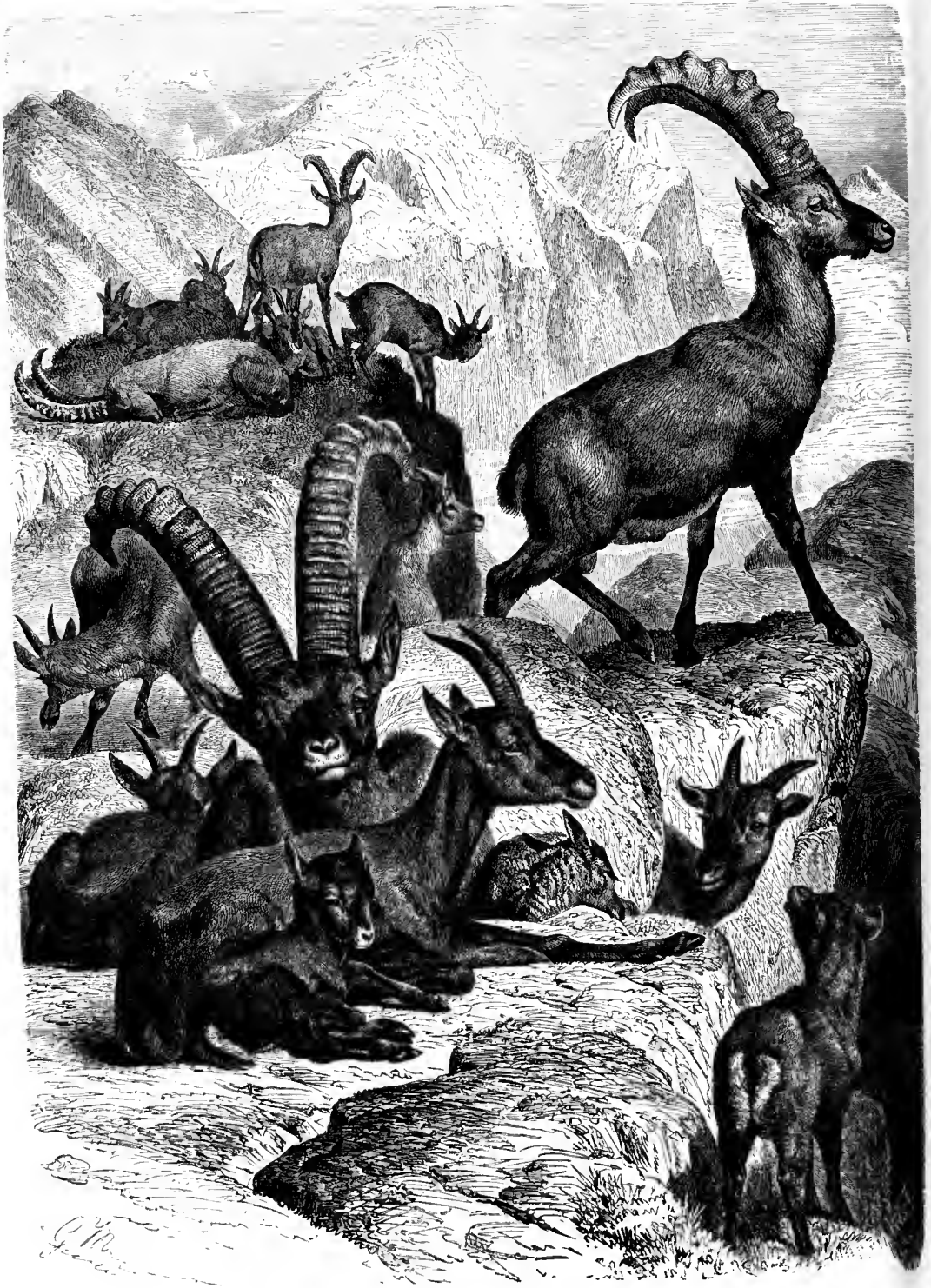
Sudan Goat. Perhaps, however, the most remarkable of all the breeds is the Sudan goat, characterised by the short horns of 3 or 4 inches in length, curving at first backwards and outwards, and then bending forwards at their tips. The legs are short and strong; and the short but thick hair is generally dark coloured, frequently showing a mixture of black and reddish. Sometimes the general dark colour is relieved by white spots; but red, yellowish brown, and perfectly black specimens are not uncommon. From the chin depends a black beard reaching to the chest, where it divides to spread over the shoulders and upper-parts of the fore-limbs. These goats are found over all the country lying between the White Nile and the Niger, and doubtless extend over the greater part of Central Africa to the West Coast. They are kept by the natives in enormous flocks.

Feral Goats. Mention has already been made of the wild goats of the Isle of Giura, which are probably derived from a domestic race perhaps crossed with the pasang. Goats have also run wild in many other places, more especially mountainous islands like St. Helena, Tavolara near Sardinia, and Juan Fernandez. In St. Helena these wild goats have completely destroyed a large portion of the native flora, and this has resulted in the disappearance of much of the fauna. Goats were introduced by the Spaniards into Juan Fernandez in the year 1563. These soon increased enormously, and in order to diminish their numbers dogs were subsequently let loose, and likewise ran wild. At the time of Lord Anson's visit, in the summer of 1741, the goats had been greatly reduced in numbers by the dogs, and they were further so much thinned by his party that it was estimated only about two hundred remained. About thirty years ago Pechuel-Loesche visited the island, and found that while the dogs had disappeared, the goats had once more become exceedingly numerous. In 1885 the goats were being vigorously hunted by the settlers with guns and dogs. The general colour of these goats is reddish brown, in some districts spotted with dirty white.

IBEX (*Capra ibex*, etc.).

Although the Spanish and Persian wild goats are frequently spoken of as ibex, it seems preferable to restrict this term to four nearly-allied species, namely, the true or Alpine ibex, the Himalayan ibex, the Arabian ibex, and the Abyssinian ibex. All these species are characterised by their nearly uniform coloration, and by the front surface of their long scimitar-shaped horns being flattened and ornamented by a number of bold transverse knots or ridges. These horns curve backwards, and diverge regularly, although in some cases their tips have an inward inclination; they are nearly triangular in cross-section, the base of the





ALPINE IBEX.

triangle being formed by the broad front surface, and the apex by the sharp hinder edge. In the females the horns are small and placed wider apart at the base, with a nearly oval section, and they are marked by parallel wrinkles.

Alpine Ibex. The Alpine ibex, steinbok, or bouquetin (*C. ibex*), is now exterminated as a wild animal, although preserved by the Italian Government in one or two valleys on the Piedmont side of Monte Rosa. It is readily distinguished from the Himalayan ibex by the extremely small size of the beard of the males, which is so short as to be scarcely noticeable. The animal is also of smaller size, and at the present day, at least, its horns are far shorter, and have less prominent knobs than those of the Himalayan species. Doubtless, however, the general size of the animal, as well as the length of its horns, have been considerably reduced by the circumscribed area to which it is now confined. Formerly, indeed, the ibex roamed over the Alps of Savoy, Switzerland, and the Tyrol; but it is unfortunate that there do not appear to be records of the length to which the horns formerly attained. Horns of $26\frac{3}{4}$ and $31\frac{3}{4}$ inches in length have, however, been recorded of late years.

The pairing-season is in January, and the kids are born at the end of June or beginning of July. The habits of this species are practically identical with those of the Himalayan ibex.

Himalayan Ibex. The Himalayan ibex (*C. sibirica*) differs from the Alpine species by the presence of a profuse beard on the chin of the bucks, and a ridge of coarse dark hair along the back, as well as by its superior size and longer horns. The hair is coarse and brittle; and in winter is underlain by a thick coat of wool, or pashm, which enables the animal to withstand the intense cold of its native mountains. The horns of the bucks have very large knobs, placed at fairly regular intervals; and it may be observed here that these knobs do not indicate the annual stages of growth, which are marked by fine lines on the sides of the horns. In colour the Himalayan ibex is subject to a considerable amount of seasonal and local variation. Generally, however, in summer the colour is brown, only slightly paler above than below; but old males have some dirty white patches on the back. On the other hand, in winter the coat assumes a yellowish white hue, more or less tinged with brown or grey. The dark line on the back has been already mentioned, and in addition to this the beard, tail, and legs are also dark brown. In Baltistan very dark-coloured ibex are met with; and specimens from Siberia and the Thian Shan range are distinguished by having the under surface of the hinder-part of the body and portions of the legs entirely white.

A well-grown buck of the Himalayan ibex will stand about 40 inches at the shoulder; while does are about a third smaller. Fine specimens of the horns measure from 40 to 45 inches along the curve; but a pair have been recorded measuring upwards of 54 inches in length, with a girth of $11\frac{1}{2}$ inches just above the first knob; and there are several of 51 inches, or a little over, in existence.

Distribution. Assuming the ibex of the Himalaya to be identical with the one inhabiting the Thian Shan range and Siberia, the species has a very extensive geographical range. Thus, it is found in all the mountain ranges of Central Asia, from the Himalaya to the Altai, and from the neighbourhood of

Herat, on the Persian frontier, in the north-west, to Kumaon in the south-east. It is found not only on the crags but likewise on the open Pamir country. To the south of the Valley of Kashmir the ibex is unknown in the Pir Panjal range, and its continuation to the north-west of the Jhelam river, the Kajnag; but it is not known to occur in the Himalaya to the eastward of the sources of the Ganges, neither is it recorded from Eastern Tibet. Messrs. Blanford and Hodgson have, however, reason to believe that it occurs in Tibet to the northwards of Shikatsé, on the Sanpo river, and also near Lhasa.

Habits. Like its Alpine cousin, the Himalayan ibex inhabits the crags and upland meadows at or near the snow-level, rising or descending according to the season of the year. General Macintyre writes of the habits of



HEAD OF HIMALAYAN IBEX.

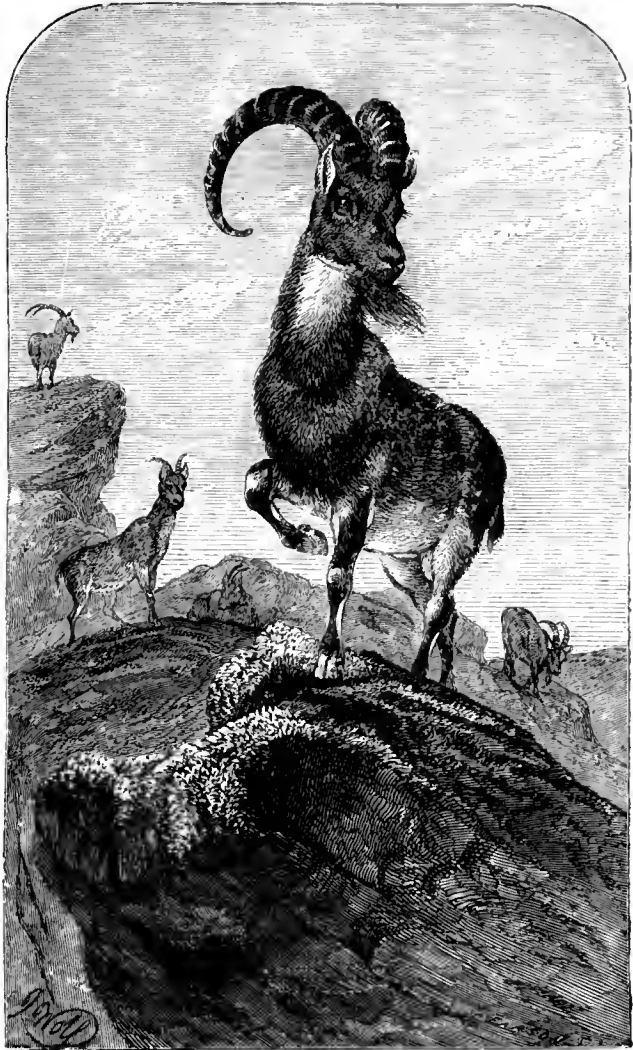
this species, in the following words:—"From what I have seen and heard of ibex, their sense of smell is not nearly so acute as their sight. But they seldom apprehend danger from above, so it is best to approach them, if possible, from that direction. During the spring and early summer they may be seen feeding at almost any time of the day on the green patches of herbage among the higher crags and snow-fields, only taking a siesta for a few hours at a time. In the dead of winter they are found much lower on the mountain-sides. Provided they do not see the hunter, they are not always scared away by firing, probably owing to their being so accustomed to hearing the noise of falling rocks and

avalanches. And sometimes they get so bewildered by the echoes of a shot, that they give time for several easy chances before making up their minds to be off. If one of them, however, catches only a glimpse of anything suspicious, a warning whistle at once sends off the whole herd, although they often depart very leisurely, even after being shot at. Ibex sometimes congregate in large numbers, but they are usually found in flocks of from six or seven to twenty or so, the older bucks often herding separately, except during the rutting-season. Despite the quantities that are shot, killed by avalanches, and by those terrible foes to all Himalayan game, the wild dogs, there appears to be little decrease in their numbers on the more sequestered hunting-grounds; for they are very prolific, each doe having as

a rule a pair of kids every summer. The villagers train their dogs to hunt them down, when the ibex become so stupefied with terror that they are easily approached and shot."

The foregoing account refers to the habits of this ibex in the Kashmir district, and it accords in the main with an earlier one from the pen of General Kinloch.

The latter writer states that ibex but seldom come as low as the upper limits of forest; and even during the winter "do not, as a rule, descend very low, but resort to places where, from the steepness of the hillside, the snow does not lie in any quantity. Here they may be detained for weeks by a heavy fall, picking a scanty subsistence from the scattered tufts of withered herbage that here and there crop out of the crevices of the rocks. At this season males and females herd together; but as the snow melts and the time for the birth of the young approaches, the old males forsake the females altogether, and, as the summer advances, retire to the most inaccessible mountains, frequently sleeping during the day above the limits of vegetation, and descending great distances to feed in the mornings and evenings. The best time to shoot ibex is when the young grass is just beginning to sprout along the margin of the snow in May and June; after the hardships and frequent long fasts of winter they feed greedily on the fresh young shoots, and in secluded spots may be found lying down on the grassy slopes during the day."



ARABIAN IBEX.

The same writer proceeds to observe that, although excessively wary, the Himalayan ibex, on account of the broken nature of the ground it frequents, is not very difficult to approach within shooting distance. From our own personal observation and the accounts of the natives of the secluded valleys around

Kashmir, we are inclined to believe that the Himalayan ibex is in the habit of descending to lower levels than is admitted by General Kinloch; and we have been told that in the valleys of Wardwan and Tibet numbers are killed at this season in the snow quite close to the villages. On one occasion, during the summer, we observed a small flock of ibex driven down from the heights by a sudden snowstorm to the level of the high-road between Kashmir and Ladak, in the valley of the Indus. In 1854 Colonel Markham wrote that in Kashmir ibex might be seen in flocks of a hundred or more, but nothing like these numbers are found at the present day; and, in spite of the statement of General Macintyre, it appears to us that in the immediate neighbourhood of Kashmir this magnificent animal is becoming rapidly scarcer.

The bucks descend from the higher crags to join the does about October, the pairing-season taking place during the winter; and the young are born in May and June, or about a month earlier than is the case with the Alpine species. To the natives of Kashmir the ibex is known as the kel, while in Baltistan and Ladak it is termed skin, or iskin.

The third representative of the group is the Arabian or Sinaitic Arabian Ibex, ibex (*C. sinaitica*), locally known as the beden. This goat is found in the Sinitic Peninsula, in portions of Palestine, and in Upper Egypt; it is common in Arabia Petraea, but more rare in Palestine proper, and never appears to have extended northwards of the Lebanon, where a few still remain. In Egypt its southern limit is approximately marked by the tropic of Capricorn. This species is distinguished from the Himalayan ibex by the horns being more compressed, and having the knobs on the front surface arranged at less regular intervals. The general colour of the fur is yellowish brown, with dark markings on the back, chest, and front of the legs; the under-parts and the hinder-surface of the limbs being whitish. In well-grown adult males the horns may attain a length of 36 inches along the curve, and Sir E. G. Loder has a pair almost 39 inches in length. The habits of the animal appear to be similar to those of the others.

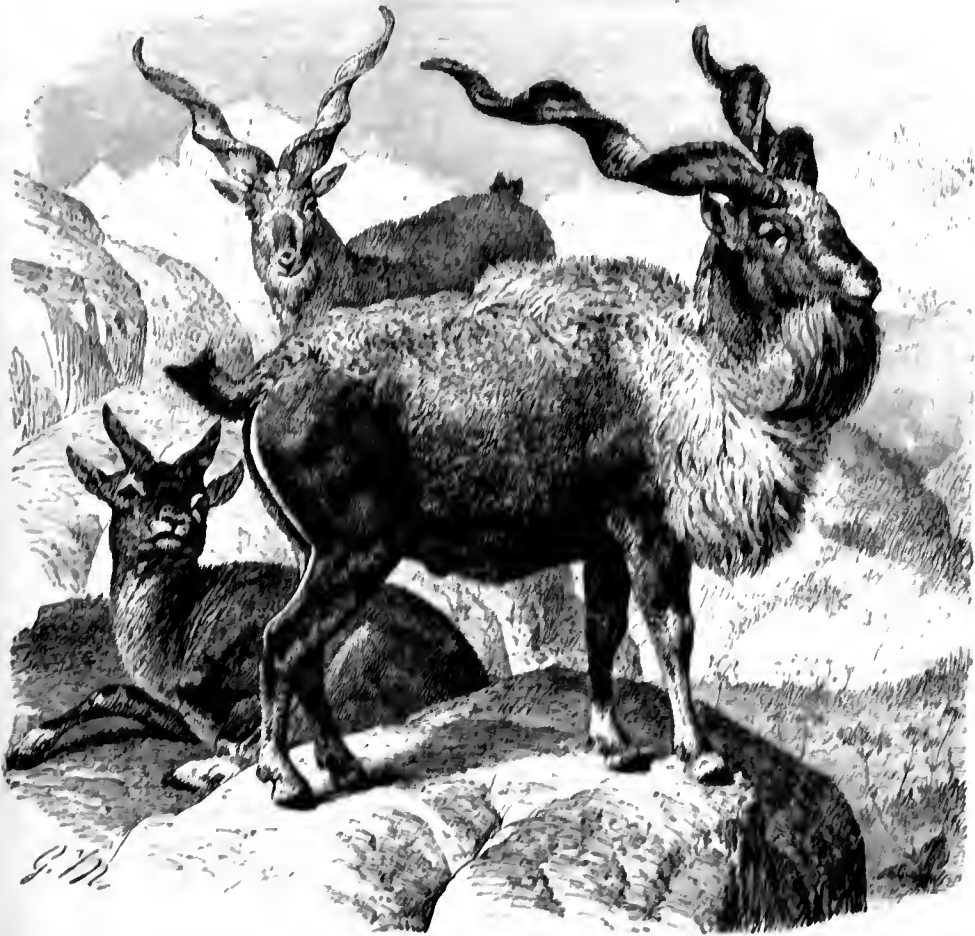
Abyssinian Ibex. Lastly, there is the little-known Abyssinian ibex (*C. walie*), from Abyssinia, distinguished from the others by the curvature of its horns, and the presence of a protuberance in the middle of the forehead.

THE MARKHOR (*C. falconeri*).

The Himalayan markhor (literally snake-enter), or spiral-horned goat, brings us to the last representative of the genus *Capra*, and one distinguished from all the others by its upwardly-directed and spirally-twisted horns, and also by the extension of the beard on to the chest and shoulders. In the latter respect this species reminds us of the arui among the sheep, although the markhor agrees with other goats in the shortness of its tail. The markhor is further remarkable for the enormous amount of variation in the form and size of the horns; one variety having them twisted in the form of a corkscrew, with not more than one and a half complete turns, while in another they are twisted on their own axis in the form of a screw, which may have as many as three complete turns. These varieties were formerly regarded as constituting distinct species, but since they are more or

less completely connected by intermediate forms like those represented in our illustrations, they are now generally regarded as the extreme developments of one very variable species. The horns of the varieties with a corkcrew like twist are the finest trophies yielded by any of the goats.

According to General Kinloch, the male markhor may stand nearly 3 feet 8 inches at the withers, although an adult Gilgit specimen, measured by Col. J



THE MARKHOR, CAROL VARIETY (♂, DR. SIDE).

Biddulph, measured only 3 feet $2\frac{1}{2}$ inches. The magnificent beard, extending in the adult males on to the chest and shoulders, and sometimes reaching nearly to the knees, is black in front and grey behind; in the young bucks and the does at all ages it is confined to the chin. The fur has but little or no pashm, and in summer is of a reddish brown colour, but becomes grey in winter; it is paler on the under-parts, and the lower portions of the front of the legs have a dark stripe. In summer the very old males become whitish all over; while the young are uniformly greyish brown, except for a dark stripe along the back. Owing to the

variation of the horns in the different races, it is somewhat difficult to give a description which will hold good for them all. They are, however, much compressed, placed close together at the base, and spirally twisted, with a keel both in front and behind. The front keel, which tends to become rounded in old animals, at first turns outwards in each horn; and the sharp back keel twists forwards to form the prominent front ridge of the first turn of the spiral. The length varies greatly in the different races. The females have small horns with a slight twist.

Distribution. The markhor is first met with in the Pir Panjal range, forming the outer boundary of the valley of Kashmir, but does not extend to the eastwards of the valley of the Chinab river. To the north and north-west of the valley of Kashmir it extends into the districts of Baltistan, Astor, and Gilgit; and it is also found in many of the ranges of Hazara and Afghanistan, and likewise in the neighbourhood of Quetta.

Varieties. Four distinct varieties of the markhor are recognised by Mr. Blanford, and are characterised as follows:—First of all, we have the typical Astor and Baltistan markhor, in which the horns form a very open spiral, never forming more than one and a half turns. The horns are extremely massive, and attain a great length. Mr. Otho Shaw has specimens measuring 49 and 55 inches in length along the posterior keel; and it is probable that an example with a length of 63 inches belonged to this variety. Next we have the Pir Panjal markhor, of which the horns are represented in the woodcut on the next page. Here the spiral is less open, and may form from one to two complete turns. This race extends across the Jhelam river into the Kajnag range, and from thence probably into Hazara and Gilgit, where it passes into the third variety. Mr. Shaw has a pair of horns measuring 45 inches along the curve, and others have been recorded of 50 inches and rather over. In the third or Cabul variety, which is the one represented in our first illustration, the horns are almost straight, but still have a slight spiral, with two complete twists. Specimens have been measured with a length of 44 inches, but it is said that as much as 60 inches have been recorded, measured along the curve. Lastly, we have the markhor of the Suliman range, on the eastern frontier of Afghanistan, in which the horns are generally perfectly straight, with the front and back keels wound round in a sharp spiral, which may form from two to three and a half complete turns. In the largest recorded head the length along the hind keel was 49 inches. This variety is considerably inferior in size to the other, and has a smaller beard.

Habits. The different varieties of the markhor exhibit some diversity in their habits, owing to the varying nature of their native districts; General Kinloch remarking that while the open-horned varieties inhabit lofty pine-clad ranges, whose summits are generally wreathed in snow, the straight-horned Suliman race has its home among barren and rocky hills of trifling elevation, where the heat during the summer months is frequently intense.

Like other goats, markhor go in small flocks, the males generally keeping apart from the females. General Kinloch remarks of the male that "his flowing black beard, and long shaggy mane, falling from his neck and shoulders to his knees, give him a most imposing appearance; and as he stands to gaze on some jutting rock on the face of a rugged precipice, overhung by dark pine trees, no

sportsman nor lover of nature can fail to be struck with admiration at his noble bearing. He is powerfully and compactly made, and, in spite of his weight, he has perhaps no equal in traversing difficult and dangerous ground. I know of no animal whose pursuit habitually entails so much difficult climbing, and to be successful one must occasionally venture into places where no less inducement would tempt one to run the risk. Old male markhor are extremely difficult to find, especially where they have been frequently disturbed. Unlike the ibex, which keeps to the rugged crags and steep ravines above the limits of the forest, the markhor delights in rocky forests, and although it occasionally comes out into the open glades, it seeks concealment as much as possible."

This description applies to the markhor of Kashmir and Astor; but in Afghanistan the animal inhabits bare and rugged hillsides, owing to the general absence of forest in that country. The ground haunted by markhor in many parts of Kashmir territory is of the most loose and rotten description, which renders stalking decidedly dangerous. Not unfrequently markhor are found with one or both horns much broken, but whether this is due to accidents from landslips and avalanches, or to combats between one another, does not appear to be ascertained. As already mentioned, the Suliman markhor is frequently found at a comparatively low elevation; and it appears that in all localities this goat does not bear extreme cold so bravely as its cousin the ibex, and that in winter it always descends to the more protected valleys. This sensitiveness to cold is doubtless correctly attributed by Colonel Biddulph to the absence of under-fur, or pashm, in the markhor.



HEAD OF MARKHOR; PIR PANJAL VARIETY.

The agile habits of this goat were well exhibited by a buck formerly kept in the London Zoological Gardens, which, in spite of the weight of a heavy chain, was found nearly every morning mounted on the top of the high wall surrounding his enclosure. In captivity markhor breed freely, the number of young at a birth being either one or two. It does not appear to be ascertained when the young are born in the Pir Panjal range, but in the districts of Astor and Gilgit they are produced in May and June. Markhor have frequently interbred with domestic goats; and it was formerly considered that the spiral-horned varieties of the latter traced their parentage directly to this species. In domestic goats, as

already mentioned, the horns are almost invariably twisted in the opposite direction to those of the markhor, although Mr. Blanford states that there are occasionally exceptions. It is, however, not improbable that some races of domestic goats may have a larger or smaller proportion of markhor blood.

The markhor appears to be one of the oldest types of wild goat, since a fossil species, which cannot at present be satisfactorily distinguished from the living one, occurs in the Pliocene rocks of the Siwalik hills at the foot of the Himalaya.

THE TAHR AND THE NILGIRI GOAT.

Genus *Hemitragus*.

The Himalayan goat, known as the tahr (*H. jemlaicus*), together with an allied species from Arabia, and a third from the Nilgiri hills of Southern India, differ so markedly from the true goats that Mr. Blanford considers they should be placed in a genus by themselves. All these goats are utterly devoid of a beard, and also distinguished by having the extremity of the muzzle naked. Their skulls are longer and narrower than in the true goats, with the sockets of the eyes less prominent; and the horns are relatively short, and but little smaller in the does than in the bucks. In form the horns are compressed and angulated in front, with their bases quite close together; and they curve backwards from the plane of the forehead. Neither of the species have glands in the fore-feet.

Tahr. The Himalayan tahr, which is represented in our illustration, is readily distinguished by the form of the black horns, which have their lateral surfaces flattened and shelving regularly up to the sharp and beaded keel on the inner front border; they diverge regularly from their bases, at the same time curving sharply backwards, with a slight inward inclination at the tips. On the head the hair is short, but it becomes longer on the body, and in old bucks is so lengthened on the neck, chest, and shoulders as to form a long shaggy mane reaching below the knees. There is considerable individual variation in colour, but the general tint of the hair is dark or reddish brown; old males being generally very dark, although pale-coloured individuals of both sexes are not unfrequently met with. The face and the front of the limbs are very dark, in some instances almost black; and old males have an indistinct dark line down the middle of the back. In young animals the colour is a uniform greyish brown; and the kids are reported to be very pale coloured. The female tahr differs from all other goats, as well as from sheep, in having four teats.

In height the male tahr varies from 3 feet to 3 feet 4 inches at the shoulder; the does being much smaller. Good specimens of the horns vary from 12 to 15 inches in length, measured along the curve; but a pair has been recorded with a length of 16½ and a basal girth of 10½ inches. In the does the length of the horns is seldom more than 10 inches.

Distribution. This goat is found throughout the higher forest-regions of the Himalaya, from the Pir Panjal range on the outer side of the valley of Kashmir in the north-west to Sikkim in the south-east, but is unknown in the arid Tibetan districts of the interior. Tahr is the native name by which it is

known in the Western Himalaya, but in Kashmir it is termed kras, while in Nipal it goes by the name of jharal. Quite recently a second smaller species, with only two teats, has been discovered in Arabia; while a fossil tahr occurs in the rocks of the Siwalik Hills at the foot of the Himalaya.

Habits. In spite of the small size of its horns, the tahr is decidedly a fine-looking animal; and it is plentifully distributed over many parts of the Himalaya. Although in the Pir Panjal range tahr are often found on the same ground as markhor, in other districts they frequent almost worse ground, and we



THE HIMALAYAN TAHR ($\frac{1}{3}$ nat. size).

have known many instances where specimens have been completely smashed by falling down precipices after they were killed. After mentioning that the tahr resembles the markhor in its forest-loving habits, General Kinloch observes that "although it sometimes resorts to the rocky summits of the hills, it generally prefers the steep slopes which are more or less clothed with trees. Female tahr may frequently be found on open ground, but old males hide a great deal in the thickest jungle, lying during the heat of the day under the shade of trees or overhanging rocks. Nearly perpendicular hills with dangerous precipices, where the forest consists of oak and ringal-cane, are the favourite haunts of the old tahr, who

climb with ease over ground where one would hardly imagine that any animal could find a footing."

The old male tahr generally herd separately from the females during the summer, but about October the two sexes come together; and it is believed that the kids are born in June and July, only a single one being produced at a birth.

Nilgiri Goat. The Nilgiri wild goat (*H. hylocrius*)—the warri-atu of the Tamils, and the Nilgiri ibex of English sportsmen—is a southern species inhabiting the Nilgiri and Anamalai Hills, and the so-called Western Ghats as far south as Cape Comorin. It is generally found at elevations of from four thousand to six thousand feet above the sea, but occasionally somewhat lower down. This species may be distinguished at a glance from the tahr by the form of the horns, and the absence of the shaggy mane which forms such a conspicuous feature on the fore-quarters of the males of the latter. Instead of being flattened externally, the horns of this goat have their outer side highly convex, and thus have a distinct anterior surface, internally to which there is a slight ridge; moreover, for some distance the two horns run parallel to one another, after which they diverge gradually. The hair is short, thick, and coarse; the males having a short, stiff mane on the back of the neck and withers. The general colour is dark yellowish brown above, with a darker stripe down the back; while the underparts are paler. The females and young show a more or less decided grey tinge. In height old males of the Nilgiri goat stand from $3\frac{1}{4}$ feet to $3\frac{1}{2}$ feet at the shoulder; the horns measuring from 12 to 16 inches in length along the curve, although in one instance a length of 17 inches has been recorded.

Writing of the habits of this species, Mr. Blanford observes that "the Nilgiri goat is found usually in herds of from five or six to fifty or sixty amongst the crags and rocky precipices that border the Nilgiris and other high ranges in the extreme south of India. It keeps above the forest, and but rarely enters woods. I have more than once seen these animals feeding on the grassy hills at the top of the Kundahs west of the Nilgiris, but their usual haunts are the grassy slopes and precipitous crags on the edges of the plateau; they feed on the former in the mornings and evenings, and rest on ledges amongst the cliffs during the day. They are quite as wary and sharp-sighted as tahr or markhor, and just as nimble and alert on precipitous ground. An old doe, as with other goats, usually acts as sentinel to the herd, and they always appear to suspect danger from below and not from above." The young appear to be born almost at any season of the year; and it is stated that there are generally two at a birth.

How this species originally reached its present habitat, so remote from that of its allies, is not very easy to understand; but the occurrence of a fossil goat apparently allied to this group in Perim Island, in the Gulf of Cambay, may eventually aid in solving the problem.

In regard to the present distribution of this goat, a recent writer observes that it is still fairly abundant on the Anamalai and Travancore Hills; but has sadly decreased elsewhere owing to the war of extermination waged against it by the native pot-hunter and European shooter, who have alike been indefatigable in slaying the does and young all seasons of the year. The ibex, as it has been locally misnamed, has become so scarce on the Nilgiris that its destruction has

been wholly prohibited since last year, but it is feared that this prohibition has been effected too late to prevent the extinction of the few now left, for the leopards are most deadly and persistent enemies, and it is a very difficult matter for a small herd to hold its own and increase in spite of their depredations.

THE GORALS.

Genus *Cemas*.

The goral (*Cemas goral*) of the Himalaya is our first representative of an assemblage of mountain-haunting Ruminants which to a great extent connect the goats with the antelopes. Most of these animals have a more or less goat-like build,



THE GORAL ($\frac{1}{10}$ nat. size).

goat-like teeth, short tails, relatively small cylindrical horns, and no beards. The goral is a relatively small creature, standing only 27 inches at the shoulder, and having somewhat stout limbs, and rather coarse short hair, which becomes elongated into a slight crest along the back of the neck. Its general colour is brown, with a more or less rufous or grey tinge; but there is a dark stripe from the nape of the neck to the black tail, and another down the front of each leg, while the throat is white. The muzzle is naked; and the face, as in the goats, has no gland below the eye, while the skull lacks any depression in the same region. The short, black, and conical horns curve regularly backwards, and are marked, except at the tip, by a number of small and irregular rings. In the bucks they may vary

from 6 to 8 inches in length, but a pair has been recorded of upwards of $9\frac{3}{4}$ inches. The horns of the does are only slightly smaller than those of the bucks.

Distribution. The goral is found throughout the outer ridges of the Himalaya, from Kashmir to Bhutan, at elevations of from three thousand to eight thousand feet. In Eastern Tibet its place is taken by the ashy goral (*C. cinerea*) and the grey goral (*C. grisea*); while in Northern China and Amurland it is represented by the long-tailed goral, distinguished by its longer tail.

Habits. The Himalayan goral is generally found in small parties of from four to eight individuals; but sometimes these animals associate only in pairs, and old bucks appear to be generally solitary. They frequent rugged grassy hills or rocky forest-clad ground; and during cloudy weather feed throughout the day, but when fine, only in the morning and evening. Where one goral is seen, there others will almost certainly be found in the neighbourhood; and these animals but rarely forsake their feeding-grounds. When alarmed, they utter a kind of hissing snort. General Macintyre writes that "goral-stalking in the precipitous and broken ground on the middle ranges [of the Himalaya], is perhaps the pleasantest though not the grandest kind of mountain sport. The amount of stiff climbing it entails is quite enough to give it zest, without making it excessively laborious. The sportsman can generally return to his tent to rest during the heat of the day, whilst the goral are doing likewise, hidden away among the shady recesses of the rocks, and he can always get back at night to a comfortable bed."

THE SEROWS.

. Genus *Nemorhædus*.

Nearly allied to the gorals are the more shaggy animals known as serows, or goat-antelopes, which are likewise peculiar to South-Eastern and Eastern Asia. Although resembling the gorals in their general build, their naked muzzles, short tails, and the presence of four teats in the females, the serows are distinguished by having a gland beneath the eye, and a corresponding shallow depression in the skull for its reception. Moreover, the plane of the forehead passes imperceptibly into that of the region behind the horns, whereas in the gorals the two are separated by a distinct angle.

The common serow (*Nemorhædus bubalinus*) is a Himalayan species extending from Kashmir to the Mishmi Hills, where it is found at elevations of from six to twelve thousand feet. It is much larger than the goral, standing about 37 inches at the shoulders, and the horns of bucks generally measuring from 9 to 10 inches in length, although they may reach as much as $13\frac{1}{2}$ inches. The serow is rather an ugly-looking animal, with large ears, and coarse and somewhat thin hair of moderate length, which forms a kind of crest along the neck. The head and neck are black, and the rest of the hair of the upper-parts black or dark grey, with a more or less distinct grizzle; the muzzle, chin, and inside of the ears are white, and the under-parts are also whitish, while the flanks, chest, etc., are rusty red. The black horns curve regularly backwards, and, in addition to

numerous rings, are marked by a number of longitudinal striae. The two sexes are very similar.

The Burmese serow (*N. sumatrensis*), which inhabits hilly districts from the Eastern Himalaya to Yunnan and Eastern Tibet, and thence to Siam, Burma, the Malay Peninsula, and Sumatra, is only distinguished by its redder colour, and perhaps rather smaller size. The other two species are the Japanese serow (*N. crispus*) from Japan, and Swinhoe's serow (*N. swinhoei*) from the island of Formosa; both of which are distinguished by their smaller size, which is about equal to that of the goral.

Habits. The habits of all the serows are probably very similar. Writing of the Himalayan species, General Kinloch observes that it "has an awkward gait, but, in spite of this, it can go over the worst ground; and it has, perhaps, no superior in going down steep hills. It is a solitary animal, and is nowhere numerous; two or three may be found on one hill, four or five on another, and so on. It delights in the steepest and most rocky hillsides, and its favourite resting-places are in caves, under the shelter of overhanging rocks, or at the foot of shady trees. Although very shy and difficult to find, the serow is a fierce and dangerous animal when brought to bay. I have even heard of an unwounded male charging when his mate had been shot. It is said that a serow will sometimes beat off a pack of wild dogs, and I believe that serow and dogs have been found lying dead together. When disturbed, the serow utters a most singular sound, something between a snort and a screaming whistle, and I have heard them screaming loudly when they had apparently not been alarmed." General Macintyre relates that on one occasion "a female serow had been shot by a sportsman, when, on his native follower approaching to secure it, a male companion rushed out from the dense cover hard by, and, going for the man, sent him rolling downhill with a butt from its horns."



HORNS OF HIMALAYAN SEROW.

THE TAKIN.

Genus *Budorcas*.

One of the most remarkable members of this group is the little-known takin (*Budorcas taxicolor*), from Eastern Tibet and the Mishmi Hills, which is evidently allied to the serow, although with very differently shaped horns. The takin is a heavily-built and comparatively large animal, standing 3½ feet at the shoulder, with stout limbs, large lateral hoofs, and a small goat-like tail. The muzzle is

covered with hair, except a small spot at the extremity; and the profile of the face is convex. The horns are black and thick in both sexes; in the males they rise



UPPER PART OF SKULL AND HORNS OF MALE TAKIN.
(From Hume, *Proc. Zool. Soc.*, 1887.)

(as in our figure) close together, and at first curve outwards, after which they make a sharp turn and are directed straight backwards. According to Mr. A. O. Hume, the horns of the female are placed further apart at the base, and curve outwards and then backwards without any marked angulation; but other writers state that they are similar in shape to those of the males, but smaller and thinner. Male horns vary in length from 20 to 24 inches, with a basal girth of 9 or 10 inches. The head of the takin is black, but the colour of the coarse hair

of the body varies from yellowish to reddish brown mingled with black. Very little is known of the habits of this Tibetan ruminant, but it appears to be found either singly or in herds.

THE ROCKY MOUNTAIN GOAT.

Genus *Haploceros*.

The so-called goat of the Rocky Mountains (*Haploceros montanus*), which is the third and last representative of the *Bovidae* inhabiting America, is another animal nearly allied to the serow. This creature is about the size of a large sheep, and averages 100 lbs. in weight. It has very short and stout legs, terminating in broad and blunted hoofs, pointed ears, and jet black horns, curving backwards, and ringed for about half their length, but smooth above this. The body is covered with a long coat of white hair, which is nearly straight, and falls on the sides of the body and limbs, but is erect along the middle of the back, and as it becomes longer over the withers and haunches the animal looks as though it had two humps. Beneath the hair there is a thick coat of wool. There are no glands below the eyes. In length the horns vary from 6 to 10½ inches; and the skeleton is remarkable for the extreme shortness of the cannon-bones.

Distribution. The range of this animal extends through the Rocky Mountains from about lat. 36° in California at least as far north as lat. 62°, but Mr. J. Fannin believes that it will be found as far north as the mountains reach. The same writer observes that it "is extremely abundant in British Columbia, ranging from its southern boundary to the watershed of the Arctic Ocean, and from the coast-line to the Rockies. Here, amid nature's wildest scenes,

amid storm-swept cañons and beetling crags, amid steel-blue glaciers and snowy peaks, where the silence is seldom broken save by the rush of mountain torrent, the howling of the storm, or the crashing of the treacherous avalanche,—here, far removed from the trail of the ordinary hunter, the mountain-goat, solitary in its habits, and contented with its chaotic and gloomy surroundings, increases and multiplies.”

Habits. Although chiefly a mountain animal, this species is occasionally observed close to the sea-level, and has even been seen swimming salt-water estuaries or rivers. Such occurrences are, however, rare; and, as a rule, the Rocky Mountain goat lives above or close to the upper limits of forests. But when driven by hunger, these animals sometimes descend to lower levels in the forest, while they will not unfrequently traverse the lowlands separating one mountain or range from another. During the pairing-season in November and in the middle of winter they are gregarious, although not markedly so at other seasons of the year. As might be inferred, from their short and clumsy limbs, these animals have but little speed; and when disturbed they move leisurely off, trusting rather to concealment behind sheltering rocks than in rapidity of pace. Formerly the Rocky Mountain goat was much hunted by the Indians for the sake of its fleece, but now that the demand for blankets made from its wool has well-nigh ceased, the pursuit itself has been abandoned in many districts.

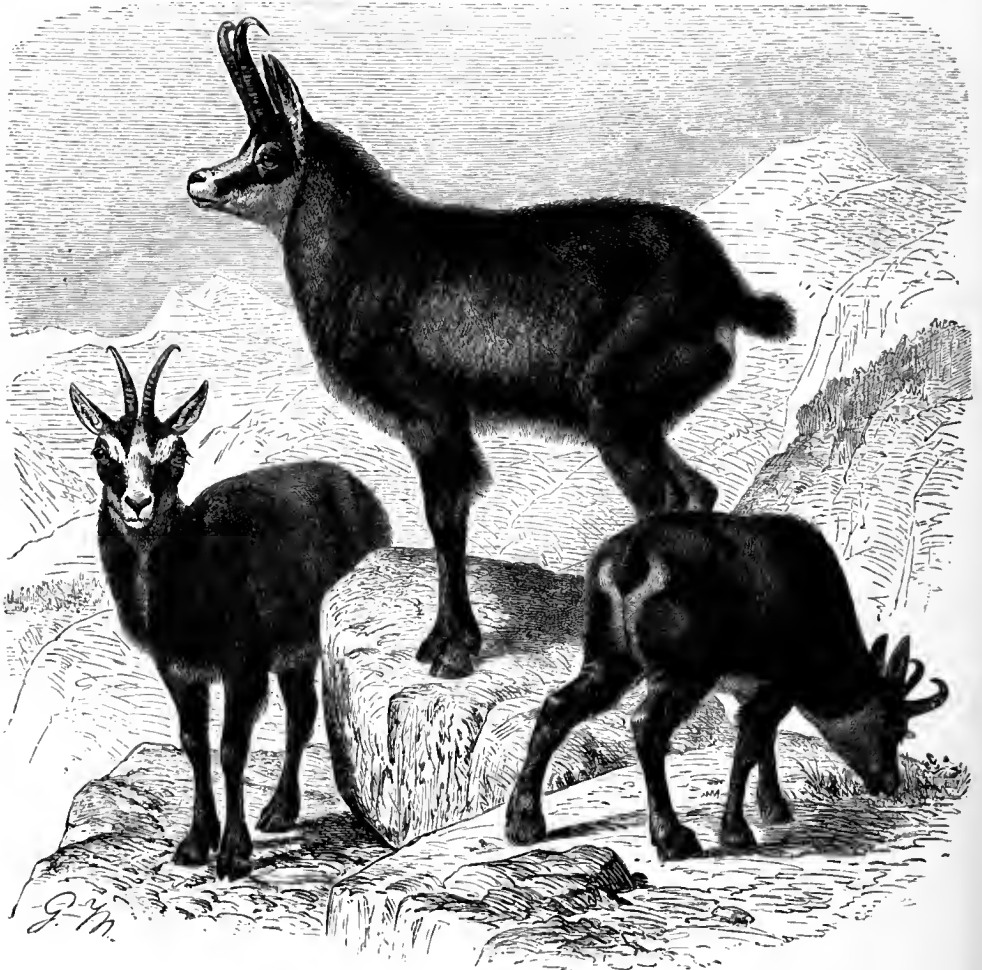
Although extremely agile among its native mountains, the Rocky Mountain goat, in spite of many statements to the contrary, does not appear to be a very wary animal. Indeed, Mr. Fannin states that it is, perhaps, the most stupid animal in the mountains, and little or no skill is required in hunting it. The great difficulty is in reaching the almost inaccessible places which it usually inhabits. The best time for hunting is in September and October, before the rainy season sets in, although the skins are not in their best condition till later on. In coloration this animal is unique among Ruminants; and is, indeed, one of the few mammals that are white at all seasons. Its white coat is admirably adapted to harmonise with the snows of its highest haunts, but would seem to be conspicuous when the animal is among dark rocks or on its grazing-grounds.

THE CHAMOIS.

Genus *Rupicapra*.

The last representative of the goat-like antelopes is the well-known chamois or gemse (*Rupicapra tragus*), of the mountains of Europe, readily distinguished from all the others by the short and cylindrical black horns rising for a considerable distance vertically from the forehead, and then bending sharply backwards and downwards in a hook-like manner. The chamois is a strongly-built animal, with relatively long and stout limbs, and a very short stumpy tail; in height it stands about 2 feet at the withers. The hair is close and rather long, with a thick woolly under-fur. During the winter the general colour is a chestnut-brown, paler on the face and under-parts, and there is a well-marked brown streak extending from below the eye nearly to the corner of the mouth; the tail being black. In

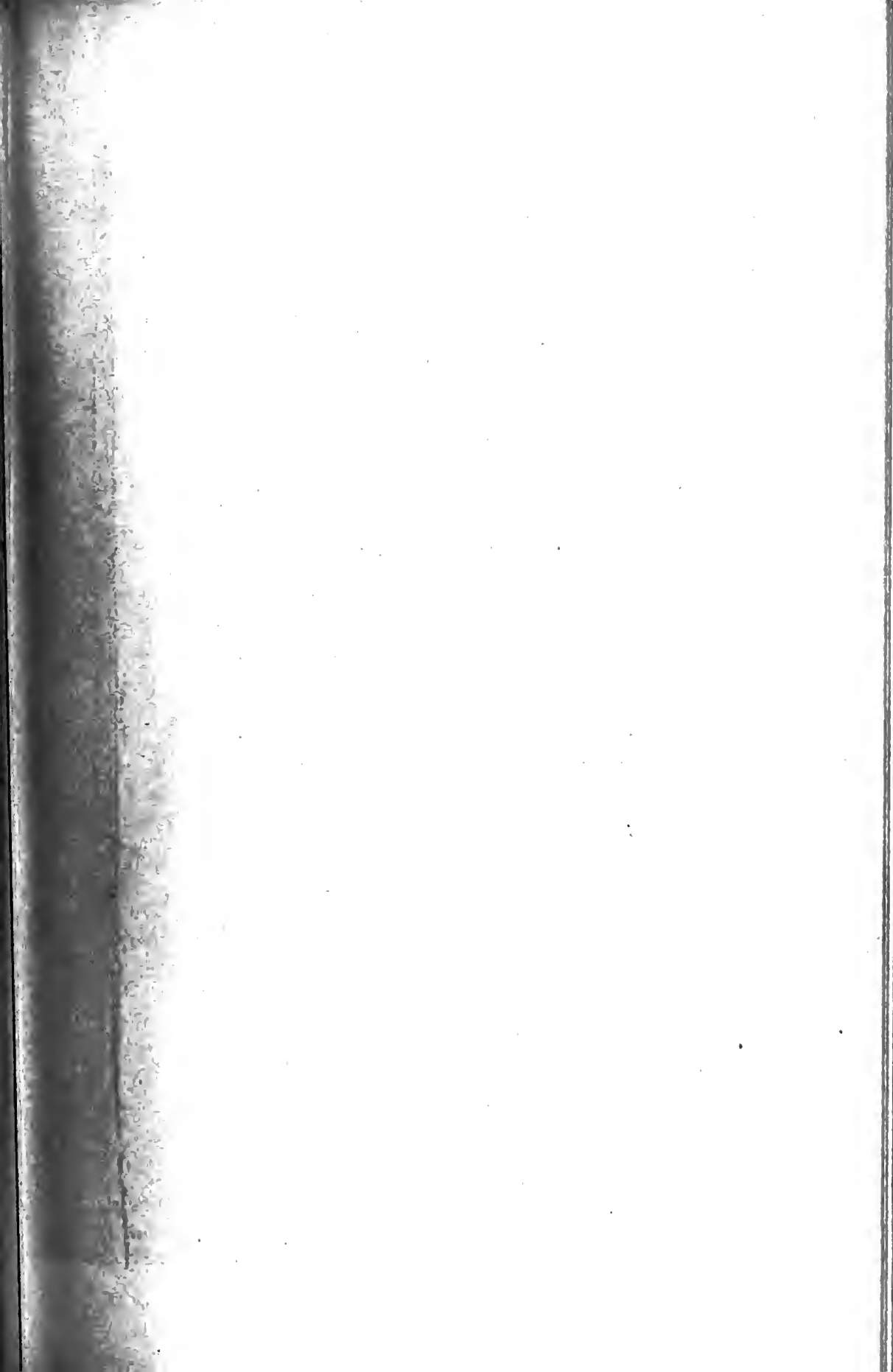
the summer the coat is lighter coloured, having in spring a more or less marked grey hue. The erect ears are sharply pointed; and the horns, except at their tips, are marked both by slight transverse rings and by longitudinal striæ. Fair-sized horns are about 7 inches in length, but some specimens measure as much as 9 inches, or rather more, while a few reach $10\frac{1}{4}$ inches. The weight of a buck chamois may vary from 50 to 70 lbs. Light-coloured, or even white varieties, are



THE CHAMOIS ($\frac{1}{2}$ nat. size).

occasionally met with. The face has a small gland below the eye, and there is a corresponding shallow depression in the skull for its reception; while the muzzle is completely covered with hair. The hoofs have their outer edges higher than the central portion, and are thus adapted for securing a firm foothold on rocks.

Distribution. The chamois has a wide distribution in the mountains of Europe, occurring in the Pyrenees (where it is known as the izard), the mountains of the coast of Spain, in Dalmatia and Greece, in the Carpathians, the





CHAMOIS AT BAY.

Swiss and Transylvanian Alps, the Caucasus, the Taurus Range, and in the mountains of Georgia. The Pyrenean izard is a smaller form, with shorter horns and a more foxy-red colour than the typical Alpine gemse; and the variety found in the Caucasus, where it is known as *atchi*, has also certain distinctive differences. Neither of these can, however, be regarded as more than local races. At the present day the chamois has become rare in the Swiss Alps, but in the Eastern Alps, in the districts of Bavaria, Salzburg, Styria, and Carinthia, it is far more common; while it is abundant on the precipitous summits of the central Carpathians. Fossil remains of the chamois are found in caverns at low elevations in several parts of the European continent, thus indicating very different climatic conditions from those now prevailing.

Habits. As regards its habits, the general notion is that the chamois is an essentially Alpine animal; that is, one frequenting the glaciers and snowy peaks above the forest-level. This, however, according to Brehun, is a mistaken idea; the truth being that the chamois is really a forest-dwelling animal, and that most individuals of the species live from year's end to year's end within the limits of the forest. A certain number during the summer always leave, however, the main flock, to take up their abode for a period of weeks or months among the glaciers and snow-fields above the upper limits of forests. These adventurous individuals are known to the hunters as glacier-chamois, in contradistinction to wood-chamois; but a short spell of severe weather is sufficient to drive even these back to the shelter of the forests. The favourite haunts of the chamois are the western and north-western slopes of the Alps in summer; while in the winter they prefer the spots with an easterly or southerly aspect.

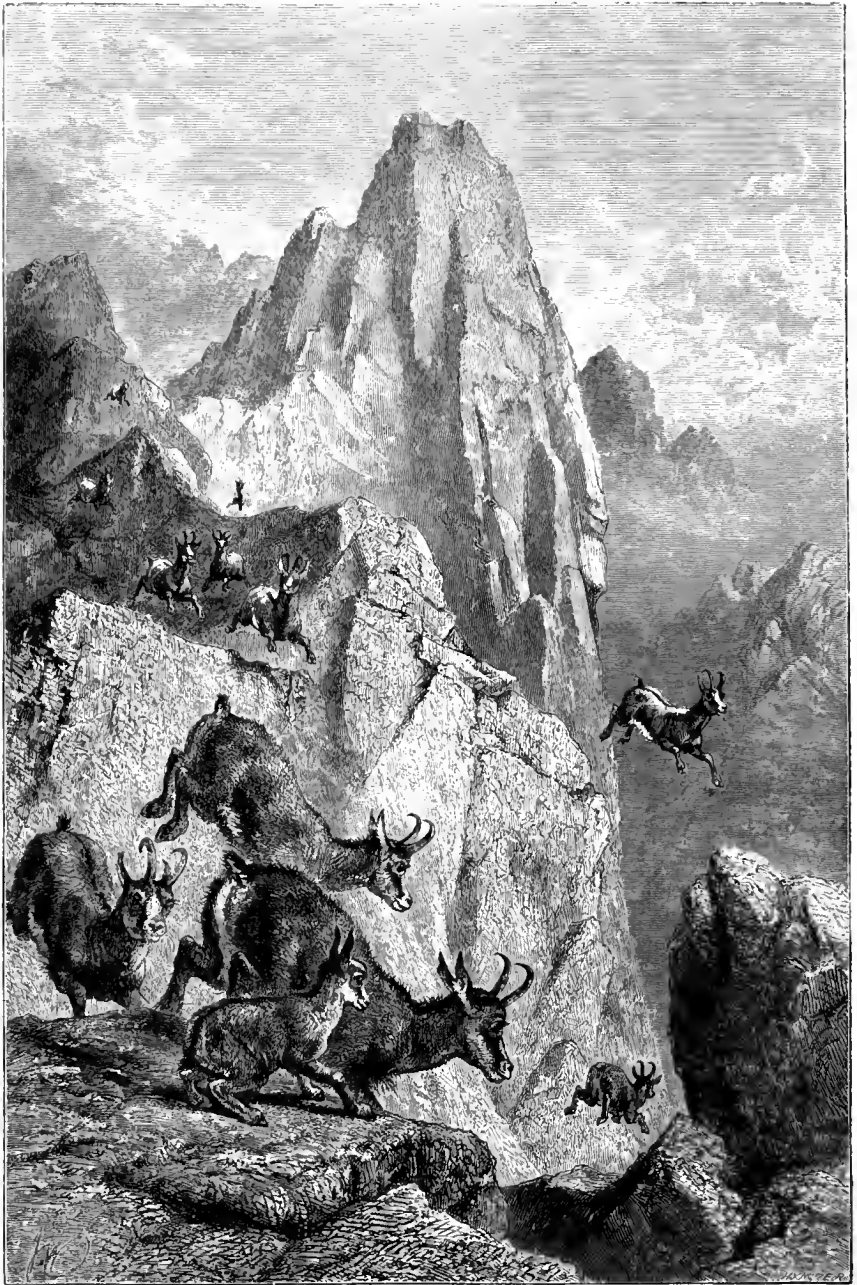
Chamois are essentially gregarious animals, usually associating together in herds of fifteen or twenty individuals. They repose during the night, but with the first glimmer of dawn commence feeding; towards the middle of the day they again seek the shelter of rocks or trees, where they lie in the shade till evening, when they once more issue forth to feed.

Their chief nutriment consists of lichens and the scanty mountain herbage. During the greater part of the year the old males live a solitary life apart from the flocks; but during the pairing-season in October and November they join the flocks of females, from which they drive away the young bucks. During this period the old bucks engage in fierce contests among themselves, which occasionally terminate fatally.

The young, generally one but occasionally two in number, are born in May or June, after a gestation of about twenty-eight weeks, and are clothed with a thick woolly coat of a reddish colour. When but a day old they are able to follow their dams almost anywhere; and in three months first show their horns. In three years they attain their full size; and it is stated that the span of life of a chamois will extend from twenty to twenty-five years, although this requires confirmation.

All who have seen chamois in their native haunts are agreed as to their extreme agility and wariness; and their sure-footedness has become proverbial. When alarmed, they utter a shrill whistling sound, which at once sets the whole flock in

rapid motion. A chamois is able to stand on the summit of a pinnacle of rock with all its four feet gathered into a space of the size of a crown piece; and as its



THE LEAP OF THE CHAMOIS.

sense of sight, smell, and hearing, are of the acutest, its pursuit taxes the utmost powers of the hunter.

ELAND.

Genus *Orias*.

With the large and handsome African animals known as eland, or impofo, we come to the first representatives of the extensive group of antelopes, which includes the whole of the remaining members of the bovine family. Although the term antelope is one in common use, and most of the members of the group are easily recognised, yet, owing to the number of generic types and the diversity of their structure, it is exceedingly difficult to distinguish antelopes as a whole from the oxen on the one hand and from the goats on the other; the transition to the former group being effected by means of the anoa, and to the latter by the goat-like antelopes just described. Antelopes are, indeed, the most generalised members of the present family now existing, and since they are also its oldest known representatives, it is probable that from them have been derived the more specialised types already treated of, so that the above-mentioned transitions are precisely what we might naturally expect to occur.

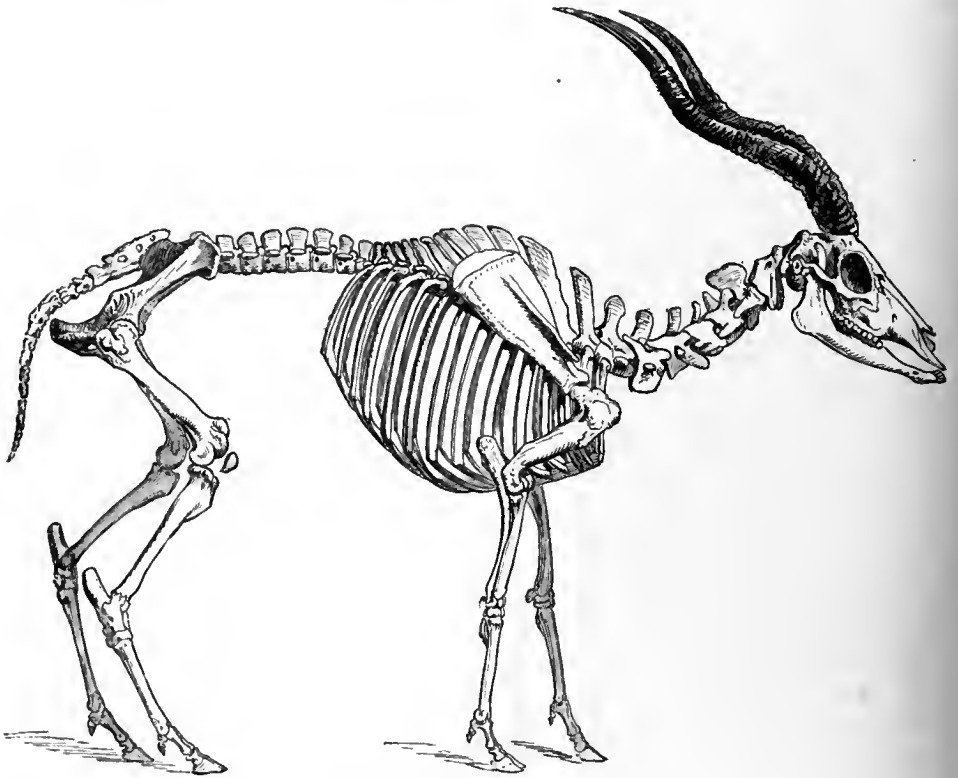


HEAD OF BULL ELAND.—After Nicolls and Eglington.

Characters of Antelopes. As a whole, antelopes are characterised by their graceful build, and by the head being carried considerably above the level of the back. The horns, which may or may not be present in the females, are generally long, more or less cylindrical, and often lyrate in shape; while they are frequently marked with prominent rings, and have an upright direction. Their bony internal cores, instead of being honeycombed, as in the oxen, sheep, and goats, are nearly solid throughout. These animals very generally have a gland beneath the eye, by which they are distinguished from the oxen and goats; but, as regards their teeth, some of them resemble the oxen, while others approximate to the sheep and goats.

Distribution. Antelopes (in the proper sense of the word) are strictly confined to the Old World; and by far the greater majority of them are now restricted to Africa, with the adjacent regions of Syria and Arabia. Indeed, if we except the widely-spread group of gazelles, the only antelopes found beyond those

regions are the black-buck, four-horned antelope, and nilgai of India, the saiga of Tartary, and the chiru of Tibet. It was not, however, always so, since in early times antelopes of African types were distributed over a large portion of India and Southern Europe; and it is still one of the problems of zoology to account satisfactorily for the disappearance of these animals from the latter regions. The introduction of antelopes into Africa appears to have been comparatively recent; but having once made good their footing on that continent they multiplied, both as regards individuals and species, in a manner quite unparalleled in any other region, the total number of African antelopes exceeding ninety. Unfortunately,



SKELETON OF THE ADDAX.

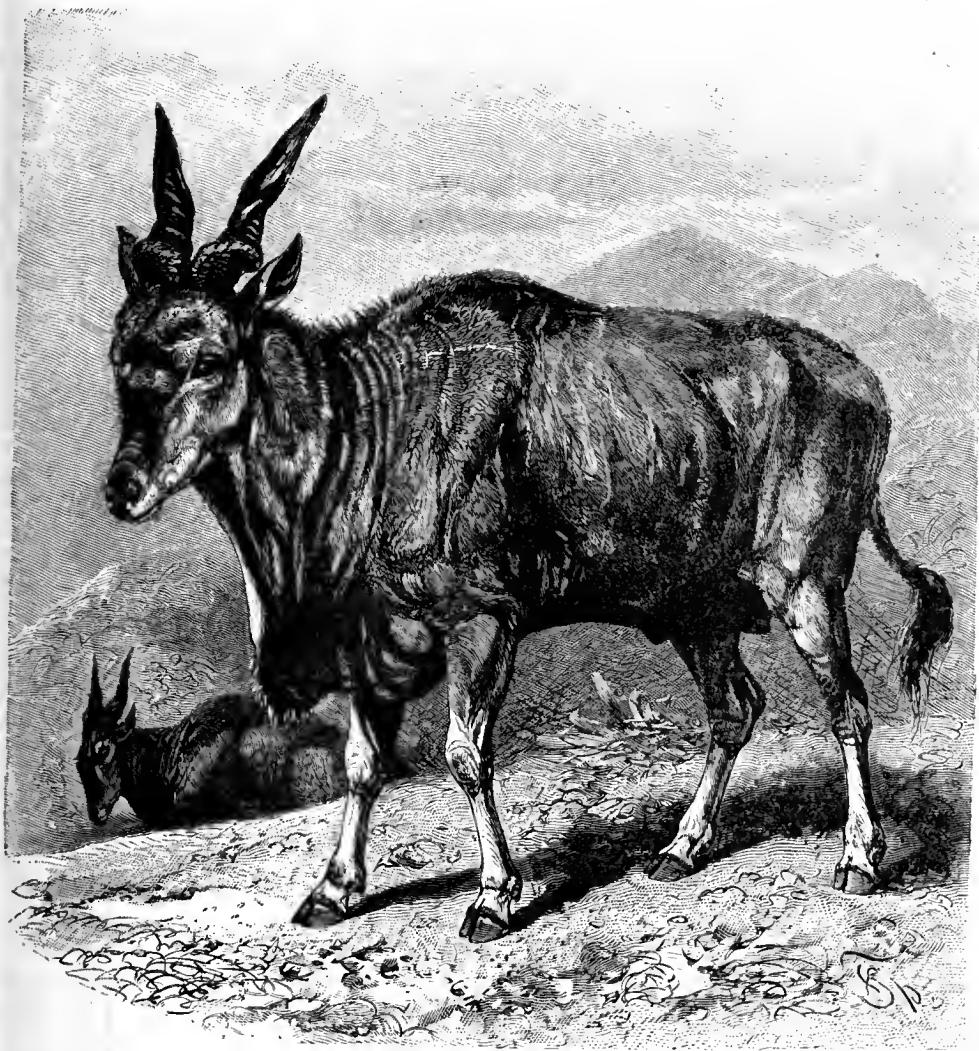
this profusion and exuberance of ruminant life, which, but a few decades back, characterised the dark continent, is rapidly disappearing before the advance of civilisation.

Eland.

The eland belongs to a group of large and almost exclusively African antelopes, characterised by the general absence of horns in the females, and by those of the male being devoid of rings, angulated in front, and usually spirally twisted. There is a small gland below the eye, the muzzle is naked, the tail long, and the upper molar teeth generally have short crowns.

Eland are the largest of all antelopes, and differ from the other members of the group in having horns in both sexes; these being spirally twisted on their own axis and directed upwards and outwards. The horns have a sharp ridge both in

front and behind, and are directed upwards and outwards in the plane of the face. The naked muzzle is broad, the gland below the eye small, and the tufted tail reaches below the hocks. Both sexes have a large dewlap; and the crowns of the upper molar teeth are low and broad. The common eland (*Orias canna*), which formerly ranged over the greater part of South, East, and Central Africa, is char-



THE ELAND ($\frac{2}{3}$ nat. size).

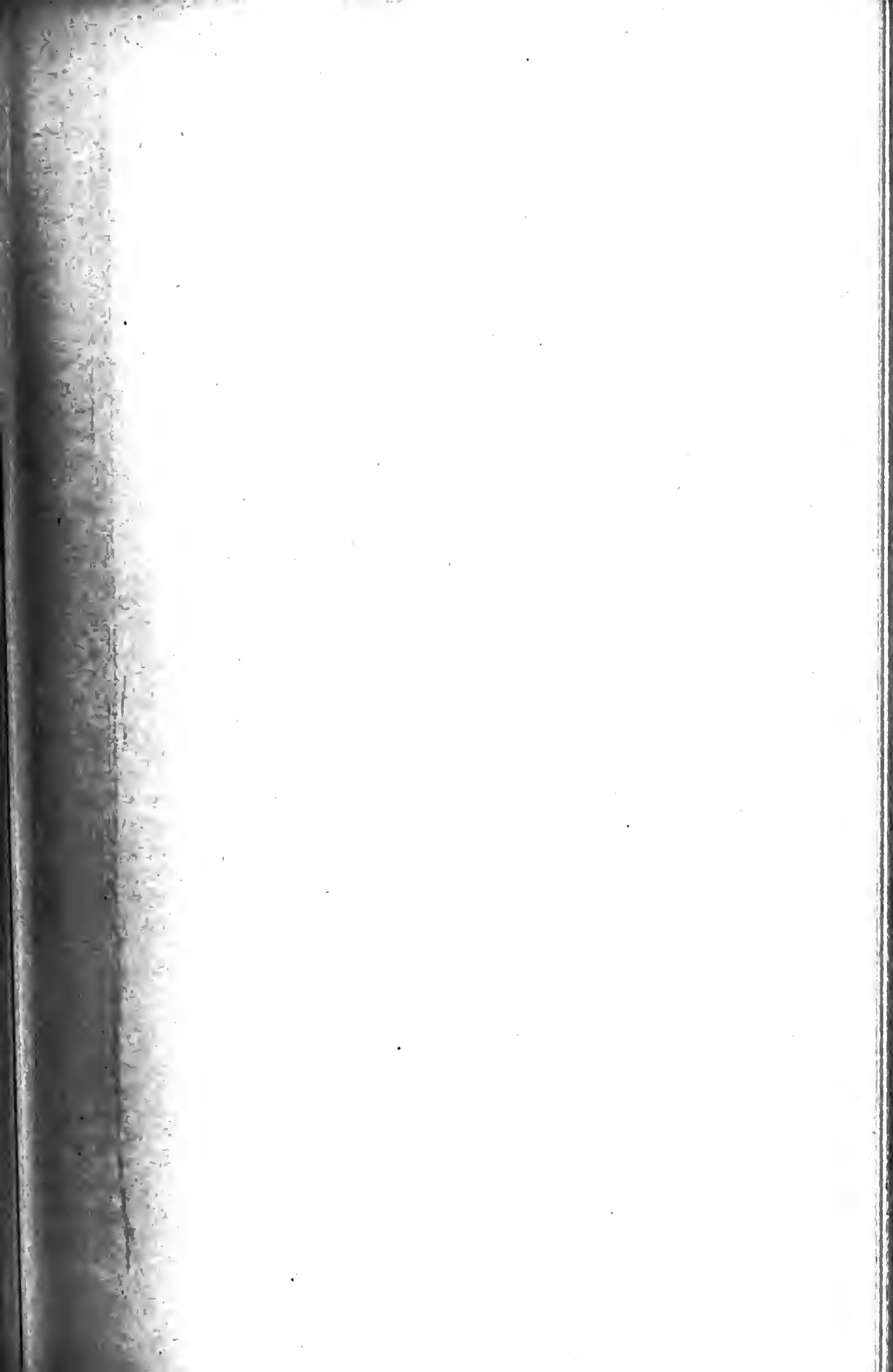
acterised by the horns of the cows being longer and thinner than those of the bulls. The bulls have a tuft of long dark brown hair covering the forehead; but the colour of the rest of the head and body varies from pale fawn to bluish grey; the blue tint being most marked in old individuals—more especially bulls, in which, owing to the scantiness of the hair, the colour of the skin shows through. In the southern part of its range the eland is uniformly coloured, but further north there occurs a variety in which the body is marked with vertical white stripes,

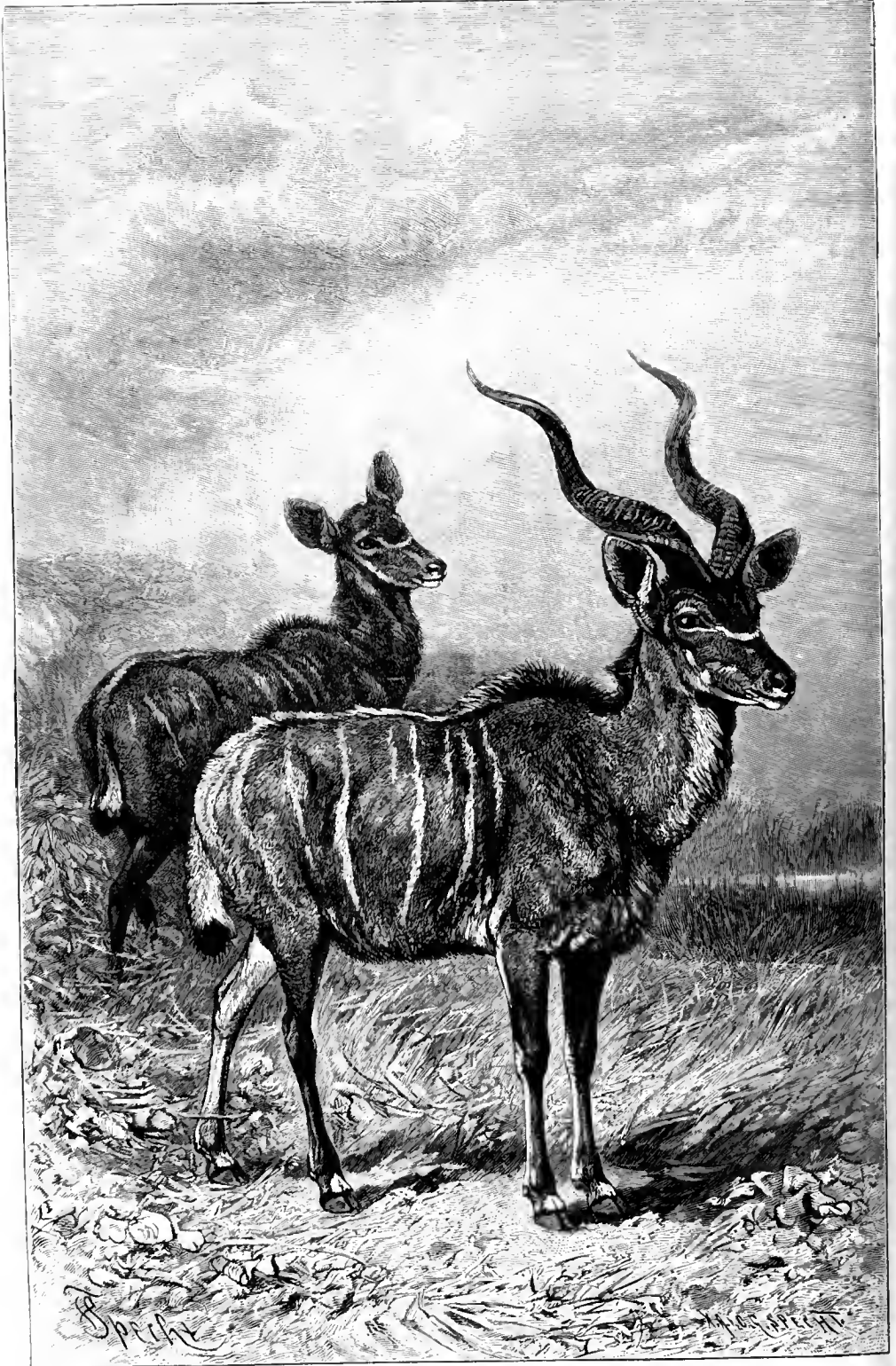
descending from a dark stripe on the back. The degree of distinctness of these stripes varies greatly in different individuals; and frequently in this variety there is a white stripe across the nose, while there is always a dark patch on the inner side of the knee. Mr. Crawshay states that in Nyasaland, among a single troop, individuals may be seen varying from a light tawny yellow to a slaty blue in very old age, while in some the stripes are clearly defined, in others faintly, and in others again they are not distinguishable at all. An average-sized bull eland shot by Mr. Selous stood 5 feet 9 inches at the withers, but some specimens are doubtless taller. Mr. Drummond states that the average weight varies from 800 to 1100 lbs., but that in old bulls it may reach 1400 or even 1500 lbs. The average length of the horns may be set down at 25 inches for bulls and 26 inches for cows; but Mr. Selous has recorded a length of 30 inches in the former and 34 inches in the latter. In old bulls the horns may be worn down to less than a foot in length.

Distribution. The eland was formerly distributed over all Southern and Eastern Africa, but has now disappeared from the Cape Colony, Natal, the Orange Free State, Griqualand West, and the Transvaal. A few years ago these antelopes were, however, abundant in the districts between the Chobi and Zambesi Rivers, as well as in the country to the north of the latter; while they are still plentiful in parts of Nyasaland, and are not uncommon in the Kilima-Njaro district. Their complete extirpation is, however, probably merely a matter of time; the animal being slaughtered on account of its hide.

Habits. Eland are found both in the desert-country, and in wooded districts, both hilly and flat. In Nyasaland Mr. Crawshay says that their favourite haunts are undulating, well-timbered country, where the grass is not too long, and where there are intervening open plains; as a rule, they visit the plains at night or in the early mornings to drink, and then wander back long distances to the forest, where they spend the hot hours of the day. In the great Kalahari Desert, where they are still common, Mr. Selous states, however, that eland go a long period without drinking any water, except that which they may obtain by eating water-melons and other plants. Eland are generally found in large herds, numbering from fifty to upwards of a hundred head, but solitary bulls or small parties of bulls are not unfrequently observed.

Elands are generally accompanied by "rhinoceros birds," which, in addition to their natural timidity, make them difficult to approach on foot. Consequently they are generally hunted on horseback. The bulls, when fat, can be easily ridden down by a good horse; but the cows have greater speed and staying power. When pursued, eland frequently leap high in the air. The calves are born in July and August; and it appears that the females do not breed oftener than once in every two years, so that the rate of increase is slow. When they have their calves with them, the cows will attack and impale dogs on their horns; but at other seasons both sexes are quite harmless. Mr. Selous states that the flesh of the eland has been very generally over-estimated; and during the dry season, when these animals often subsist entirely upon leaves, it is quite uneatable. In captivity the eland breeds freely; and it was at one time considered that it might be profitably acclimatised in England.





MALE AND FEMALE KUDU.

Abnormal Horns. Occasionally, cow-eland are found with one or both horns abnormally formed; such abnormal horns being long and nearly straight, with a triangular cross-section. Such a pair, measuring 30 inches in a straight line, were described a few years ago under the name of *Antilope triangularis*, and were supposed to indicate an extinct species of antelope, which was subsequently referred to a new genus.

Derbian Eland. The magnificent animal known as the Derbian eland (*O. derbianus*), replaces the common species on the West Coast in the districts of Angola and Senegambia. It is considerably larger than the southern and eastern form; and the bulls have a large dark brown mane and much finer horns. The horns of the cows are, however, relatively small. Male horns have been measured of $34\frac{1}{2}$ inches in length.

KUDU.

Genus *Strepsiceros*.

The graceful and beautifully marked antelopes known as kudu, of which there are likewise two species, are distinguished from eland by the absence of horns in the female, and by the cork-screw-like spiral formed by those of the male, as well as by the much shorter tail, which does not reach the hocks. The horns are characterised by the great development of the front ridge, and rise from the skull at an obtuse angle to the plane of the face. The neck is maned, and the throat may be furnished with a fringe of long hair. The body is marked with narrow vertical white stripes descending from a white line on the back; and there is also a white chevron on the face, together with white spots on the cheek, and splashes of the same colour on the throat and limbs. The hoofs are short.



HEAD OF KUDU.—After Nicolls and Eglinton.

Common Kudu. The common kudu (*Strepsiceros kudu*), which is the species represented in our illustration, is distinguished by its large size, the

open spiral formed by the enormous horns of the male, and the presence of a thick fringe of hair on the throat. The ground-colour of females and young males is reddish or greyish brown, marked with eight or nine white stripes; but in old males it becomes bluish grey, apparently owing to the skin showing through the scanty hair. The kudu is only inferior in size to the eland; a full-grown bull standing about 4 feet 4 inches at the shoulder. The horns may attain a length of 3 feet 5 or 6 inches in a straight line, while one instance is recorded where the one horn measured 3 feet 9 inches, and the other 3 feet 9½ inches. In a pair measuring 3 feet 5 inches in a straight line, the length along the curve was 5 feet 4 inches.

Distribution. The geographical range of the kudu extends from the Cape to the Abyssinian highlands, embracing all Eastern Africa and extending westwards to Angola. Some years ago Mr. Selous stated that a few kudu still lingered in the Cape Colony, while in Griqualand West they were not uncommon. From the Limpopo to the Zambesi they were at that time abundant; and Mr. Crawshay records them as distributed all over Nyásaland. In the Kilima-Njaro district they appear to be rare. Mr. Selous states that the kudu is usually partial to hilly country covered with dense thickets; but hills are by no means necessary to its existence, as it is common in the thick bush along both banks of the river Chobi, where there are no hills whatever, and it is also plentiful in the wait-a-bit thorn-jungles on the Lower Molapo, just on the edge of the flat and sandy Kalahari Desert. In Nyasaland they are never found far away from the hills. Mr. Crawshay states that kudu are fond of browsing on the young and tender shoots of trees and shrubs, especially in the dry season, when the grass has been burnt off, and has not had time to grow. When alarmed, kudu sometimes give vent to a low bark, but this is only audible at close quarters.

Habits. Kudu are generally found in pairs or in small parties. Their speed is not great; but owing to the circumstance that when disturbed they invariably make for the roughest ground, while the districts they haunt are frequently infested with the tsetse fly, it is but seldom that they can be hunted on horseback. With dogs, however, they afford excellent sport; and Mr. Drummond gives the following graphic account of two bull kudu brought to bay by a pack of Kaffir dogs. "My eyes," writes Mr. Drummond, "were fixed upon the river, for there, on a small sandbank, stood the two noble kudu bulls at bay. Two or three dogs had also gained a footing, and made the air ring with their sharp barking, re-echoed back again and again by the precipice on which I stood; while several more swam about trying to stem the current and regain the ground which they had lost. One of the antelopes stood with lowered head, and his long circling horns pointed towards the dogs, and in his side I now saw that a spear was half buried; the other, evidently unwounded but unwilling to leave its companion, remained motionless, his nostrils thrown forward, as if to catch the first taint of the human pursuers sure to follow in their dogs' wake, and his equally magnificent horns resting almost on his haunches."

Lesser Kudu. The lesser kudu (*S. imberbis*) is a much smaller animal, apparently restricted to Somaliland and the Kilima-Njaro district. In addition to its inferior dimensions, this species is distinguished by the absence of a fringe of long hair down the throat, and by the more compressed spiral of its horns.

Measured in a straight line, the horns vary from about 17 to 25 inches in length. The lesser kudu, although very common about Kilima-Njaro, is but seldom seen, as it rarely leaves the bush. In Somaliland Captain Swayne states that while the large kudu frequents the mountain ranges, the present species inhabits the thicket-clad slopes at their feet.

An imperfect skull appears to indicate the occurrence of a kudu in India during the Pliocene period.

THE HARNESSED ANTELOPES.

Genus *Tragelaphus*.

The harnessed antelopes, or bush-bucks, of which five species are now recognised, come so close to the kudus that it may be a question whether they ought not to be included in the same genus. They are, perhaps, the handsomest of all the antelopes, being generally ornamented with vertical stripes like the kudus, while in some cases the ground-colour is of a most brilliant hue. The harnessed antelopes resemble kudus in the females being hornless; but they differ in that the horns, which are placed behind the eyes, have but one or two turns to the spiral, while the ridge on their front surface is less strongly marked. Moreover, the skull generally lacks the deep depression in the middle of the forehead characteristic of the kudus, and the vacuity below the eye is of smaller size. The throat may be either fringed or smooth; and in some species the hoofs are extraordinarily elongated. The coloration of the two sexes is usually very different. The group is confined to Africa; and whereas four of the species are of large size, the fifth does not exceed the dimensions of an ordinary goat.

Bongo. The largest of all is the West African bongo (*Tragelaphus euryceros*), from Liberia, Fanti, the Ashkankolu mountains, and the Gabun. It has short hoofs, and is distinguished by its short hair, the deep chestnut colour of the males, the numerous and distinct narrow white stripes, the want of a fringe on the throat, and the smooth and massive horns, forming rather more than a single turn, and wearing yellow at their tips. The chest is marked by a white crescent, and there are two white spots on the face below the eye. The males attain a height of 3 feet 7 inches at the shoulder; and the horns may reach a length of 30 or 31½ inches in a straight line. We have practically no knowledge of the habits of this species, except that, like the rest, it is a forest-dwelling one.

Nyala. In East Africa, in Zululand, and St. Lucia Bay, the bongo is replaced by the nyala (*T. angasi*). The males stand about 3 feet 4 inches at the withers, and have horns varying from 22 to 28 inches in length. The hair is long, and the general colour of the males dark bluish grey, with the white stripes faintly marked and few in number, and a fringe of long hair on the neck and under-parts of the body. The horns are characterised by their rough surface. Mr. Drummond states that these antelopes are only to be found in low-lying, fever-stricken swamps, where they frequent the densest jungle they can find. They are shy and difficult to stalk; and from this circumstance, coupled with the

feverish nature of their haunts, comparatively few are killed by Europeans. The ground-colour of the female's fur is reddish.

West African
Harnessed
Antelope.

The third species is the West African harnessed antelope (*T. gratus*), from the Camerun mountains and the Gabun district, of which the head is figured in the accompanying woodcut. This

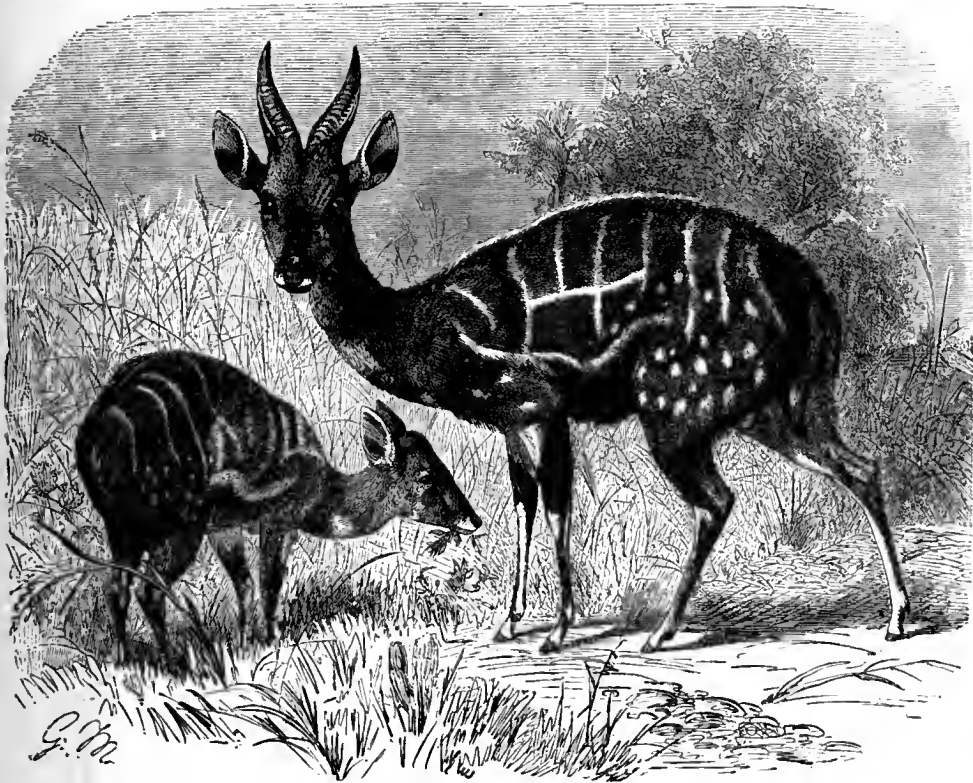


HEAD OF WEST AFRICAN HARNESSED ANTELOPE.
(From Selater, *Proc. Zool. Soc.*, 1883.)

antelope agrees with the last in having white spots on the head and stripes on the body, but differs from all those yet noticed in the extreme elongation of the main hoofs, which are evidently specially adapted for walking on swampy ground. The lateral hoofs, moreover, which in most of the foregoing species are extremely small, are in this antelope large and elongated. The male stands about $3\frac{1}{2}$ feet at the shoulder; and is characterised by the absence of a fringe of long hair on the throat, and the dark olive tint of the coat. In the female the ground-colour of the fur is bright rufous, ornamented, as in the male, with white spots on the face and stripes on the body. The horns of the male are generally about 18 or 19 inches in length, measured in a straight line. Little or nothing appears to be known as to the habits of this species in its wild state, but several examples have been exhibited in the Zoological Gardens at Amsterdam, where they have bred.

Nakong. The last of the four large species of harnessed antelopes is the nakong or sititunga (*T. spekei*), of the swamps of Central and South-Central, and East Africa. This species, while agreeing with the last in its elongated hoofs, differs from all those yet noticed in its perfectly uniform greyish brown colour. The young are, however, faintly striped and spotted. The hair is longer and more silky than that of the others; and the smooth, slender, and strongly-ridged horns form nearly two complete turns, and thus approximate to those of the kudu. The height of the male is 3 feet 7 inches. Mr. Selous states that the longest horns he met with measured 25 inches in a straight line, but a pair of 27 inches has been subsequently recorded. Like the other members of the genus, the nakong goes in pairs, and is never found in herds. Mr. Selous observes that he once saw a female nakong "standing breast-deep in the water, in the midst of a

bed of reeds, feeding on the young shoots that just appeared above the water. When she saw us, she at once made off, making a tremendous splashing as she plunged through the water. The natives told me that very often when these antelopes are met with under similar circumstances they do not attempt to run, but, sinking down in the water, submerge their whole bodies, leaving only their nostrils above the surface, and trusting that their enemies will pass them unobserved. They (the Kaffirs) then paddle alongside, and assegai them from the canoe. Another way the natives have of killing them is by setting fire to the reeds when they become quite dry, and then waiting for the sititunga in their canoes in one of the channels of open water by which the marsh is intersected." Further up the Chobi River it is stated that these antelopes are in the habit of diving, and even sleeping beneath the water with only their nostrils exposed.



MALE AND FEMALE GUIB ($\frac{1}{4}$ nat. size).

Guib. The guib (*T. scriptus*) is the last representative of the harnessed antelopes, and differs from all the others by its inferior size, being about equal in dimensions to an ordinary goat. The average length of the horns is about 12 inches, but specimens of 14 inches and one of 16 $\frac{1}{4}$ inches have been recorded. This species has a wide distribution, ranging from Abyssinia to the Cape; and it exhibits such variations in colour that it was originally split up into four distinct species, now regarded as varieties. In the Abyssinian variety, which is shorter and stouter than the others, the general colour is yellowish, and the

stripes are nearly obsolete; but there is one distinct longitudinal band, sometimes broken into spots, and the haunches are spotted, while the back has a dark line. In the typical variety, from West, Central, and South-Central Africa (which is the one represented in the illustration on p. 277), the colour is bright rufous, brilliantly marked all over the body with white spots and longitudinal and vertical stripes. In the males the line down the middle of the back is white; and the chest has a fringe of blackish hair. In East Africa we come across a third variety in which the general colour of the bucks is dark brown, with two or three obscure vertical stripes on the hind-quarters, and even these occasionally absent. The spots are variable, although less numerous than in the preceding variety. Lastly, we have the true bush-buck of the Cape, in which the coloration is of a uniform dark brown at all ages, with no trace of stripes, and the spots reduced to a few indistinct ones on the haunches.

Guib, or bush-buck, are very common in most parts of Africa. Writing of this species, Mr. Selous says that it is "never met with except in places where dense bush comes right down to the water's edge; and on the Chobi, where I have seen most of these antelopes, I have never found one at a distance of more than a hundred yards from the river."

Extinct Species. Remains of antelopes more or less nearly allied to *Tragelaphus* are common in the Tertiaries of Europe, as far down as the Middle Miocene, so that the group is evidently a very old one.

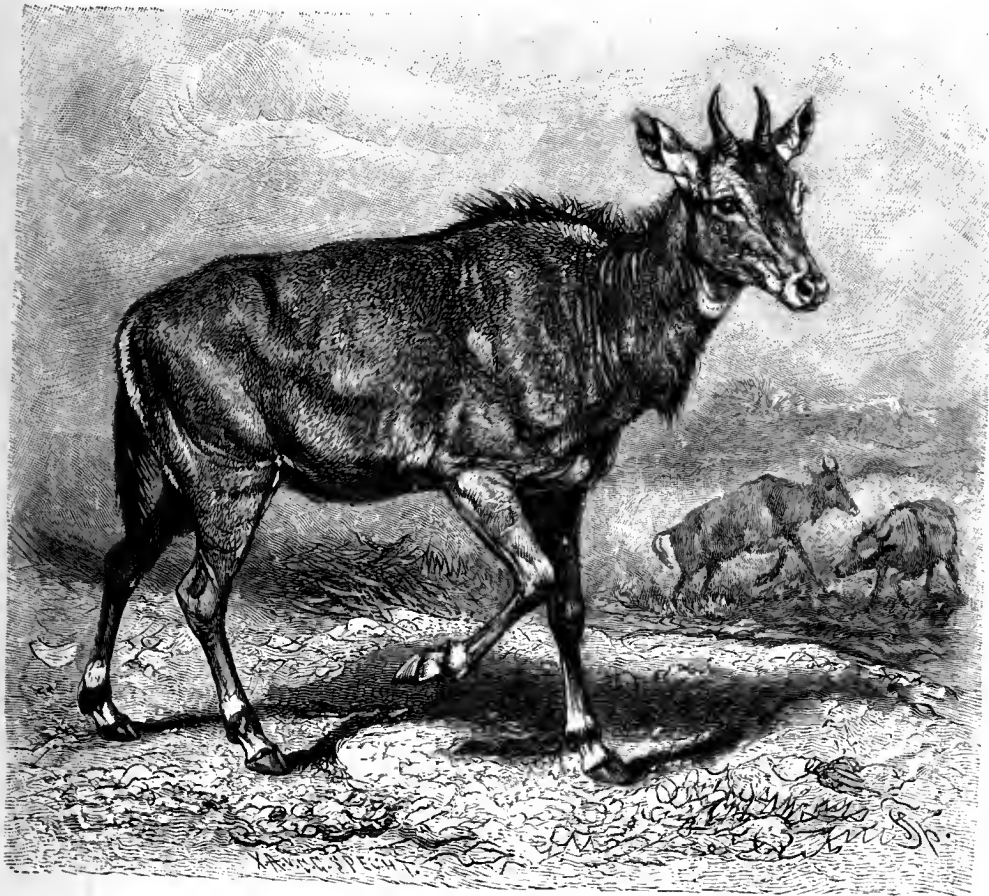
THE NILGAI.

Genus *Boselaphus*.

The nilgai (*Boselaphus tragocamelus*), which is the largest of the Indian antelopes, appears to be the oriental representative of the group of African species described above, although it differs from them in several important structural features. The males only are horned, and the horns themselves are short, smooth, nearly straight, and directed upwards and backwards, with a triangular section at the base, but becoming cylindrical at the tip. In front the horns have a distinct ridge, comparable to that found in those of the eland, and in very old individuals this ridge extends forwards and inwards, till the horns almost touch at their bases. The nilgai is peculiar in having the fore-limbs longer than the hinder, and the withers very high, in consequence of which its whole appearance is somewhat ungainly. The tail is tufted, and reaches the hoeks; and in both sexes the neck is maned, while the throat of the male has a small tuft of hair. The gland below the eye is very small and the muzzle naked. The upper molar teeth (one of which is figured on p. 155) differ from those of the foregoing species by their tall crowns, with a large additional column on the inner side. In general colour the adult bull nilgai is dark grey, with either a brownish or bluish tinge. The long hairs on the neck, throat, and tail, and some portions of the ear, are however black; and there are white markings on the face, ears, and throat, while the under surface of the tail, the under-parts of the body, and a ring above and below each fetlock are likewise white. In young males and females the colour is brown. A bull nilgai

usually stands from 4 feet 4 inches to 4 feet 8 inches at the withers, but it is stated that 4 feet 10 inches has been measured. The cows are much smaller. The black horns average 8 or 9 inches in length, with a basal girth of 8 inches; but one pair has been recorded with a length of 11 $\frac{3}{4}$ and a girth of 9 $\frac{1}{2}$ inches.

Distribution. The nilgai is exclusively an Indian animal, being quite unknown in Ceylon. Even in India its distribution is restricted, as it does not occur in Eastern Bengal or Assam nor, apparently, near the Malabar coast. Fossil



THE NILGAI ($\frac{1}{4}$ nat. size).

species occur in the river-gravels of Central India, and also in the Pliocene sandstones of the Siwalik Hills at the foot of the Himalaya.

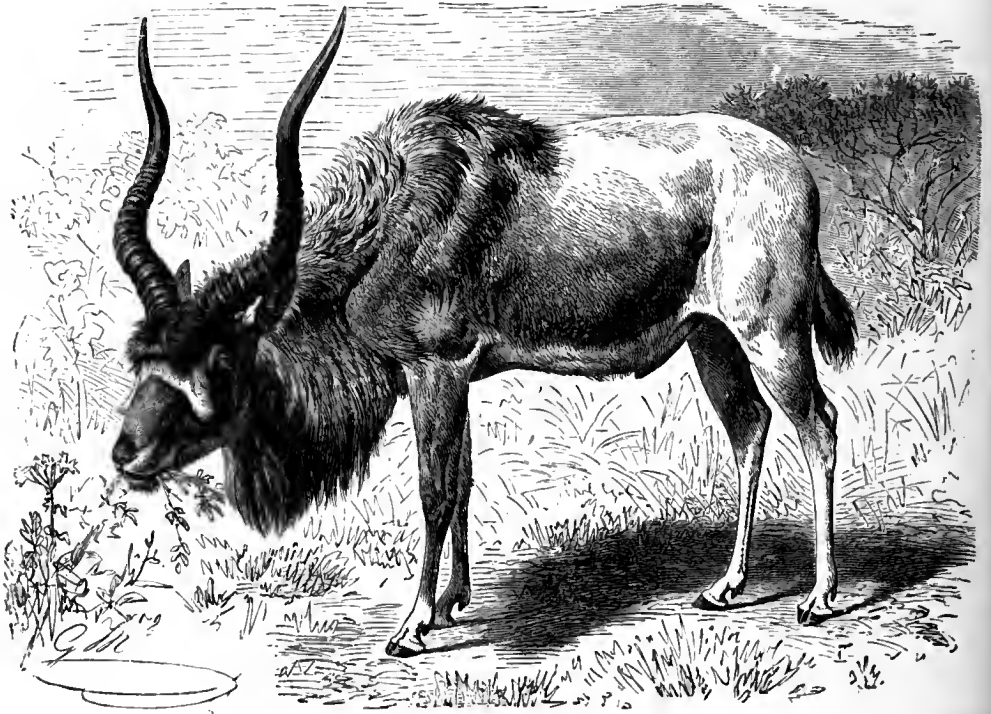
Habits. Nilgai may be found either on the plains or in low hills, generally preferring ground covered with thin bush, among which are scattered low trees, or alternations of scrub-jungle with open grassy plains. They are but seldom met with in thick forest, although far from unfrequent on cultivated grounds. The bulls are generally solitary, but occasionally assemble in small parties, which, according to Mr. Blanford, may include as many as a dozen head. The females and calves are generally found in parties of from four to ten, but sometimes in herds of from fifteen to twenty or more, and they are on some

occasions accompanied by one or more full-grown bulls. Nilgai both graze and browse, and will feed at any time of the day, although they resort sometimes to the shade for repose. Mr. Blanford believes that, in the cold season, at least, they drink but once in two or three days. General Kinloch writes that "in places where they are not disturbed, especially in some of the native states, nilgai are absurdly tame, but in districts where they are much molested they become extremely shy and wary. It must not, therefore, be supposed that they can always be easily shot, but they afford such a poor trophy that they are not much sought after. When they can be found sufficiently far from thick cover they may be speared, and they then show capital sport, as they will probably lead a well-mounted horseman a chase of several miles. On hard ground I doubt if a cow nilgai could be speared by a solitary hunter; the bull, being much heavier, is more easily ridden down." They can be readily tamed, but the bulls are apt to be savage. Either one or two young are produced at a birth.

THE ADDAX.

Genus *Addax*.

With the addax (*Addax nasomaculatus*) we come to a group of African and Arabian antelopes of large size, including the genera *Addax*, *Oryx*, and *Hippotragus*,



THE ADDAX ($\frac{1}{2}$ nat. size).

which present the following distinctive characteristics. They have long cylindrical horns in both sexes, which are placed over or above the eyes, and are either sub-

spiral, straight, or recurved. The muzzle is covered with hair, and there is no gland below the eye; while the skull has no depression below the socket of the eye, and but a very narrow unossified space in the same region. The tail is long and tufted, and the upper molar teeth resemble those of the oxen, having very tall and broad crowns, with a large additional column on the inner side. It is probable that this group is very closely related to the oxen; and all the members are desert-haunting animals.

The addax, which is an inhabitant of North Africa and Arabia, has the horns ringed for the greater part of their length, and ascending in an open spiral nearly in the plane of the face. In height this antelope stands a little over 3 feet, and the greater part of the body is covered with short and thick hair. There is, however, a tuft of long hair on the forehead and a mane extending down the neck to the shoulders, and also a fringe of long hair on the throat. The general colour is yellowish white, in marked contrast to which is the brown of the head, neck, and mane. There is a transverse white band below the eyes, while the lips and a spot on the outer surface of the ears are also white. In the males the long hair is more abundant and darker in colour than in the other sex, and during the winter the yellowish white of the body tends to grey. The horns attain a length of from 20 to 28 inches in a straight line, and from 26 to 35½ along the spiral.

Distribution and Habits. The range of the addax in Africa lies to the northward of the 18th parallel of north latitude, and, like the gemsbok, the animal inhabits barren, sandy deserts, where water is scarce. It is a shy and wary creature, and is doubtless able to go for long periods without slaking its thirst. Our accounts of its habits are far from full, but its general mode of life is probably very similar to that of the gemsbok. The addax is hunted by the Bedouins, partly for the sake of its flesh, partly in order to capture the young, and also to test the speed of their horses and greyhounds. Large hunting-parties are assembled for this purpose, and the expeditions may last for several weeks. The skeleton of the addax is figured on p. 268.

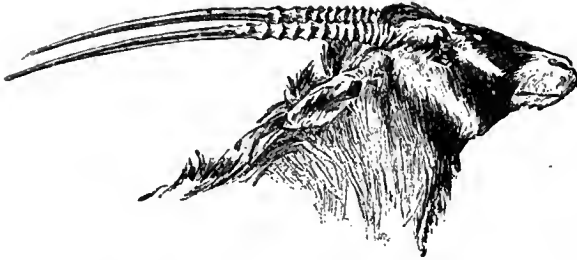
ORYX.

Genus *Oryx*.

Under the title of oryx may be included five species of antelope, distinguished from the addax by their straight or recurved horns, their longer and more bushy tails, the small size of the mane on the neck, and by the throat being either short-haired or furnished with a single tuft of long hair. The horns, which are of great length, slope backwards more or less nearly in the plane of the face. Oryx are found throughout the desert regions of Africa, and also range into Arabia and Syria.

Gemsbok. Commencing with South Africa, we find the group represented by the gemsbok (*Oryx gazella*), characterised by its long straight horns, ringed for about half their length, the tuft of hair on the throat, and the black markings on the head, body, and limbs. The gemsbok stands about 4 feet in height, and its general colour is greyish, becoming white beneath. A black stripe on the flanks divides the grey of the sides from the white below, and there is also a

black area on the haunches extending as a line on the back, and continued over the whole of the tail. In addition to this, there is also black on the upper-parts of the limbs, on the front of the legs above the fetlocks, and along the throat; the



HEAD OF GEMSBOK.—After Nicolls and Eglington.

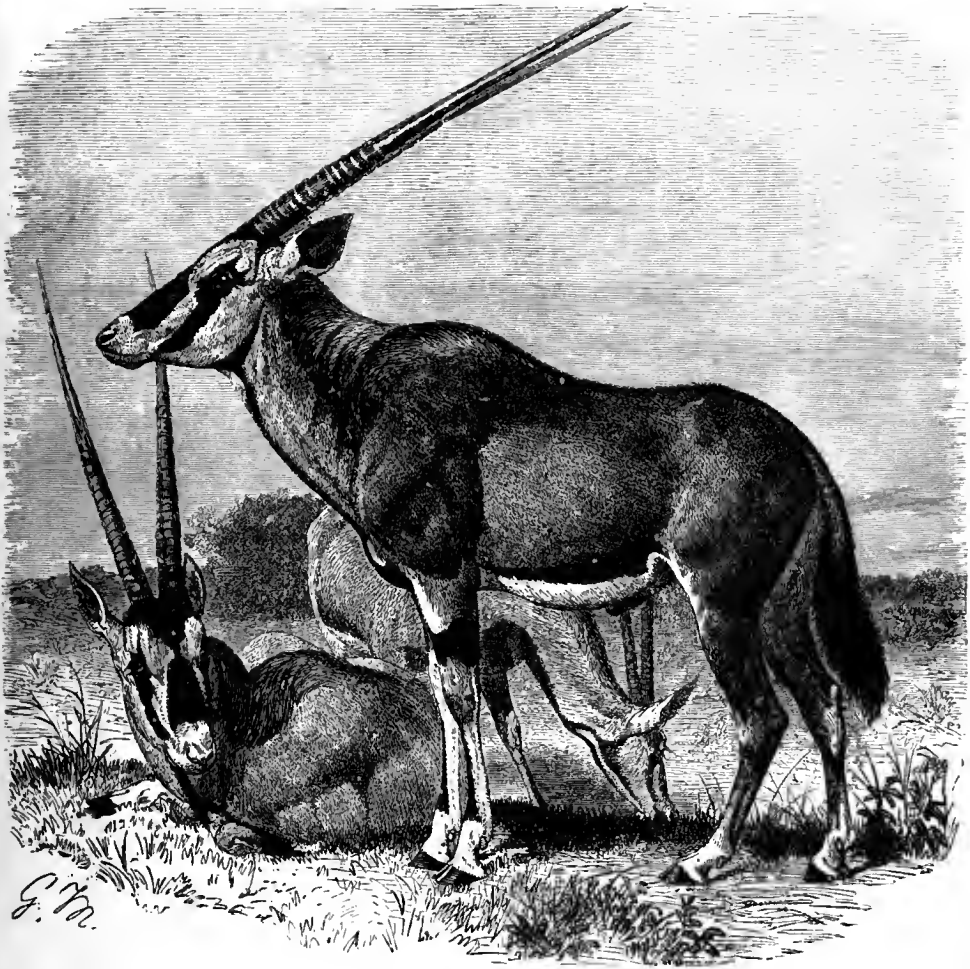
throat-stripe dividing and running up the sides of the head nearly to the ears. On the face a black stripe runs from each horn through the eye nearly to the muzzle, which is connected by a narrow stripe with a broad black patch on the centre of the forehead, thus completely isolating the white of the muzzle from that of the upper part of

the face. Mr. Selous states that the longest male horns of this species which he saw measured 42 inches in length, while those of the female may reach 46½ inches. Horns have, however, been recorded measuring 47½ inches.

Distribution and Habits. Gemsbok inhabit the desert regions of South-Western Africa, and are still fairly common in the Kalahari Desert, while in Damaraland they are reported to occur in large herds; north of the Chobi River they appear to be unknown. On the west coast they occur in Senegambia, Timbuctu, and the Niger district. Mr. Selous says that they are generally met with where the country is either completely open or covered with stunted scrub. Gordon Cumming writes that the gemsbok "thrives and attains high condition in barren regions where it might be imagined that a locust would not find subsistence; and, burning as is the climate, it is perfectly independent of water, which, from my own observation and the repeated reports both of the Boers and aborigines, I am convinced it never by any chance tastes. Its flesh is deservedly esteemed, and ranks next to the eland." Mr. Selous states that the gemsbok is by no means fleet, and that it can be run to a standstill by a hunter on foot. According to Boer reports, the gemsbok is enabled to beat off the lion with its spear-like horns; and several instances are recorded where the skeletons of the two animals have been found together, the body of the lion having been transfixed by the horns of the antelope, which remained too firmly fixed in the flesh to admit of their withdrawal during life.

Beisa. In Abyssinia and Somaliland as well as on the Red Sea littoral near Suakin, the gemsbok is replaced by the beisa (*O. beisa*), readily distinguished by the absence of the tuft of hair on the throat, and by the black patch on the front of the face being completely separated from the stripe running through the eye. There is no black on the haunches and thighs, and the horns also are shorter and less divergent, their maximum recorded length being 36 inches in the male and 37 inches in the female. The beisa is probably the true oryx of the ancients, and may be the animal which gave rise to the legend of the unicorn. Mr. Blanford says that in Abyssinia these animals are found in herds of considerable size, when they present an imposing appearance. Their favourite pace is a quick walk or trot, and they only break

into a gallop when frightened. At such times they dash off with lowered heads and upraised tails, at the same time puffing and snorting. In Somaliland the beisa, according to Captain Swayne, chiefly frequents open stony grounds or grassy plains, but it may be found in any kind of country except thick jungle or the cedar forests. The herds are chiefly composed of cows, the bulls wandering about by themselves.



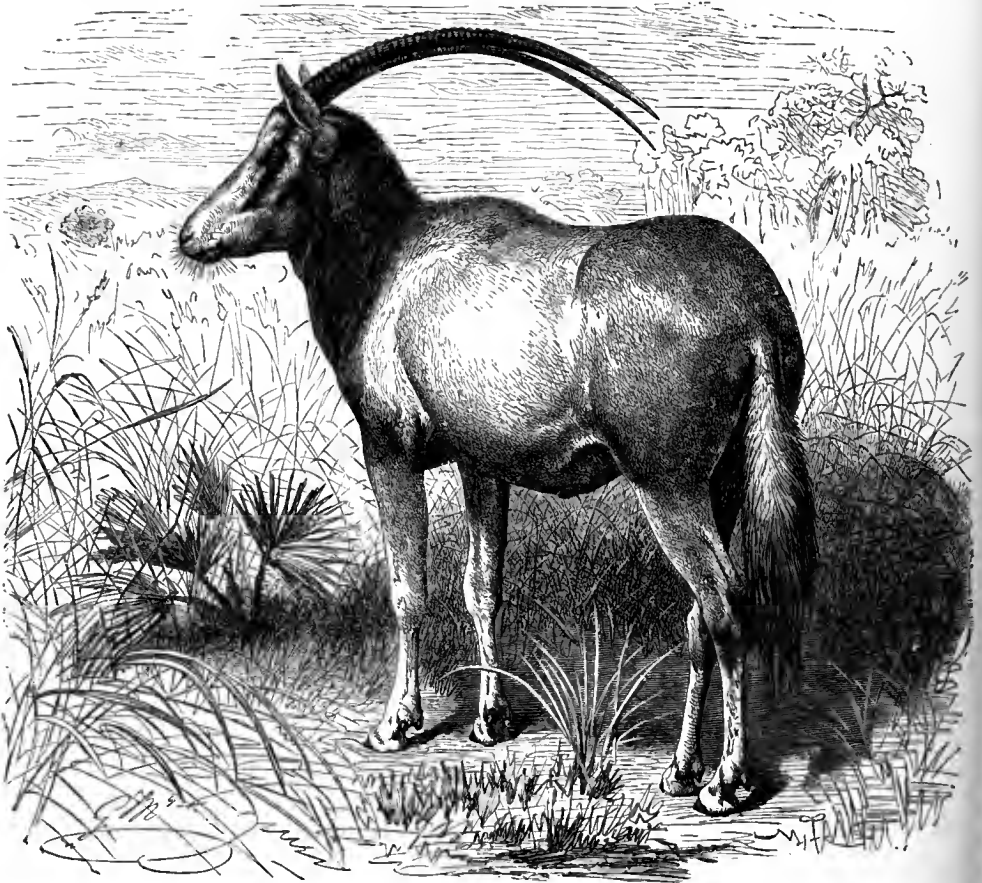
THE BEISA ($\frac{1}{6}$ nat. size).

The Midgans of Somaliland hunt the beisa with packs of yellow pariah dogs. One of the largest pair of horns measured $34\frac{1}{2}$ inches in length.

Fringe-Eared Oryx. In the Kilima-Njaro district the genus is represented by the fringe-eared oryx (*O. callotis*), distinguished from the beisa by the ground-colour of the upper part of the face being of a rich fawn, and by the sharply-pointed ears terminating in a tuft of long black hair, as shown in the illustration on p. 287. This species is common in the plains and the tracts of thin thorny bush. In examples killed by Sir J. Willoughby the horns in the females measured from 30 to 32 inches in length, while those of the males were shorter, but thicker.

Beatrix Antelope. The beatrix antelope (*O. beatrix*) of Western Arabia, and, it is said, of the Bushire district, is a much smaller animal than either of the above, standing about 2 feet 8 inches in height, and is of a whitish colour, with a dark spot on the face, and a large dark patch on each cheek meeting beneath the throat; the knees and the front of the lower part of both legs are also blackish brown, and the end of the tail is black. The horns are only about 15 inches in length.

Sabre-Horned Antelope. The last representative of the genus is the sabre-horned antelope, or leucoryx (*O. leucoryx*), which, while agreeing nearly in size with the beisa, differs from the other four species in its recurved scimitar-like horns,



THE SABRE-HORNED ANTELOPE ($\frac{1}{6}$ nat. size).

and uniform whitish coloration, which frequently shows a reddish tinge. The reddish tinge is more marked in the under-parts and the inner surfaces of the limbs than elsewhere; and the neck is darker than the body. The head is marked by six brown patches, of which there are one between the horns, two between the ears, and two between the horns and eyes, while the sixth forms a streak on the nose. The horns vary from 34 to 39½ inches in length. The leucoryx is confined to the north-eastern portion of Central Africa, being abundant in Senaar and

Kordofan, less common in the Central-Western Sudan, and also occurring in parts of Nubia.

Extinct Forms. In the Pliocene deposits of various parts of Europe, there occur remains of antelopes closely allied to the oryx, some of which have been generically separated under the name of *Palæoreas*, and are said to show signs of affinity with the sable antelope and its kindred.

THE SABLE ANTELOPE AND ROAN ANTELOPE.

Genus *Hippotragus*.

The sable and roan antelopes, together with some allied species, constitute an exclusively African genus nearly allied to the oryx. They are distinguished by the stout horns, which are ringed nearly to their tips, rising vertically from a ridge on the skull immediately over the eyes at an obtuse angle to the plane of the lower part of the face, and then curving in a bold sweep backwards. The neck is clothed with a distinct, erect, and often-recurving mane; the tail is rather short and distinctly tufted; and the ears are enormous. The horns of the females are shorter than those of the males.

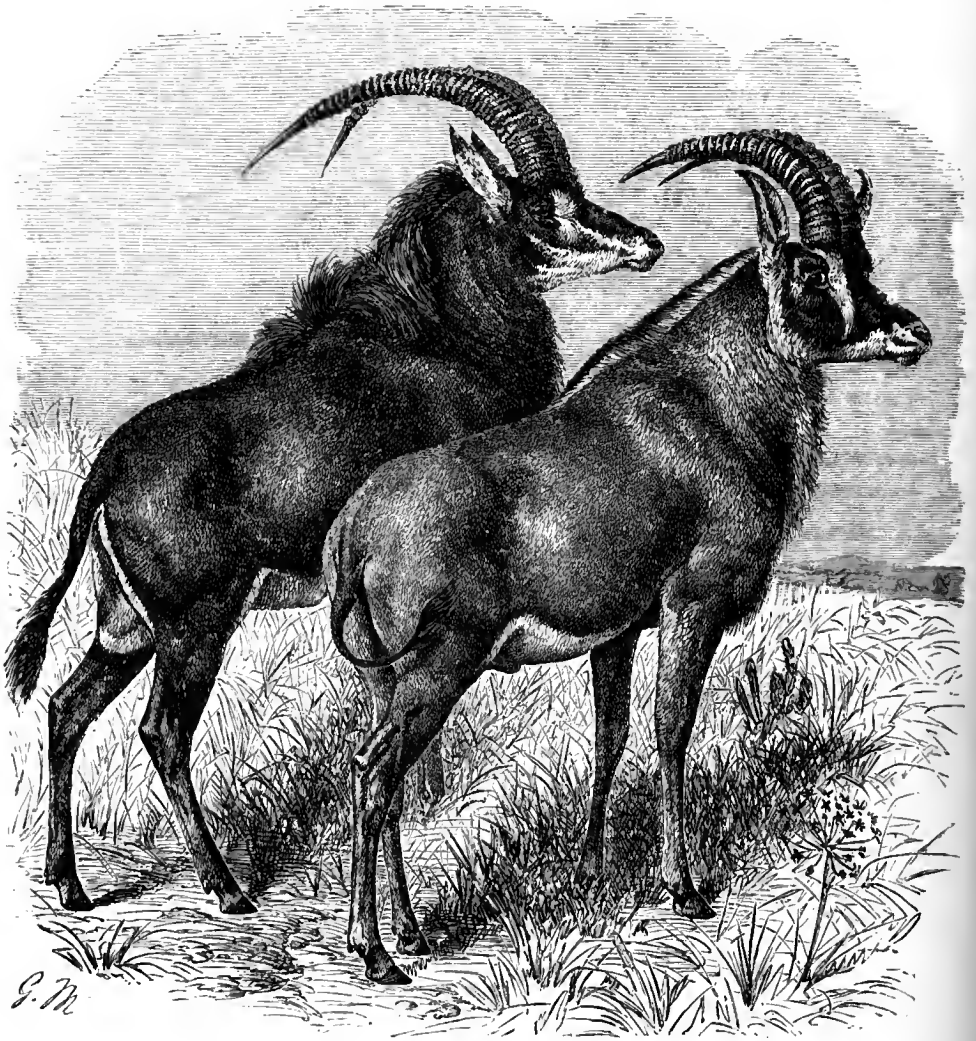
Roan Antelope. The roan or equine antelope (*Hippotragus equinus*)—the bastard gemsbok of the Boers—is represented in the right-hand figure of our illustration on next page, and is the largest and one of the best-known representatives of the genus, standing rather over 4½ feet at the withers. There is considerable individual variation in colour, some specimens, according to Mr. Selous, being of a strawberry roan, others of a deep dark grey or brown, and others again so light in colour as to appear almost white at a distance. The under-parts are but little lighter than the body, while the head and jaw have dark brown markings. The latter markings are characterised by the white streak in front of the eye being separated by a dark band from the white of the muzzle. The ears are very large, and the mane small and erect. The horns of the bull seldom exceed 36 inches in length, measured along the curve, but specimens measuring 33 and 42 inches have been recorded. This species has a large range in central South Africa, and has also been recorded from Senegal. Mr. Selous states that it is nowhere numerous, and it is seldom that as many as twenty are seen together.

Blaubok. The blaubok (*H. leucophaeus*) was a smaller but nearly-allied species from the Cape, which now appears to be extinct. It derived its Dutch name from the bluish hue of the hairs, and its head was uniformly coloured.

Sable Antelope. Perhaps the handsomest member of the genus is the sable antelope (*H. niger*), represented in the left-hand figure of our illustration. This species is rather smaller than the roan antelope, but has much longer horns, smaller ears, and a longer and more abundant mane, which is partly pendent. With the exception of portions of the face, buttocks, and the under-parts, the fur is entirely of a deep glossy black; the contrast formed by the white of the under-parts being very striking; the markings on the face differ from those of the roan antelope in that the white streak in front of the eyes is continued to join the white of the muzzle, and is separated by a dark streak from that of

the throat. The horns of the males not unfrequently attain a length of 42 or 43 inches, but they may reach as much as $44\frac{1}{2}$ or even 46 inches along the curve. In the females 36 inches seems to be the maximum.

Distribution and Habits. The sable antelope is a southern species, ranging some distance to the north of the Zambesi, and being now most abundant in Mashonaland. This antelope, unlike the various species of oryx, generally



THE SABLE ANTELOPE AND THE ROAN ANTELOPE ($\frac{2}{3}$ nat. size).

frequents forest-clad highlands. In Mashonaland, according to Mr. Selous, it is commonly met with in herds of from ten to twenty individuals, although occasionally as many as fifty may be seen together. The same writer observes that, "as a rule, the sable antelope runs very swiftly and has good bottom; but in this respect different individuals differ considerably, as is the case with all animals, and I have run down without much difficulty individual sable antelopes

and roan antelopes, and one gemsbok, whilst others have gone clean away from me. The sable antelope is often very savage when wounded, and, like the roan antelope and gemsbok, will commit terrible havoc amongst a pack of dogs. Indeed, I have known one to kill three dogs with three consecutive sweeps



SABLE ANTELOPE.

FRINGE-EARED ORYX.

ROAN ANTELOPE.

of its long scimitar-shaped horns." As mentioned on p. 573 of the first volume, the sable antelope is sometimes successfully chased by the Cape hunting-dog. From having been discovered by Sir C. Harris, it is frequently termed the Harris-buck by the inhabitants of the Cape.

All who have seen this antelope in its native wilds seem to be impressed with its beauty and majestic appearance. Gordon Cumming, writing of his first sight of the sable antelope, says that "I shall never forget the sensation I experienced on

beholding a sight so thrilling to the sportsman's eye ; he stood with a small troop of palas right in our path, and had, unfortunately, detected us before we saw him. Shouting to my pack, I galloped after him ; but the day was close and warm, and the dogs had lost their spirit. My horse being an indifferent one soon lost ground, and the beautiful creature, gaining a rocky ridge, was quickly beyond my reach, and vanished for ever from my view. I sought in vain to close my eyelids that night, for the image of the sable antelope was still before me."

Baker's Antelope. In the Sudan the genus is represented by Baker's antelope (*H. bakeri*), standing upwards of 4 feet 8 inches at the withers, and distinguished by its pale liver-colour, pencilled ears, and some black stripes across the shoulders. Its horns are of a massive type.

Extinct Species. Fossil antelopes from the Pliocene deposits at the foot of the Himalaya indicate the existence of the genus *Hippotragus* at a former period of the earth's history in India, and it is not improbable that it was also represented in Europe during the same epoch.



HEAD OF SABLE ANTELOPE. —After Nicolls and Eglington.



W. Kubmett.

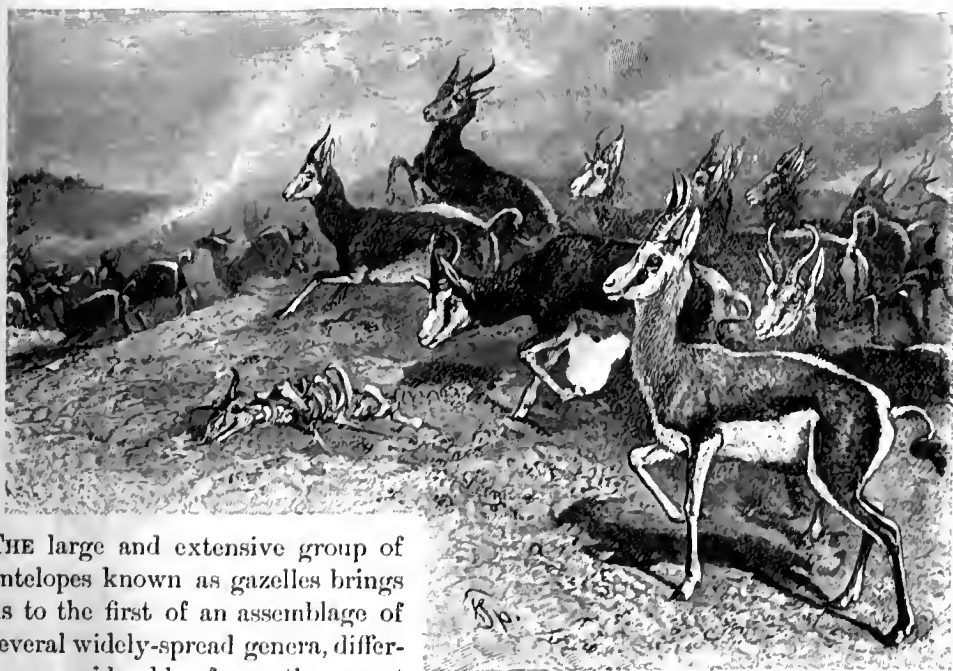
DORCAS GAZELLE.

CHAPTER XXI.

THE UNGULATES,—*continued.*

THE HOLLOW-HORNED RUMINANTS,—*continued.*

THE GAZELLES. Genus *Gazella*.



A "TREK" OF SPRINGBOK.

THE large and extensive group of antelopes known as gazelles brings us to the first of an assemblage of several widely-spread genera, differing considerably from those yet noticed. Most of these antelopes

are of small or moderate size, and the majority of them are inhabitants of the deserts of the Old World. The whole of them have narrow upper molar teeth like sheep, and their muzzles are similarly covered with hair. There is very frequently a gland below the eye, and the tail is either short or of moderate length. As a rule, the horns are compressed and lyrate or recurved, or cylindrical and spiral, with distinct rings for a considerable portion of their length. The skull has large pits in the forehead.

The gazelles are among the most elegant of all antelopes, and are characterised by their sandy colour and the presence of a white streak on the side of the face from the base of the horn nearly to the nose, thus cutting off a dark triangular patch in the middle of the forehead, while the streak itself is bordered externally

by a diffused dark line.¹ The horns, which are generally present in both sexes, are lyrate or recurved and are compressed, oval in section, and completely ringed



HEAD OF GRANT'S GAZELLE.
(From Sir V. Brooke, *Proc. Zool. Soc.*, 1878.)

throughout the greater part of their length. The knees are generally furnished with tufts of hair. Glands are present in the feet, and the gland below the eye, if present, is small and covered with hair. Most of the gazelles do not exceed 30 inches in height, although the mohr reaches 36 inches. There are about twenty-one living species belonging to the genus *Gazella*, which are mainly found in the deserts of Asia and North Africa, although the group is represented in South Africa by the springbok. Two of the Asiatic species are found at great elevations. Several species of fossil gazelles occur in the Pleistocene and Pliocene deposits of both Europe and India.

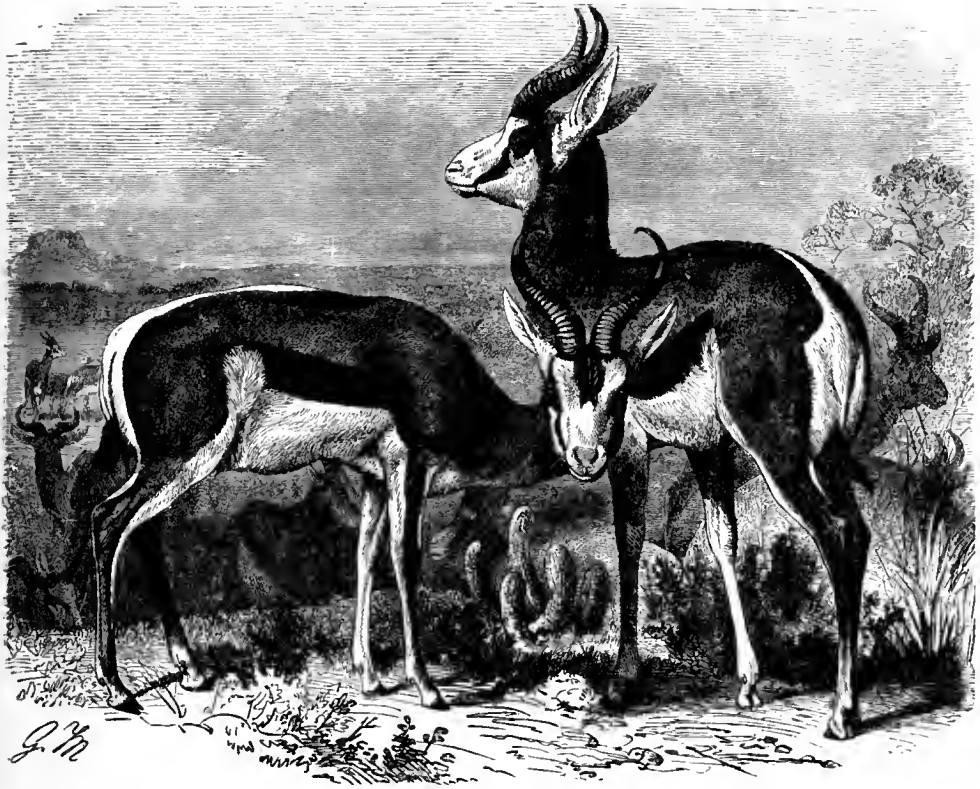
The existing gazelles may be divided into several groups, according to coloration and the presence or absence of horns in the females; and, since the species are so numerous, we shall content ourselves with selecting one from each group for special notice.

Springbok. Our first representative of the genus is the South African springbok (*Gazella euchores*), which differs from all the other species by the presence of a stripe of long white erectile hairs running down the middle of the back, and also by having only two premolar teeth in the lower jaw. Both sexes are horned. In height the springbok stands about 30 inches, and the black horns are lyrate, with about twenty complete rings, and in the males attain a length of from 10 to 15 inches. The general colour is dark cinnamon-yellow, but there is a dark brown stripe on the flanks dividing the cinnamon colour of the sides from the white of the under-parts, and a dark streak running through the eye. The general distribution of the white is shown in our figure, but it may be remarked that there is more white on the face than in any other species, the dark central area of the forehead being reduced to a small patch below the horns. The snow-white hairs on the back have a length of 3 or 4 inches.

In eastern South Africa the northern range of the springbok extends to about latitude 20°, its limits being marked by the forests south of the Mababi River;

¹ These markings are absent in the Tibetan gazelle.

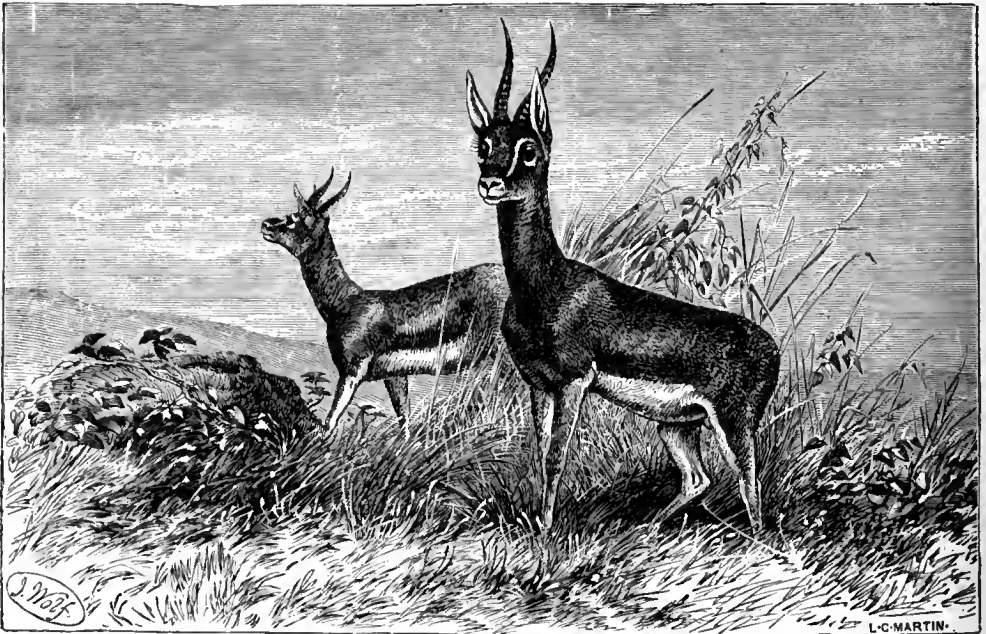
westward of Lake Ngami it extends, however further north, reaching Benguela and Angola on the west coast. According to Mr. Selous, this antelope is still found in the north-west of the Cape Colony, and throughout the Transvaal and Griqualand West; while it is abundant on the borders of the Kalahari desert. The springbok derives its name from its habit of suddenly leaping in the air; and is remarkable both for the vast numbers in which it formerly occurred, and for its periodical migrations. Writing of one of these migrations, Gordon Cumming states that "for about two hours before dawn I had been lying awake in my waggon, listening to the grunting of the buck within 200 yards of me; imagining that some large



THE SPRINGBOK ($\frac{1}{2}$ nat. size).

herd of springboks was feeding beside my camp, but, rising when it was light and looking about me, I beheld the ground to the northward of my camp actually covered with a dense living mass of springboks, marching slowly and steadily along. They extended from an opening in a long range of hills on the west, through which they continued pouring like the flood of some great river, to a ridge about a mile to the north-east, over which they disappeared—the breadth they covered might have been somewhere about half a mile. I stood upon the fore-chest of my waggon for nearly two hours, lost in astonishment at the novel and wonderful scene before me, and had some difficulty in convincing myself that it was a reality which I beheld, and not the wild and exaggerated picture of a hunter's dream. During this

time, these vast legions continued streaming through the neck of the hills in one unbroken phalanx." Later on the same writer continues that, "on our climbing the low range of hills through which the springboks had been pouring, I beheld the plains and even the hillsides which stretched away on every side of me thickly covered, not with herds, but with one vast mass of springboks; as far as the eye could strain, the landscape was alive with them, until they softened down into a dim red mass of living creatures. To endeavour to form any idea of the amount of antelopes which I had that day beheld were vain; but I have no hesitation in saying that some hundreds of thousands were within the compass of my vision." Vast, however, as must have been the numbers on this occasion, the Boers informed the narrator that they were nothing to those that had been witnessed in some



DORCAS GAZELLE.

trekbokken, when the animals extended over a succession of flats, instead of being confined to one alone, and were crowded together like sheep in a fold throughout a long day's journey, as far as the eye can reach. So dense are the moving masses that if a flock of sheep becomes intermingled with the herd they are swept along without hope of escape; and it is said that even the lion may be thus entrapped. Livingstone suggests that these migrations are due to the grass in the Kalahari desert becoming so tall as to impede the springbok from obtaining a clear view of the surrounding country.

Dorcas Gazelle. The Dorcas gazelle (*G. dorcas*), which is figured in our coloured Plate, may be taken as the representative of a group in which the white of the rump does not encroach on the fawn-colour of the haunches, while both sexes have lyrate or sublyrate horns. This well-known species inhabits the deserts of Egypt, Algeria, Syria, Palestine, and parts of Asia Minor. It stands barely

24 inches at the shoulder; and the horns are relatively long and slender, with their tips incurved, their length being sometimes a little over 13 inches. Like most other gazelles, this beautiful little animal is of extremely delicate build, and is remarkable for its great speed. When running, it appears to skim the ground like a bird, and often takes leaps of a yard or more in height. Closely allied to this species is the isabelline gazelle (*G. isabellina*) of Kordofan and Senaar, distinguished by the tail being rufous, instead of black, above. Other species are the korin (*G. rufifrons*) of Senegal; Sundevall's gazelle (*G. lævipes*) of Senaar; and the black-tailed gazelle (*G. tilonura*) of Bogosland; the latter being characterised by its superior size, reaching 29 inches at the shoulder, and the horns varying from 7 to 10 $\frac{3}{4}$ inches in length.

Indian Gazelle.

The Indian gazelle (*G. bennetti*), brings us to a subgroup distinguished from the preceding by the horns not being distinctly lyrate, but generally having a slight S-shaped curvature when seen from the side. The general colour of this well-known species—the ravine-deer of Indian sportsmen—is light chestnut above, while the tail is blackish.

In height the buck stands 26 inches at the withers; and the horns, which usually have fifteen or sixteen rings, average 10 to 12 inches in length along the curve. This species inhabits the plains of Central and North-Western India, whence it extends through Baluchistan to Persia. It is commonly found in parties of from two to six, although occasionally from ten to twenty may be found together. Its swiftness is such that it can but seldom be taken with dogs; but it does not leap in the air like the dorcas. Mr. Blanford writes that this gazelle “keeps much to waste ground, especially where that is broken up by ravines, but it is seldom seen on alluvial plains, and it haunts cultivation less than the [Indian] antelope. It is frequently found amongst scattered bushes or thin tree-jungle, and may be met with on undulating ground even on the top of hills; it is commonly found amongst sand-hills, and is nowhere so abundant as in parts of the Indian desert. It lives on



SKULL OF INDIAN GAZELLE.

grass and the leaves of bushes, and I believe never drinks, for it is common in tracts where there is no water except from deep wells.” Other members of this group are the mountain-gazelle (*G. cuvieri*) of Morocco and Algeria, which reaches a height of 27 $\frac{1}{2}$ inches; the small-horned gazelle (*G. leptoceros*) of the Sudan; the well-known Arabian gazelle (*G. arabica*); and Speke's gazelle (*G. spekei*) of the plateau of Somaliland. The latter species is of very small size, and remarkable for the loose flabby skin of the nose, and is further distinguished by the length of its hair and dull coloration. The length of the horns ranges from 9 $\frac{1}{2}$ to 11 $\frac{1}{2}$ inches.

Another group is formed by three Asiatic gazelles, which differ from all other members of the genus by the females being hornless. Of these, the Persian Gazelle. Persian gazelle (*G. subgutturosa*) inhabits the highlands of Persia and

a large area in Central Asia, extending as far the Gobi Desert. This species has lyrate horns, with incurved tips, which may have from sixteen to twenty-five rings; and the tail is not surrounded by a white disc. The longest pair of horns known measure $14\frac{1}{2}$ inches. In Mongolia, this species is replaced by the larger Mongolian gazelle (*G. gutturosa*), characterised by its extremely pale-coloured horns. The third member of the group is the goa or Tibetan gazelle (*G. picticaudata*), distinguished by the white disc round the tail, the long winter-coat, short ears and tail, the greatly curved horns, and the uniform colour of the face. The height of the animal is 24 inches; and the largest recorded horns measured $15\frac{3}{4}$ inches in length; the number of rings varying from twenty to thirty. This gazelle inhabits the Tibetan plateau at elevations of from 13,000 to 18,000 feet, and goes in small parties of from two or three to a dozen. It is less shy than other species.

Grant's Gazelle. The last group of the true gazelles is characterised by the white of the rump extending forwards in an angle into the fawn-colour of the haunches; both sexes having horns, which are frequently longer than in the other groups; the animals themselves being also relatively large. Perhaps the handsomest member of the whole genus is the East African Grant's gazelle (*G. granti*), from the Kilima-Njaro district and the neighbourhood of Zanzibar, of which the head is figured in the woodcut on p. 290.

Grant's gazelle has longer and finer horns than any other species of the genus; their length being frequently as much as 26 inches, while in one instance a length of 30 inches has been recorded. The general colour of the upper part of the body is fawn, and there is no dark band on the flanks dividing the fawn-colour from the white of the under-parts. On the neck and back the hair has a kind of wavy appearance, somewhat like the pattern on watered silk. This gazelle is common on the open plains of East Africa, and is generally found in small parties comprising from ten to fifteen does and fawns, accompanied by a single adult buck. Sir J. Willoughby states that in the Kilima-Njaro district these gazelles "were in extraordinary profusion, though extremely wild, and among the herds we noticed many fine bucks. It may be worthy of record that they would often allow us to crawl towards them without showing any sign of alarm, until we were within a fair rifle range; whereas, if we attempted to walk towards them, even in a stooping position, they would invariably start off before we had approached within 400 yards."



HORNS OF THOMSON'S
GAZELLE. (From
Günther.)

Thomson's Gazelle. In Masailand, on the east coast to the north of Zanzibar, Grant's gazelle is replaced by the allied but smaller Thomson's gazelle (*G. thomsoni*), of which the horns are figured in the woodcut. In this species the horns are relatively smaller and thinner than in the last, not exceeding 15 inches in length. This gazelle is also distinguished from the preceding by the broad dark brown band on the flanks, dividing the fawn-colour of the body from the white of the belly.

Other Species. The largest of all the group is the swift gazelle (*G. mohr*), which is a West African species from Senegal, standing upwards of 32

inches at the withers, and still higher at the rump. Allied to this is the dama gazelle (*G. dama*), from the Sudan, with relatively short lyrate horns, and no dark band on the flanks. Another fine species is the aoul (*G. sømmerringi*), inhabiting the lowlands of Somaliland, and also found in Abyssinia and the Sudan. In the swift gazelle the length of the horns may be 12 inches; while in the aoul or Sømmerring's gazelle this varies from about 12 to upwards of 19½ inches. The height of the latter species at the shoulder is about 30 inches. It is characterised by its very massive lyrate horns, marked with about eighteen rings, and may be distinguished from the dama by its longer ears, bordered with black externally, and the more strongly-defined and nearly black markings on the face. This is the finest of the Somaliland gazelles; and was formerly found in small herds close to the shore.

CLARKE'S ANTELOPE.

Genus *Ammodorcas*.

Nearly allied to the true gazelles is a remarkable antelope (*Ammodorcas clarkei*), recently discovered in Somaliland, which serves to connect the preceding with the following species. Clarke's antelope, while having the facial markings of the gazelles, is distinguished by the regular upward and forward curvature of the rather short horns, which are ringed in front at the base. The females are hornless; and the skull is intermediate between that of the gazelles and the under-mentioned gerenuk. The neck is very long, and the tail thin and long. The number of rings on the horn varies from five to ten. The general colour is a deep cinnamon, darker than in any of the true gazelles. These antelopes appear to be local in Somaliland, but are said to be common in parts of the interior. Mr. Clarke states that when running they throw the tail upwards and forwards, and at the same time incline the long neck backwards, so that the two look as if they would touch each other. It is locally known as the dibatag.



HEAD OF CLARKE'S ANTELOPE.—After Thomas.

THE GERENUK.

Genus *Lithocranius*.

Still more remarkable than the preceding is the gerenuk, or Waller's gazelle (*Lithocranius walleri*), which is also an East African species, ranging from Somaliland to the Kilima-Njaro district. The most peculiar external feature about

this animal is the excessively long neck (as shown in the accompanying figure), which has led to its being likened to a miniature giraffe. The horns of the bucks curve forwards at the tips in a peculiar hook-like manner, and are usually about 13 inches in length, although they may reach 14 inches. The skin of this antelope is distinguished by the presence of a very broad dark-brown band running down the middle of the back, which in its widest part measures some 7 or 8 inches across, and stands out in striking contrast to the rufous fawn of the flanks and limbs.



HEAD AND NECK OF THE GERENUK.
(From Selater, *Proc. Zool. Soc.*, 1892.)

The skull differs from those of the true gazelles by its extremely dense and solid structure, as well by the relative shortness of its facial portion, its remarkable straightness, and the unusually small size of the cheek-teeth.

Habits.

Captain Swayne says that "the gerenuk is found all over the Somali country in small families, never in large herds, and generally in scattered bush, ravines, and rocky ground. I have never seen it in the cedar-forests, nor in the treeless plains. Gerenuk are not necessarily found near water; in fact, generally in stony ground with a sprinkling of thorn-jungle. The gait of this antelope is peculiar. When first seen, a buck gerenuk will generally be standing motionless, head well up, looking at the intruder, and trusting to its invisibility. Then the head dives under the bushes, and the animal goes off at a long, crouching trot, stopping now and again behind some bush to gaze. The trot is awkward-looking, and very like that of a camel; the gerenuk seldom gallops, and its pace is never very fast. In the whole shape of the head

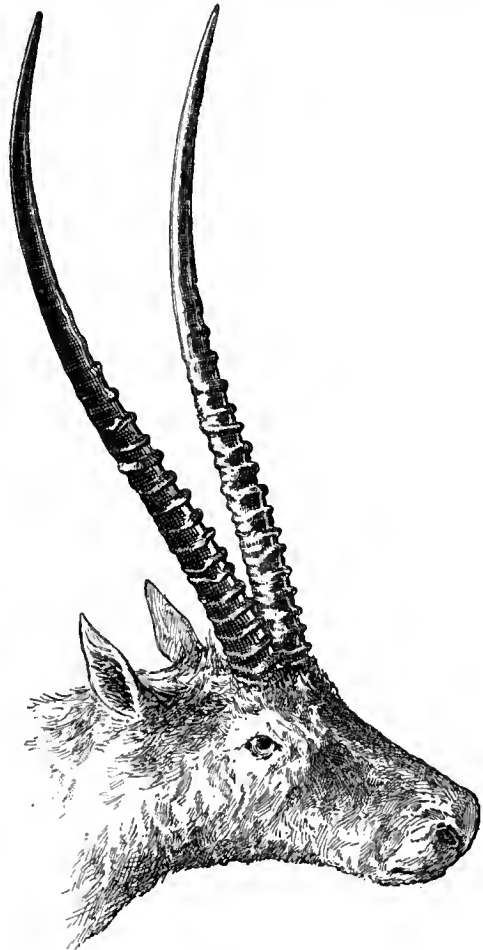
and neck, and in the slender lower jaw, there is a marked resemblance between the gerenuk and the dibatag." This antelope subsists more by browsing than by grazing, and it may not unfrequently be observed standing up on its hind-legs, with outstretched neck, and its fore-feet resting against the trunk of a tree, in order to pluck the foliage.

THE CHIRU, OR TIBETAN ANTELOPE.

Genus *Pantholops*.

In addition to possessing a peculiar species of gazelle, to which reference has already been made, the elevated and barren plateau of Tibet is further characterised by an antelope remarkable for the swollen nose and long elegant horns of the bucks. This antelope is the chiru (*Pantholops hodgsoni*), the sole representative of the

genus to which it belongs. In many respects the chiru is allied to the saiga, mentioned next, but the nose is less convex, and the nostrils open anteriorly instead of downwards. The horns (which, as in all the following members of this group are present only in the bucks) are black, long, erect, laterally compressed, and sublyrate, with rings in front for the lower two-thirds of their length. There is no gland below the eye; and the skull lacks the pits between the eyes found in the other members of the group. In height the male chiru stands 32 inches at the shoulder; and it is covered with very thick, close fur, becoming woolly near the skin. The colour is pale fawn above and white below; the whole face and a stripe down the front of each leg being black or dark brown in the bucks. The horns frequently reach 24 and 26 inches in length, and one pair has been recorded of 27½ inches. The chiru probably inhabits the whole of the Tibetan plateau, at the same elevations as the Tibetan gazelle.



HEAD OF CHIRU.

Habits. In summer the sexes live apart; and these antelopes are often found in parties of from three to four individuals, but sometimes in large herds. They frequent the open rolling plains, or broad river-valleys, and generally feed at morning and evening. Although usually difficult to approach, a solitary buck will sometimes start up from a ravine close to the traveller's feet, as once happened to the present writer. General Kinloch states that the chiru is in the habit of excavating hollows in the sand, in which it will lie concealed during the day. The young are born in summer; one only being produced at a birth.

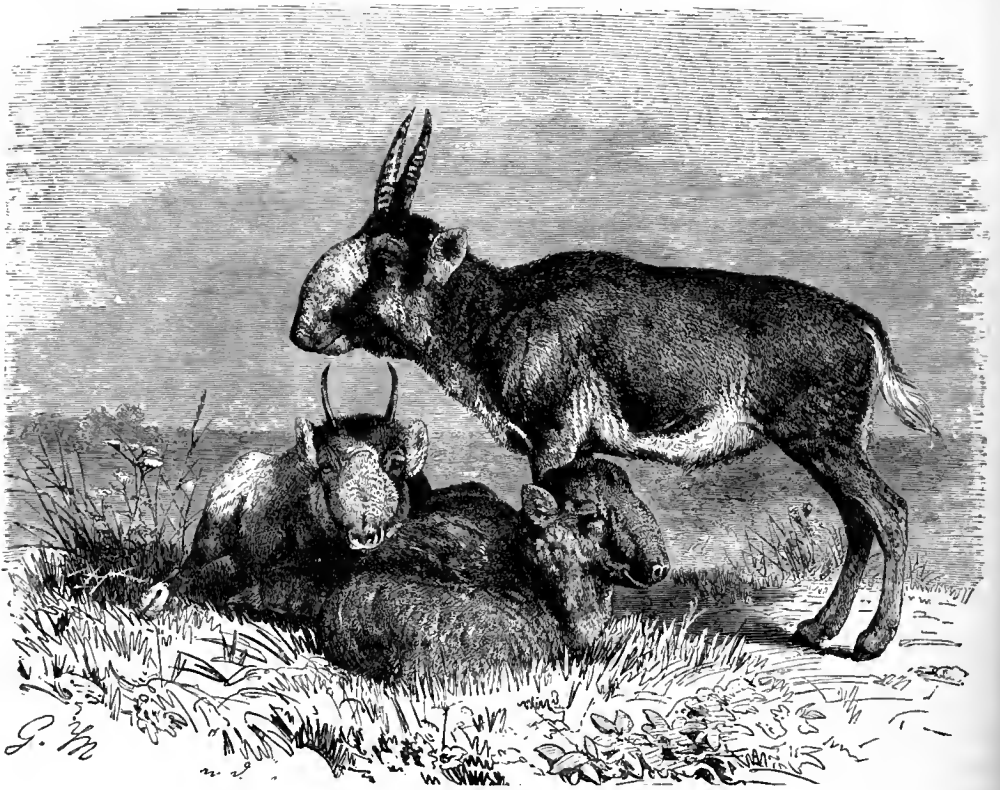
THE SAIGA.

Genus *Saiga*.

From the peculiarly bloated appearance of the nose of the male, the saiga (*Saiga tartarica*) of the steppes of Eastern Europe and Western Asia is one of the most ungainly of the antelopes, and thereby presents a marked contrast to the gazelles. In size this animal may be compared to a sheep, and its whole build is clumsy. The nose is very large, convex, and inflated, with the nostrils opening

downwards; and the face has a small gland below the eye. The ears are small and rounded; and the tail is of moderate length. The lyrate horns are rather short, completely ringed, and of an amber-yellow colour. In summer the general colour of the upper-parts is tawny yellow; but in winter, when the hair increases in length, the tint is greyish, and, in fact, externally nearly white; the face, under-parts, and the lower surface of the tail are always white. The horns usually attain a length of from 10 to 12 inches along the curve, but may be over 14 inches.

Habits. The saiga is found in large herds, sometimes comprising several hundred individuals during the summer, but these split up into small parties in the winter; the old males always remaining with the herds. According to



THE SAIGA ($\frac{1}{2}$ nat. size).

Pallas, some members of the herd keep watch while the others sleep. Although the saiga, when first started, can run swiftly for a short distance, it soon becomes blown. When caught young, these animals can be easily tamed, and will follow their owners about like a dog.

Distribution. At the present day the range of the saiga embraces Southern Russia and South-Western Siberia; its headquarters being the Kirghiz Steppes. A century ago the saiga extended, however, as far as the confines of Poland; and it is now gradually retreating towards the east of the Volga. In summer the saiga wanders as far north as the districts inhabited by the reindeer; while in winter it migrates south, and thus comes in contact with the Persian

gazelle. When we pass back to the Pleistocene period, the saiga had a much more extensive range to the westward, its fossilised remains having been obtained from the caverns and superficial deposits of Hungary, Belgium, and the south of France. Moreover, from the frontlet of a male having been discovered in the gravels of Twickenham, it is evident that the animal occasionally wandered as far as Britain. In Moravia there have been found the remains of a saiga differing from the living species by having six, in place of five, lower check-teeth. From the occurrence of saiga remains, together with those of other mammals now characteristic of the steppes, in Western Europe, it has been inferred that steppe-like conditions and climate must formerly have prevailed over portions of that area.

PALAS.

Genus *Epyceros*.

The South African antelope, known by the name of pala or impala (*Epyceros melampus*), is a rather large animal, standing a little over 3 feet in height, and of a dark-red colour above, gradually shading into white below. There is no gland on the face below the eye; and the feet are distinguished by the total absence of the lateral hoofs. The horns of the males are lyrate, widely divergent, and somewhat spiral, with about a dozen complete and widely-separated rings. The ordinary length of pala horns does not exceed 16 inches; but Mr. Selous records specimens of 20 and 21 inches, measured in a straight line. The pala is found throughout Southern and South-Eastern Africa. Mr. Selous states that these antelopes are nowhere more plentiful than along the Chobi, and may often be seen in herds of from twenty to one hundred together. "There are very few males in comparison with the number of females, though I have sometimes seen a herd composed entirely of rams, ten or fifteen in number. They are like thick corn along the river's bank, and are seldom seen at a distance of more than a mile from water; and there is no more certain sign of the proximity of water than the presence of impala antelopes." In Nyasaland, Mr. Crawshay states that they frequent sandy plains covered with mimosas and low scrub near the rivers. The same writer observes that "no antelope I have seen can compare with the impala in fleetness of foot, and certainly no other can display such wonderful leaping power; they go off like the proverbial arrow from the bow, and, with most beautiful gliding bounds, cover the ground, without apparently the least effort. When alarmed they often give utterance to a sharp bark." From its red colour, the pala is known to the Dutch Boers as the roybok.



HEAD OF PALA.—After Selous.

Gordon Cumming relates that on one occasion near his camp "a loud rushing noise was heard coming on like a hurricane; this was a large troop of pala pursued by a pack of about twenty wild dogs. They passed our camp in fine style within

a hundred yards of us, and in a few minutes the dogs had fastened upon two of the palas, which my Bechuanas ran up and secured. One of these animals cleared a distance of fifty feet in two successive bounds, and this on unfavourable ground, it being very soft and slippery."

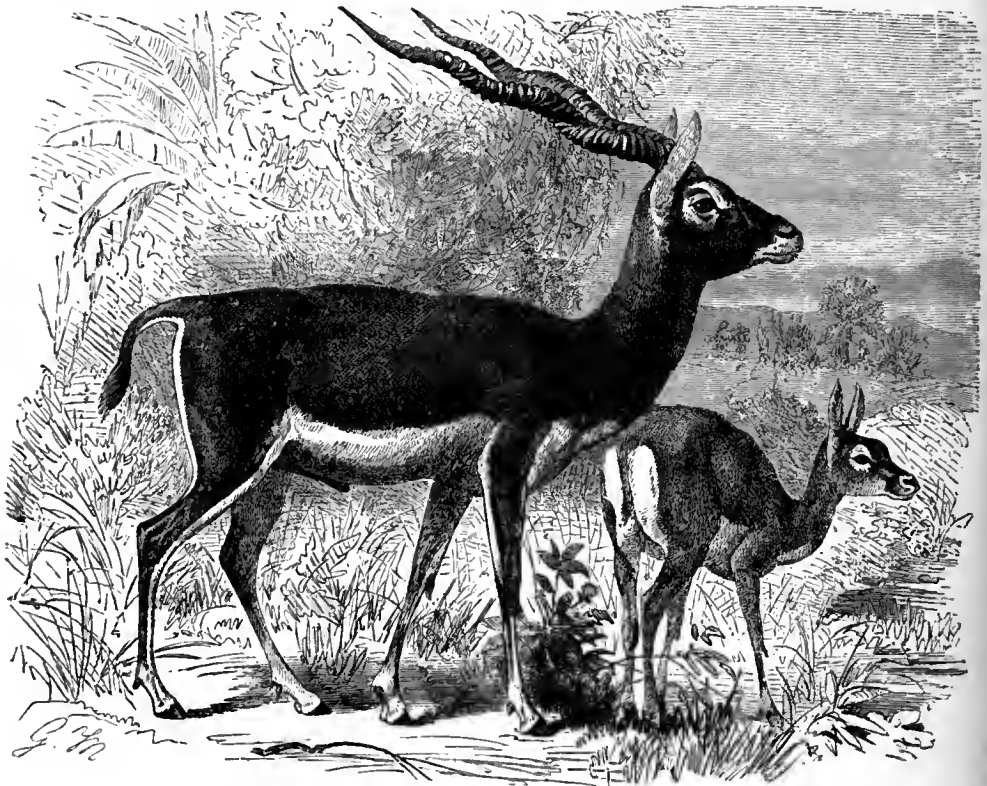
Lesser Pala. The lesser pala is a smaller variety inhabiting part of Nyasaland, in the very heart of the distributional area of the typical form from which it is distinguished by its more slender skull and smaller horns.

Angola Pala. On the west coast, in Angola and Hasholand, the genus is represented by the Angola pala (*A. petersi*). This pala is distinguished by the presence of a black streak down the middle of the face, from the eyes to the upper part of the nose, and also by a black patch below each eye.

THE BLACK-BUCK.

Genus *Antilope*.

The handsomely-coloured black-buck or Indian antelope (*Antilope cervicapra*) is the sole representative of its genus, and at the same time the last member of the



MALE AND FEMALE OF THE BLACK-BUCK ($\frac{1}{2}$ nat. size).

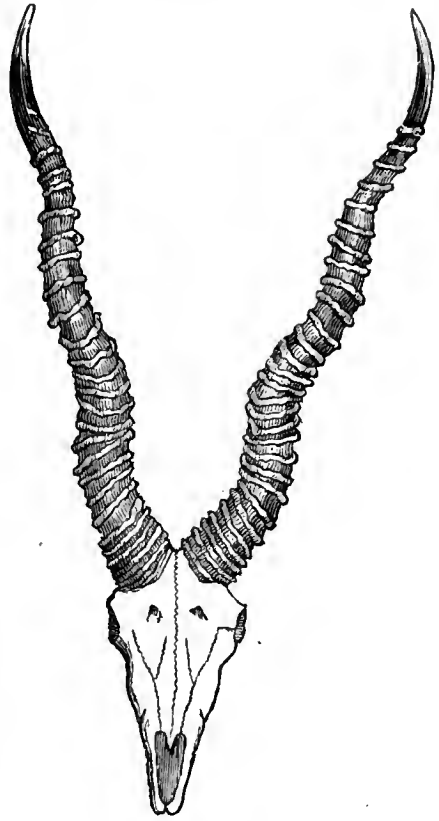
present group. The black-buck stands about 32 inches at the shoulder, and has a short and compressed tail, large glands, with a linear aperture below the eyes, tufts

of hair on the knees, and small but distinct lateral hoofs. The horns of the bucks rise close together, and are cylindrical, divergent, and spiral, with complete blunt rings throughout their length. The number of turns in the spiral of the horns varies from less than three to as many as five; and there is great individual variation in regard to the degree of divergence of the horns. The usual length of horns varies from 16 to 20 inches in a straight line, and in Peninsular India the length seldom exceeds 22 inches; but in Rajputana and Harriana the horns are longer, and have been known to attain a length of 28 $\frac{1}{2}$ inches. Does and young bucks are yellowish fawn-colour above and on the outer sides of the limbs, and white on the under-parts; the two colours are sharply defined, and just above the line of division there is a distinct pale streak. Save for a rufous patch on the nape of the neck, the old bucks are blackish brown above, and also on the sides of the neck and the whole of the face, with the exception of a white ring round each eye. In very old individuals the blackish brown becomes almost completely black. Occasionally does are met with having small recurved horns.

Habits.

The black-buck is an inhabitant of open plains from the foot of the Himalaya nearly to Cape Comorin, and from the Punjab to Lower Assam; and is most abundant in the North-West Provinces, Rajputana, and portions of the Deccan. It frequents either grassy districts or cultivated lands, and is generally found in herds, which may comprise hundreds or even thousands of individuals, but more usually number from ten to thirty, or even fifty does, accompanied by a single old buck. Mr. Blanford states that frequently "two or three younger bucks, coloured like the does, remain with the latter,

but these young males are sometimes driven away by older bucks, and form separate herds. This antelope never enters forest nor high grass, and is but rarely seen amongst bushes. When not much pursued or fired at, it will often allow men to come in the open within about one hundred and fifty yards, sometimes nearer." Carts and natives can approach still closer. The black-buck feeds at all hours, although it generally rests during the middle of the day. In certain districts, where there is no fresh water except in deep wells, it is certain that these animals never drink; but several observers have proved that in other places they, at least occasionally, drink freely. Like the springbok, the black-buck frequently leaps high in the air when running. The speed and endurance of these animals are well known; and it is but very seldom that they are pulled down on good



SKULL OF BLACK-BUCK.

ground by greyhounds. In heavy sand, or on soft ground during the rains, they are, however, easily overtaken by good dogs; and wounded buck may be ridden down. An account of black-buck coursing with the hunting-leopard will be found on p. 445 of the first volume; and antelope-stalking is a favourite Indian sport.

Young fawns are generally concealed by the does in long grass. The bucks utter a short grunt, and the does a kind of hissing sound when alarmed. During the pairing-season the bucks engage in frequent combats among themselves. When taken young, the black-buck can be easily tamed, but the males are apt to be dangerous at certain seasons.

THE REITBOK.

Genus *Cervicapra*.

The reitbok, or reedbuck (*Cervicapra arundineum*), introduces us to a totally different group of large or small antelopes confined to Africa. These animals have horns only in the males; narrow, goat-like, upper molar teeth; and either a hairy or a naked muzzle. There is generally a gland below the eye, which may, however, be very small; and the skull usually has a large unossified space below the eye, and distinct pits in the forehead. The horns may be either large, lyrate, widely spreading, and thickly ringed, or small and upright. The tail is either of medium length, or very short.

The reitbok is characterised by its comparatively small horns, which bend forwards somewhat after the manner of those of Clarke's antelope. The tail is bushy and comparatively short, not reaching to within some distance of the hocks, and the lateral hoofs are very small. In height this antelope stands nearly 3 feet; and the short, smooth, and almost woolly fur is of a pale brownish fawn on the upper-parts, with a tinge of orange on the head; the under-parts and inner sides of the limbs being dirty white. Very old does become much paler, in fact almost white. The ordinary length of the horns is from 12 to 13 inches along the curves, although they occasionally reach 15 and 16 inches.

Distribution and Habits. Formerly reitbok were to be met with throughout Central South Africa, wherever there are open grassy or reedy valleys traversed by streams, but they are now practically exterminated in Bechuanaland, and rare in the Transvaal, although still common in many districts, such as the Chobi region. They generally associate in pairs, and it is seldom that more than three or four individuals (of which one or two will be young) are seen together, although sometimes as many as eight may be observed feeding within a short distance of one another. Mr. Selous mentions that "although the reedbuck is never found far from water, it always keeps on dry ground, and when chased I have never seen one take to boggy ground, but have noticed that rather than cross a narrow stream of water they will make a long detour." Indeed, when hunted these antelope will invariably seek refuge in bush, or by flight into the open dry country. The males, if suddenly frightened, sometimes utter a whistling sound. In pace this species is slow, and it is one of the easiest of African antelopes to stalk.

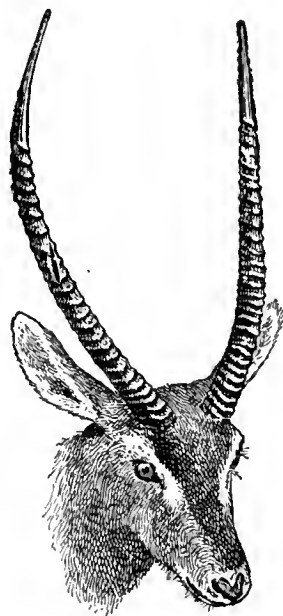
Other Species. The South African antelope known as the roi rhebok (*C. lalandi*), which, by the way, must not be confounded with the true or vaal rhebok, is a smaller but nearly-allied species, standing only about 28 inches at the shoulder. It has long and coarse reddish-brown hair on the upper-parts, while beneath it is white. The horns are seldom more than 8 or 9 inches in length, and bend forwards in a sharp sweep, without any outward inclination. The West African nagor (*C. redunca*) is closely allied to, if not identical with, this species; the coloration being similar, and the small horns not usually exceeding 6 inches in length. The other representative of the genus is the bohor (*C. bohor*), extending in East Africa from Abyssinia to Masailand; it is a larger and brighter-coloured animal than the last, from which it is also distinguished by certain characters of the skull.

WATER-BUCK, LICHU, ETC.

Genus *Cobus*.

The antelopes included in the genus *Cobus* are water-loving animals, generally of larger size than the reitbok, and associating in herds. Their horns are long, sublyrate, and ringed nearly throughout; the tail is longer than the reitbok, and tufted at the end. As in the latter, the gland below the eye is rudimentary; and the colour, with the exception of some patches on the rump and the head is uniform. The muzzle is naked. The skull may be distinguished from that of *Cervicapra* by the premaxillary bones reaching upwards to join the nasals.

Water-Buck. The water-buck (*C. ellipsiprymnus*) stands upwards of 4 feet or more at the withers, and is characterised by its long and very coarse hair, which varies in colour from reddish brown to dark grey, with an oval ring of white on the buttocks, extending above the tail, a white gorget on the throat, a streak of the same colour on part of each eye, and some white near the muzzle. Good horns average about 28 inches along the curve, but they may measure 30, 31, or even 33½ inches; their colour is pale. Water-buck inhabit Southern and Eastern Africa to some distance north of the Zambesi; and they are never found in herds of more than twenty individuals. Mr. Selous states that the water-buck is most partial to steep stony hills, and is often found at a distance of more than a mile from the nearest river, for which, however, it always makes when pursued. Though a heavy-looking beast, it can clamber with wonderful speed and sureness of foot up and down the steepest hillsides. In Nyasaland Mr. Crawshay writes, that water-buck are always found in greatest numbers on large swampy plains overgrown with coarse grass, tall reeds, and papyrus, where in the wet season it is almost impossible to get at them; unlike other antelopes, except the



HEAD OF WATER-BUCK.—After Selous.

reedbuck, they do not appear to leave the lowlands in the rains, but keep to the plains all the year round. The water-buck is less difficult to stalk than the reitbok, but its flesh is so coarse and stringy as to be almost uneatable.

Sing-Sing. The sing-sing (*C. defassa*), from Western and Central Africa, which stands 3 feet 10 inches at the shoulder, differs from the water-buck by its fine and soft hair, and the presence of a continuous whitish patch on the buttocks, which does not rise above the level of the rest of the tail; while there is no white gorget. The horns do not exceed $27\frac{1}{4}$ inches in length, or a fraction over. The sunu (*C. leucotis*), from Uganda, is another large species, distinguished by the blackish colour of its fur, and the white ears, rings round the eyes, and under-parts. The horns are relatively long and thin, reaching from 17 to nearly 20 inches in length.

Other Species. The remaining species are of smaller size, and distinguished by their more reddish or foxy-coloured hair. It is probably to one of these smaller species that the species of *Cobus* found in the Pliocene rocks of



THE PUKU.—After Livingstone.

Northern India is allied. The West and East African æquitun (*C. cob*) is a much smaller animal than the under-mentioned lichi, and has shorter horns, coming more forwards. It has a relatively shorter tail than the water-buck, and is of a general pale reddish-brown colour, with white on the inner sides of the ears, the under-parts, the inner surfaces of the limbs, the tip of the tail, and a ring round each fetlock. Good horns vary in length from 17 to 18 inches. This is one of the few antelopes that range across Africa, occurring both in Uganda and in Gambia.

The lichi (*C. leche*) and the puku (*C. vardoni*), are two allied species from South Central Africa, both of which were discovered by Livingstone. The puku is about the size of the pala, standing some

3 feet 3 inches at the shoulder; its hair is of a uniform foxy-red colour, with the tips of the ears black, and black markings down the front of the fore-legs. The horns are rather small, without much forward curvature, and with the rings not extending so high up as in the lichi; their length varying from 13 to 16, and in one instance reaching 19 inches. The puku is a plumply-built animal, with a very erect carriage; and its horns may attain a length of 16 inches along the curve. The lichi is distinguished by its superior size, less erect carriage, and the completely fawn-coloured ears of the adult; the general colour being pale brown,

with the under-parts and rings round the eyes whitish. The horns seldom exceed 24 inches in length, although they have been recorded of $27\frac{1}{2}$ inches. The lichi is strictly a swamp-dwelling animal; and, when undisturbed, can be approached very easily. Mr. Selous states that when these antelopes "first make up their minds to run, they stretch out their noses, the males laying their horns flat along their sides, and trot; but on being pressed they break into a springing gallop, now and then bounding high into the air. Even when in water up to their necks they do not swim, but get along by a succession of bounds, making a tremendous splashing. Of course, when the water becomes too deep for them to bottom they are forced to swim, which they do well and strongly, though not so fast as the natives can paddle; and when the country is flooded, great numbers are driven into deep water and speared." Generally these animals are to be seen standing knee- or belly-deep in the water, lazily cropping the aquatic plants; or reposing close to the water's edge. Puku are usually met with in herds of from three to twelve in number, although occasionally as many as fifty may be seen together. They are generally found on dry ground close to the edges of the rivers, but when pursued will take readily to the water. Mr. Selous states that puku and lichi are never found together, although the latter may associate with pala.

THE RHEBOK.

Genus *Pelea*.

The rhebok, or vaal rhebok (*Pelea capreola*), is the first representative of the second division of the Cervicaprine group, in which the species are mostly of small size, and characterised by their short and nearly upright horns. Of this subgroup the rhebok, which stands about 30 inches at the withers, is the largest species. The horns are placed wide apart over the eyes, and are sharp, slender, and well ringed, rising nearly vertically with a slight forward bend, but with little divergence. Their cross-section is elliptical; and their length from $5\frac{1}{2}$ to $8\frac{1}{2}$ inches. The gland below the eye and the corresponding depression in the skull are wanting. The muzzle is naked; the tail short, broad, fan-like, and bushy; and the hair thick and rather woolly. The colour is a light greyish brown, passing into white beneath.

Habits.

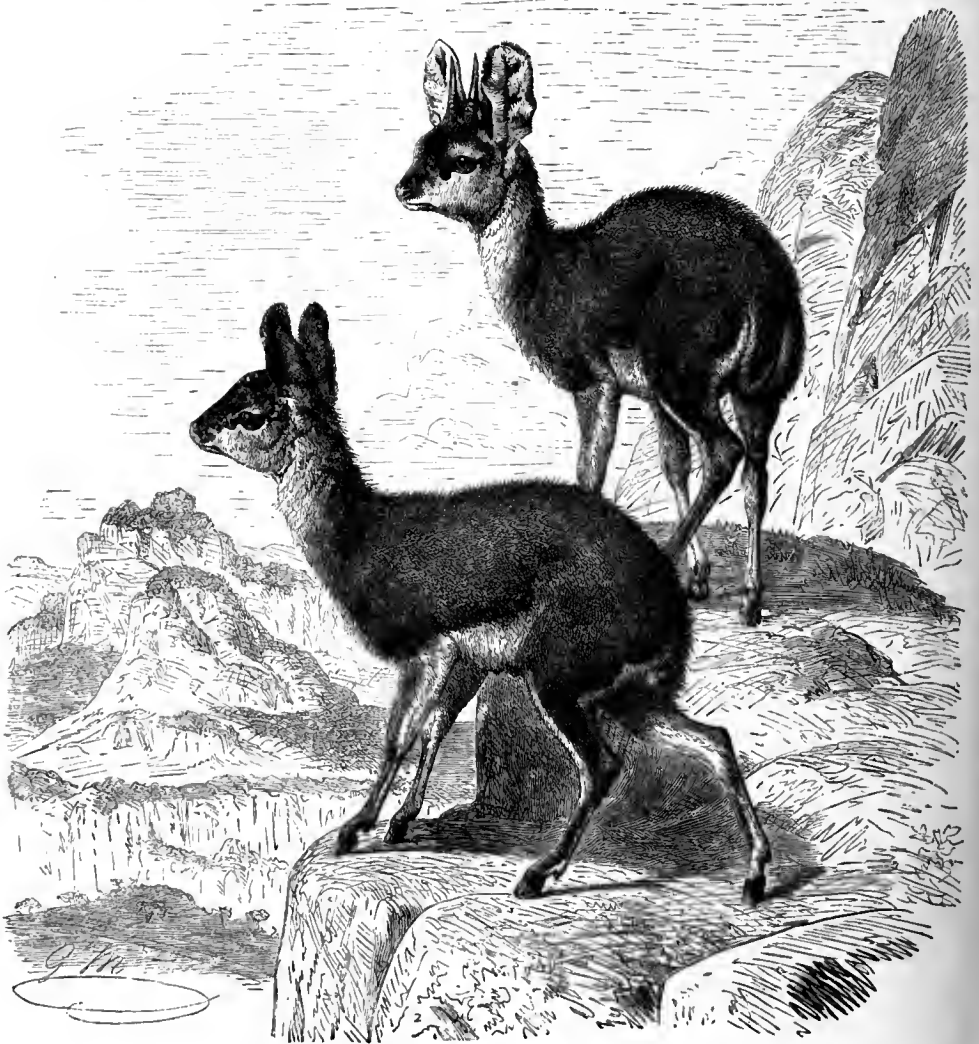
This antelope is an inhabitant of hilly and mountainous districts in Southern and Eastern Africa; and its habits much resemble those of the chamois. Mr. Drummond states that rhebok "are never found but on the bare hills among rocks and stones, and their habits of springing are wonderful. It seems extraordinary how their delicate limbs escape injury, when they take bound after bound, like an india-rubber ball, in places that a cat would shudder at. I do not suppose that they are really more shy than some of the other antelopes; but the nature of the ground which they inhabit makes it appear so. That it is hard to get at them no one will deny, and it is equally difficult to drive them, unless, indeed, you happen to know the particular troop, have often seen it, and been accustomed to notice the direction they usually take when disturbed." Rhebok only descend from the mountain-tops and ridges at night for the purpose

of drinking. They are usually found in parties of from six or seven to as many as a dozen. From their wary nature, the best way of shooting rhebok is by driving. At the present time, although widely distributed, these antelopes are nowhere abundant.

THE KLIPSPRINGER.

Genus *Oreotragus*.

Even more active than the rhebok is the diminutive klipspringer (*Oreotragus saltator*), which derives its name—meaning “rock-jumper”—from its unrivalled



MALE AND FEMALE KLIPSPRINGER ($\frac{1}{2}$ nat. size).

power of leaping from crag to crag. This little antelope stands about 22 inches in height, and is characterised by its peculiarly thick and brittle hairs, which are

hollow internally. The colour of the upper-parts is uniform olive. The small straight horns of the male rise vertically from the head and incline slightly forwards at their tips; their length averaging only about 4 inches, so that they are overtopped by the large ears. The hoofs, although somewhat clumsily shaped, are so small that all the four feet could easily stand upon a penny-piece.

Habits. The range of the klipspringer extends from the Cape through Eastern Africa as far north as Abyssinia; and in the latter country these pretty little animals are found as high up as eight or nine thousand feet above the sea. The small size of their hoofs enables the klipspringers to obtain foothold on the smallest projections, and they are consequently enabled to bound up the sides of the steepest cliffs; needless to say, these antelopes are exclusively confined to hilly districts. They were formerly abundant at the Cape, but have now become comparatively scarce. Mr. Crawshay writes that "I have never seen more than a pair together, though in places where they are numerous, one occasionally sees as many as three or four on the move at the same time." The flesh is tender and well-flavoured.

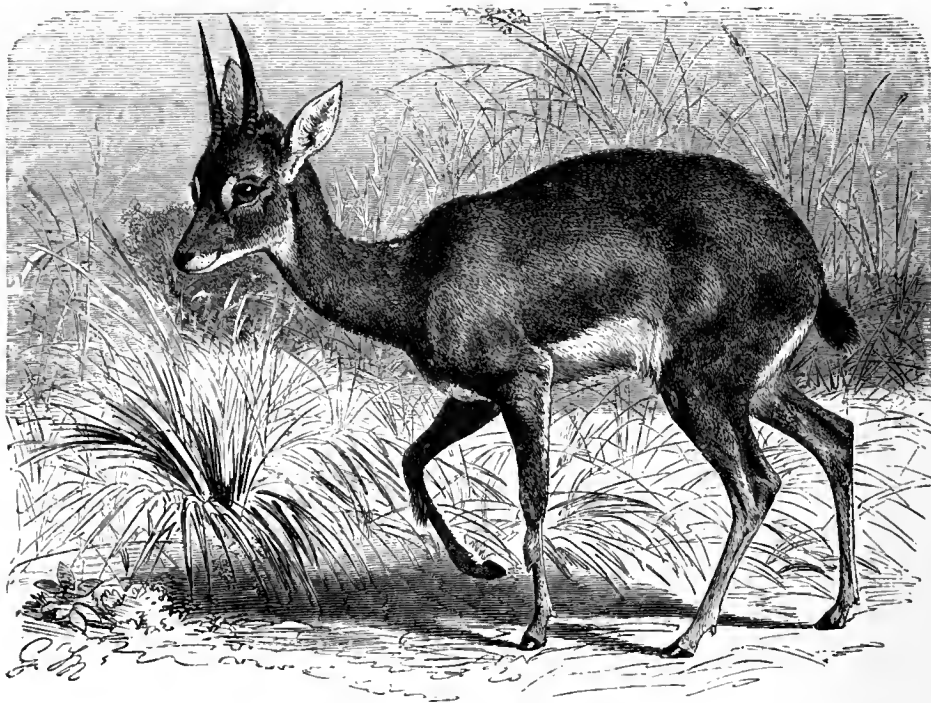
THE STEINBOKS.

Genus *Nanotragus*.

Although the name steinbok is properly restricted to a single species of antelope, it will be found convenient in zoology to apply it to all the members of a small group of these animals forming the genus *Nanotragus*. These pretty antelopes are all of small size, with short horns in the males, no tuft of hair on the crown of the head, a naked muzzle, and a distinct gland below the eye, of which the aperture is circular. The steinboks may be divided into three sections, of which the first is represented by the true steinbok (*N. campestris*). This antelope stands about 23 inches at the shoulder, and is usually of a reddish brown colour, white below; but while in one variety the hue of the fur tends to rufous, in another it is more or less silvery. Together with the other members of the section to which it belongs, the steinbok has neither lateral hoofs nor tufts of hair at the knees. The horns usually attain a length of about 4 inches, but rarely may be 5; and the tail is of moderate length, and of the same colour as the back. This little antelope frequents either open country or thin forest, but avoids mountainous districts, and is common throughout South and East Africa as far north as the Zambesi. Although abundant, these animals are difficult to find, owing to the careful manner in which they conceal themselves. On the east coast this species is replaced by the larger Zanzibar steinbok (*N. moschatus*). The third member of the section is the royal antelope (*N. pygmaeus*) of the Guinea coast, which is the smallest of all the Ruminants, standing only 12 inches at the shoulder. It is of a bright chestnut colour, darker on the back than the flanks, with the underparts glistening white.

Oribi. The oribi (*N. scoparia*), which is the species represented in our figure, differs from the preceding forms by the presence of lateral hoofs, and tufts of hair on the knees. It stands 24 inches in height, and is of a tawny-yellow above and white beneath, the horns being about 5 inches in length.

These antelopes range in South Africa to some distance north of the Zambesi, and are found in parties of two or three on open ground, but are very local. Their colour harmonises closely with the ground, and their speed is very great. The flesh forms excellent venison. There are three other species of this section, among which is the Abyssinian steinbok (*N. montanus*).



THE ORIBI ($\frac{1}{2}$ nat. size).

Grysbok. The grysbok (*N. melanotis*), which is met with only to the north of the Limpopo, differs from the oribi by the absence of the tufts of hair on the knees. It is of about the same size as the steinbok, and of a chocolate-red colour. It is fairly numerous in hilly districts and extends far into the interior.

SALT'S ANTELOPE.

Genus *Neotragus*.

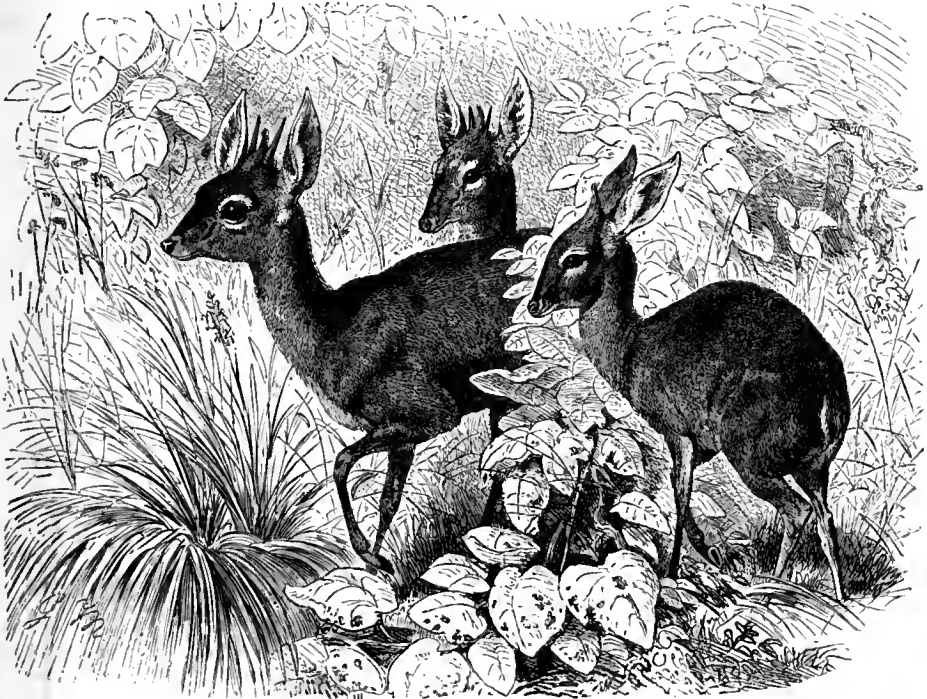
The Beni-Israel or Salt's antelope (*Neotragus saltianus*) of the Red Sea littoral and Abyssinia, which is only slightly larger than the royal antelope, is the best-known representative of a genus distinguished from the preceding by the presence of a tuft of hair on the crown of the head, and by the hairy muzzle, as well as by the horns of the males sloping backwards in the plane of the face. Moreover, the skull is distinguished by the great size of the aperture for the nose and the shortness of the nasal bones, while the last molar tooth in the lower jaw, instead of being composed, as in other Ruminants, of three distinct lobes, has either only two such

lobes, or two with a mere rudiment of the third. The female of the Beni-Israel is only 16 inches in height. In central Somaliland, Kilima-Njaro, and Damaraland this species is replaced by Kirk's antelope (*N. kirki*), differing from the first by having a rudiment of the third lobe in the last lower molar. Kirk's antelope also has a more puffy nose than the Beni-Israel, while its horns are cylindrical instead of being flattened on the inner side. So common is Kirk's antelope in parts of Somaliland, that two or three may be killed at a shot. When disturbed, they start up with great bounds, uttering a shrill cry; the flesh has an unpleasant musky flavour.

DUIKERBOK.

Genus *Cephalophus*.

The elegant little South African duikerbok brings us to an assemblage of small or medium-sized antelopes, differing in many important respects from the preceding, or Cervicaprine group, which includes all the species from the reitbok to the Beni-



THE DUIKERBOK ($\frac{1}{2}$ nat. size).

Israel. The name duikerbok properly applies, of course, only to the typical species, but it may be conveniently extended to include the whole group. These antelopes, which are exclusively African, are mainly inhabitants of thick forest, although the typical form frequents brush-covered or open country. They are characterised by their small straight horns, which are generally present in both sexes, being placed far back on the skull and separated by a long tuft of hair. The gland below the

eye is small, and is peculiar in opening either in the form of a slit (as in the species figured) or as a row of small pores. The muzzle has a large naked portion, and the tail is very short. The upper molar teeth have broad and square crowns (as in the figure on p. 158), and thereby differ markedly from those of the preceding group. The majority of the duikers are light and elegantly-built animals, of a more or less uniform colour, and are all very similar in structure. From their generally inhabiting jungly or forest country, they are frequently spoken of as bush-bucks, but since that name is also employed for the guib (p. 277), its use is best avoided.

The common or true duiker (*Cephalophus grimmi*) is found in bush-covered districts from the Cape to the Zambesi and Nyasaland, and on the west coast ranges as far north as Angola. It stands about 26 inches in height, and belongs to a group of three species characterised by the general absence of horns in the female, and by those of the male rising upwards at a sharp angle to the plane of the nose. The ears are very long and narrow, and the colour typically yellowish brown, with a more or less marked grey tinge; but there is great variation in this respect, some skins tending to reddish and others to greenish, while the amount of white on the under-parts is also variable. The length of the horns is usually from 3 to 4 inches, although they may reach 5 inches. The name duiker, it may be mentioned, signifies diver or ducker, in allusion to the rapidity of the creature's movements when in cover. The madoqua (*C. abyssinicus*) is a smaller but allied species from Abyssinia, distinguished by its grizzled greyish brown colour.

Red Buck.

The red buck or Natal duiker (*C. natalensis*), which stands about 24 inches at the shoulder, differs by its horns (present in both sexes) inclining backwards in the plane of the nose, as in the majority of the genus. It is also distinguished by its bright reddish-bay colour, shorter and broader ears, smaller horns, and larger head-tuft. Owing to the sudden rushes they make when disturbed, these antelopes are difficult to shoot, and their flesh is unpalatable. There are many other more or less nearly-allied species, such as the philantomba (*C. maxwelli*) of Sierra Leone, to which it will be unnecessary to refer.

Blue Buck.

The little South African blue buck or pigmy antelope (*C. monticola*) must, however, claim attention as being the smallest member of the genus. These tiny creatures, which swarm in the Natal jungles, and stand only 13 inches at the shoulder, are smaller and lighter in build than a hare, and are of a bluish mouse-colour, with the tiny straight horns scarcely showing above the tuft of hair. Mr. Drummond states that these antelopes feed principally on certain berries and shrubs found growing in the jungles, and seem to be on the move, more or less, the whole day, though they are most often to be seen at early morning and evening. "Perhaps the most enjoyable way of shooting them is to steal about in the dense jungle, and shoot them as they patter about among the dead leaves which strew the game-paths, or catch them while feeding on some favourite bush."

Zebra-Antelope.

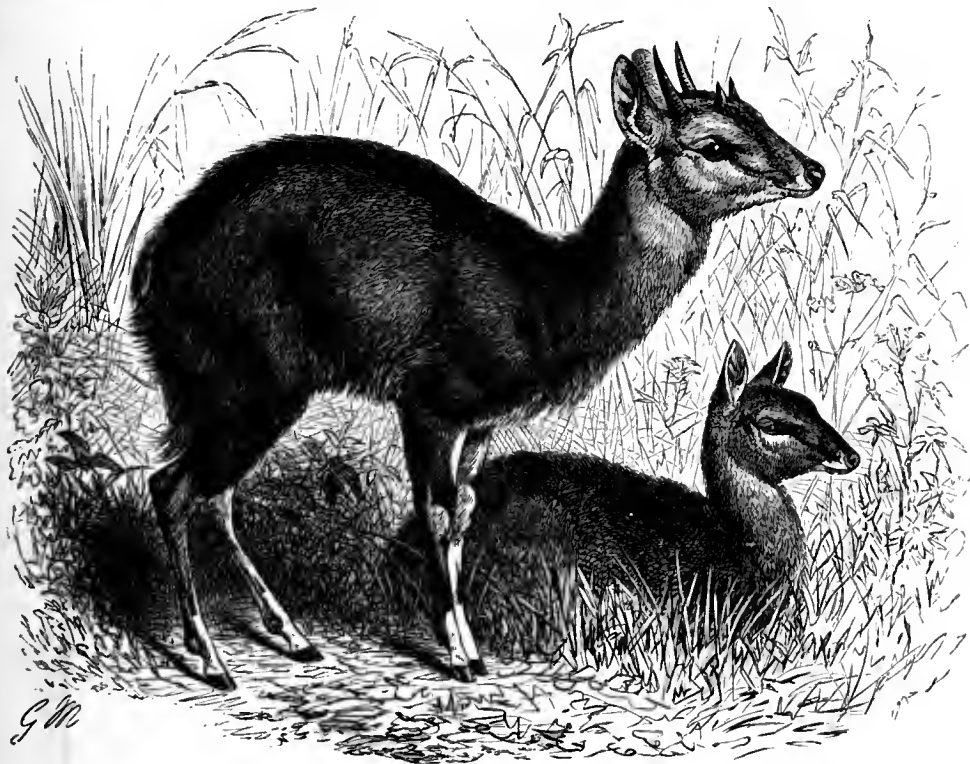
Another member of the group is the much larger zebra-antelope (*C. dorcas*) of West Africa, which takes its name from the eight or nine black transverse bands crossing the back and loins, and gradually narrowing to a point on the flanks; the ground-colour being a golden-brown. This coloration is quite unique among Ruminants, and rivals that of the marsupial thylacine.

Wood-Antelope. Two species of this genus from West Africa also call for mention on account of their great superiority in size over its other representatives. One of these is the wood-antelope (*C. sylvicultor*) of Sierra Leone and the Gabun, and the other the black wood-antelope (*C. jentinki*) from Liberia. The former stands about 2 feet 10½ inches in height, and is of a blackish colour, with the hinder part of the middle of the back marked by a yellowish white line. The second species is rather smaller, and is of a greyish colour on the body, with the head and neck black, and the legs, lips, and inner sides of the ears whitish. The tuft of hair on the head is small and inconspicuous. Altogether nineteen species of these antelopes are recognised by Mr. O. Thomas.

FOUR-HORNED ANTELOPE.

Genus *Tetraceros*.

The chousingha, or four-horned antelope (*T. quadricornis*) is the Indian representative of the duikerboks, and differs from all other living Ruminants in



MALE AND FEMALE FOUR-HORNED ANTELOPES (¼ nat. size).

that the male generally has two pairs of horns, of which the larger are placed as in the duikers, while the smaller pair are situated immediately over the eyes. The gland below the eye has nearly the same elongated aperture as in the duikers; but there is no tuft of hair on the crown of the head, and the upper molar teeth

have no additional column on the inner side. All the horns of the male are short, conical, and smooth; the front pair being often reduced to mere knobs, and not unfrequently absent. In height the male chousingha stands $25\frac{1}{2}$ inches at the withers, but an inch and a half higher over the haunches. The fur is thin, harsh, and short, and longer on the upper surface of the tail than elsewhere. The general colour is dull pale brown, with a more or less marked rufous tinge above, passing gradually into white on the under-parts and inner sides and lower portions of the limbs. There is a dark streak down the front of each leg, which is larger in the fore than in the hind pair. The second pair of horns usually vary from $3\frac{1}{2}$ to 4 inches in length, and do not appear to exceed $4\frac{1}{2}$ inches. The front pair are generally not more than $1\frac{1}{2}$ inches in length, but may reach $2\frac{1}{2}$ inches; they are fre-



SKULL OF FOUR-HORNED ANTELOPE.

quently absent in specimens from Madras.

Distribution. The chousingha is found along the foot of the Himalaya from the Punjab to Nipal, and over the greater part of Peninsular India in wooded and hilly country, although it avoids dense jungle. It is unknown in the plain of the Ganges, on the Malabar coast in Madras, and likewise in Ceylon.

Habits. Mr. Blanford writes that the chousingha "differs from all other Indian antelopes in habits as much as in structure. It is not gregarious, very rarely are more than two seen together; it haunts thin forest and bush, and keeps chiefly to undulating or hilly ground. It drinks daily, and is never seen far from water. It is a shy animal, and moves with a peculiar jerky action whether walking or running. The rutting season is in the rains, and the young, one or two in number, are born about January or February." General Kinloch writes that these animals "conceal themselves in long grass or among low bushes, and somewhat resemble hares in their habits. They are seldom to be seen out feeding, but usually jump up at the feet of the hunter and bound away at a great pace." Fossil remains of the existing species have been discovered in a cave in Madras; and it is believed that the genus is represented in the Pliocene deposits of the Siwalik Hills at the foot of the Himalaya.

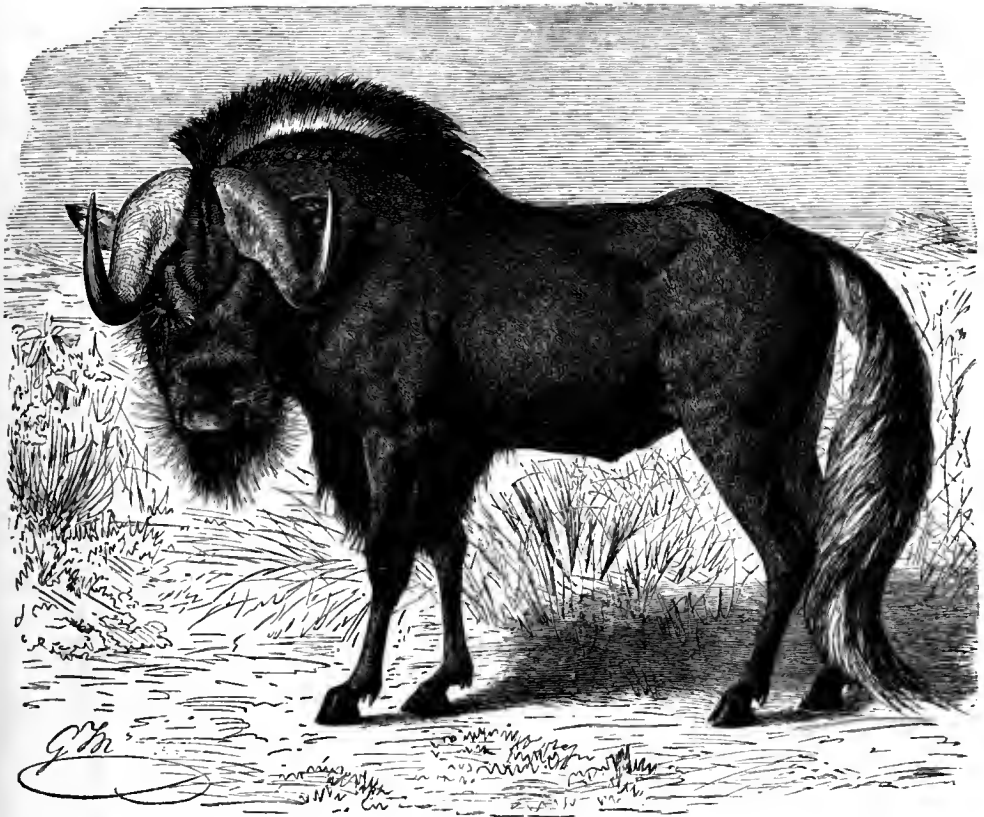
WILDEBEESTS.

Genus *Connochoetes*.

The last group of the antelopes is represented by the wildebeests and their allies the hartebeests and blessbok; and is mainly confined to Africa, although one species of hartebeest ranges into Syria. All these antelopes are of large size, and are characterised by the presence of horns in both sexes, as well as by the circumstance that the withers are more or less elevated above the level of the haunches. The muzzle is naked; and there is a small gland below the eye, marked by a tuft of hairs. The tail is long, and the general colour mostly uniform. The horns are more or less lyrate or recurved, and at their origin are placed more or less closely together. Unlike those of other antelopes, the bony cores of the horns are honey-

combed with cavities, as in the oxen; but the upper molar teeth differ entirely from those of the latter animals, having very narrow crowns, without any additional column on the inner side.

The wildebeests, or, as they are often called, gnus, are ungainly-looking creatures, distinguished by their broad and short heads, in which the muzzle is of great width, and fringed with long bristles, so that the nostrils are separated from one another by a considerable interval. The neck is furnished with an erect mane of stiff hairs; and the long tail is thickly haired throughout its length. The nearly smooth, cylindrical horns are situated on the highest point of the skull, and curve

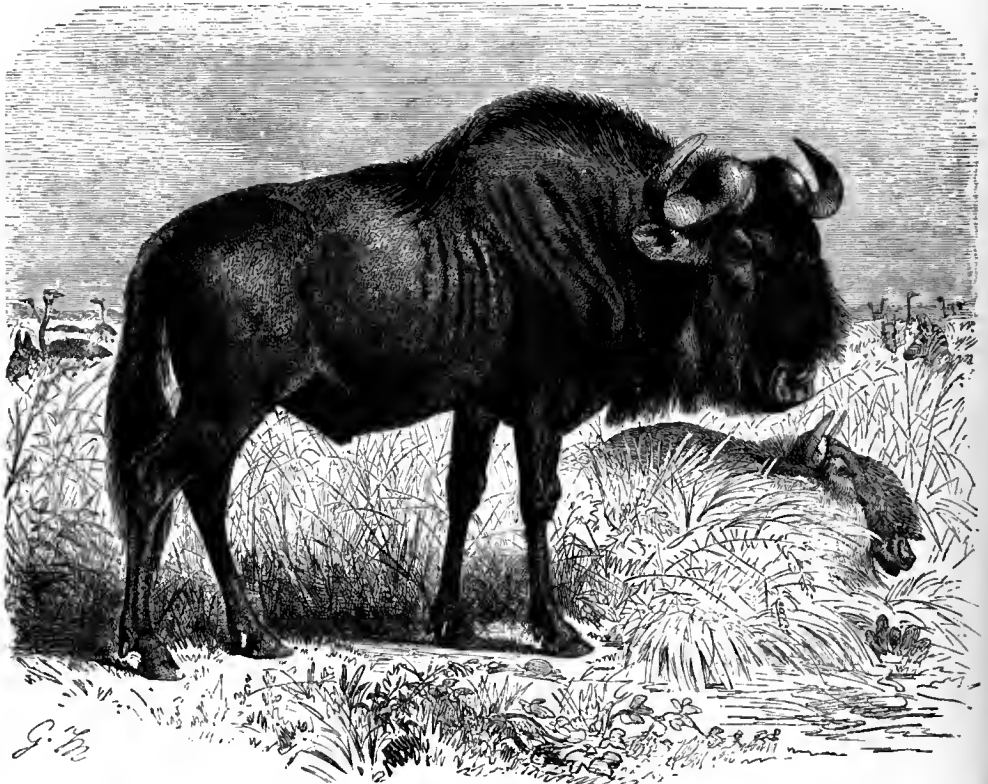


THE WHITE-TAILED WILDEBEEST ($\frac{1}{2}$ nat. size).

outwards, or outwards and downwards, and then bend upwards near the tips. In the young wildebeest the horns are, however, straight and diverging, placed at some distance below the highest point of the skull, and separated from one another by a wide space at the base covered with hair. These straight horns persist as the tips of those of the adult, the curved basal portion of the latter being a subsequent development. In very aged bulls the two horns approximate at their bases, so as to form a helmet-shaped mass completely covering the part of the skull, as in the Cape buffalo.

There are two well-marked species of wildebeest, confined to South and East Africa, both of which are represented in our illustrations. Of these the common,

or white-tailed wildebeest (*Connochates gnu*), is strictly South African; while the blue, or brindled wildebeest (*C. taurina*), is not found to the south of the Orange River, and on the east side of the continent extends in the Uganda district some distance to the north of the Victoria Nyanza. The former species, which stands about $4\frac{1}{2}$ feet at the shoulder, is distinguished by the long hair fringing the chest, the long white tail, and the uniform coloration of the body. On the other hand, the blue wildebeest has no long hair on the chest, the tail is black and shorter, the sides of the withers are marked with dark transverse stripes, and the hair on the face lies more smoothly. In the ordinary form of this species, the fringe of long



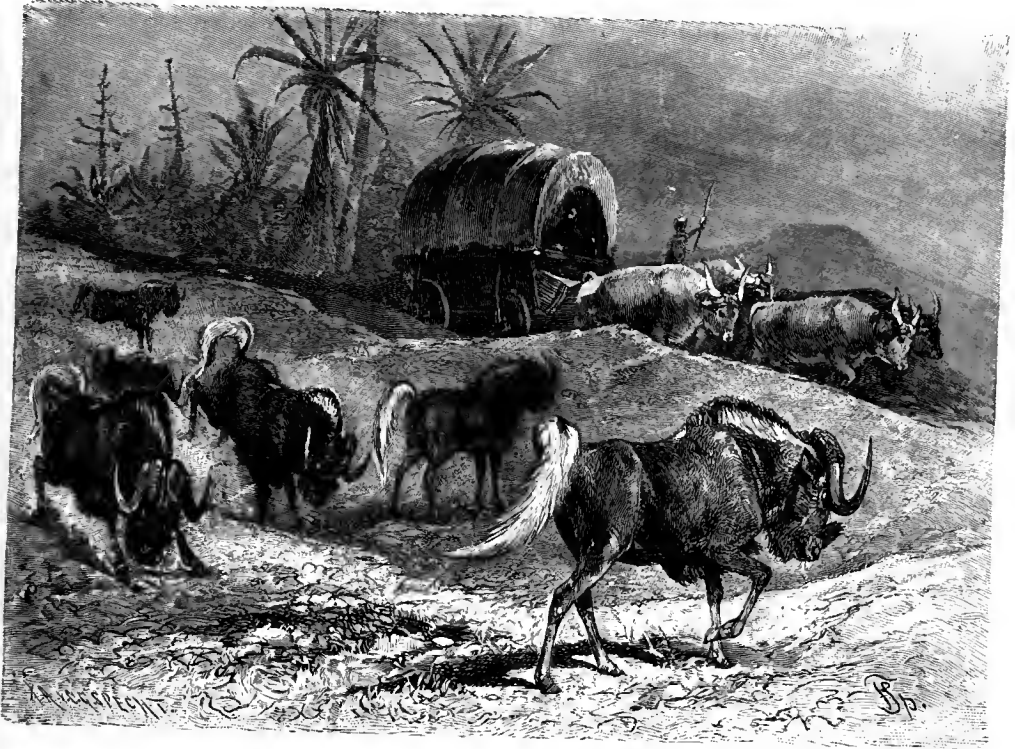
THE BLUE WILDEBEEST ($\frac{1}{16}$ nat. size).

hair on the throat is black; but it is white in a variety from Uganda. The horns of the males of this species have a spread of from 2 feet to 2 feet 2 inches; and in a specimen in which the spread was 2 feet $1\frac{3}{4}$ inches, the greatest length of each horn along the hinder curve was $19\frac{1}{2}$ inches, and the basal girth $13\frac{1}{2}$ inches. Mr. Selous states that the blue wildebeest is met with on the western borders of Griqualand West and the eastern edge of the Kalahari Desert, and from Mashonaland to Lake Ngami in suitable districts. Near Kilima-Njaro it is found in large herds, as is likewise the case in some other districts.

Habits.

Wildebeest are found in open country, and never, according to Livingstone, wander far away from the neighbourhood of water. When quagga were abundant, both these animals were frequently found together;

and Mr. Selous states that at the present day a solitary wildebeest may frequently be observed feeding among a herd of sassabi or zebra. Both species of wildebeest are characterised by their speed and endurance. Describing the habits and appearance of the white-tailed species, Gordon Cumming writes as follows:—"The black wildebeests, which also cover the entire length and breadth of the blessbok country, in herds averaging from twenty to fifty, have no regular course, like the blessboks. Unless driven by a large field of hunters, they do not leave their ground, although disturbed. Wheeling about in endless circles, and performing the most extraordinary varieties of intricate evolutions, the shaggy herds of these eccentric and fierce-



WHITE-TAILED WILDEBEESTS CURVETING ROUND A WAGGON.

looking animals caper and gambol round the hunter on every side. While he is riding hard to obtain a shot at a herd in front of him, other herds are charging down wind on his right and left, and, having described a number of circular movements, they take up positions upon the very ground across which he rode only a few minutes before. Singly, and in small troops of four or five individuals, the old bull wildebeests may be seen stationed at intervals throughout the plains, standing motionless during a whole forenoon, coolly watching with a philosophic eye the movements of the other game, uttering a loud snorting noise, and also a short sharp cry which is peculiar to them. When the hunter approaches these old bulls, they commence whisking their long white tails in a most eccentric manner; then, springing into the air, begin prancing and capering, and pursue each other in circles at their utmost speed. Suddenly they all pull up together to over-

haul the intruder, when the bulls will often commence fighting in the most violent manner, dropping on their knees at every shock; then, quickly wheeling about, they kick up their heels, whirl their tails with a fantastic flourish, and scour across the plain enveloped in a cloud of dust." In addition to their speed, wildebeest are remarkable for their extreme tenacity of life; and, owing to the vigorous use they make of their horns, are awkward creatures to hunt with dogs. Mr. Drummond states wildebeest are "so extremely wary that fewer are killed by native hunters than of any other species. Europeans, however, find them good practice in rifle-shooting, as they will stand in herds at a distance which they think secure, say three hundred or four hundred yards, and watch the passer-by." Only occasionally can they be approached within easy range by fair stalking; although they may be killed by watching at their drinking-holes at night. Mr. Drummond writes that, during a thunderstorm of unusual intensity, "I walked, hardly knowing where I was going, right into a herd of gnu. I did not see them until I was almost among them; but even had my gun not been hopelessly soaked, the fearful storm made self-preservation, and not destruction, one's chief thought. They were standing huddled in a mass, their heads together, and their sterns outwards, and they positively only just moved out of my way, much the same as a herd of cattle might have done"

HARTEBEESTS, BLESSBOK, AND BONTBOK.

Genus *Bubalis*.

The well-known hartebeest of South Africa (so called on account of a fancied resemblance to a stag) is the type of a genus which may be taken to include several nearly-allied species, and likewise the aberrant blessbok and bontbok.

All these animals differ from wildebeests by their long and pointed heads, terminating in a narrow muzzle; their ringed and often lyrate horns, the absence of a mane on the neck or throat, and their shorter and less thickly-haired tail. In consequence of the narrowness of the muzzle, the nostrils are closely approximated. The horns are compressed, and ringed for a considerable portion of their length; and in form are more or less lyrate, with their tips frequently bent suddenly backwards. In the typical forms the withers are much higher than the haunches, and this feature, together with the great length of the face, communicates an ugly and ungainly appearance to the whole animal. These characters are, however, far less strongly marked in the blessbok and bontbok, and some of the intermediate species. The cows of this genus differ from those of the wildebeests in the presence of only two, in place of four, teats.

Titel. The titel, or bubaline antelope (*Bubalis mauritanica*), of North Africa, Syria, and Arabia, is the only member of the genus not confined to the African continent. It is the smallest representative of the group, standing only 3 feet 7 inches at the shoulder; and is of a uniform bright bay colour throughout. The face is extremely elongated, and the horns are perched on a crest situated on the very summit of the skull. The horns are comparatively short and thick, of a deep black colour, with the rings extending nearly to their tips. They diverge from one another in a U-shaped form; and have their tips

GROUP OF AFRICAN ANTELOPES, VIZ., TORA ANTELOPE; BLESSBOK AND MONTEBOK; AND KOHIGUM.





bent suddenly backwards, nearly, but not quite, at a right angle. Their length varies from 13 to 14½ inches.

The Tunisian hartebeest (*B. major*), of west North Africa, is a much larger but closely-allied species, with enormously massive horns, which may be just over 20 inches in length, with a girth of 10¼ inches.

Hartebeest. The true hartebeest (*B. cama*) is a South African species, not ranging as far north as Matabililand and Mashonaland. This fine



HARTEBEEST (½ nat. size).

animal stands about 4 feet at the withers; its general colour being greyish brown, with a pale yellowish patch on each side of the haunches, and black markings on the forehead and nose. The hair of the face is reversed as high up as the eyes, or even to the horns; whereas in the preceding species it is reversed only for a distance of one or two inches above the muzzle. The horns are long, and boldly ringed, diverging from one another in the form of a V, with their tips directed backwards at a right angle, and the bases curved away behind the plane of the forehead. Their length varies in good specimens from 20 to 24 inches.

In the neighbourhood of the Victoria Nyanza the preceding species is re-

placed by Jackson's hartebeest (*B. jacksoni*), distinguished by the uniform pale colour of the face; the hair being reversed for a distance of only about 4 inches above the muzzle. The horns are of about the same dimensions as those of the hartebeest; in the typical specimen their length being $20\frac{3}{4}$ inches along the front curves, with a basal girth of 12 inches; but in a second example the length was $23\frac{1}{2}$ inches.

Habits.

Writing of the common hartebeest, Mr. Drummond states that it is one of the fastest antelopes in Africa, and possesses such strength as to render it almost impossible for anything under a whole pack of strong and swift hounds to bring it to bay. "It is common in the great level grass-plains to the north-west of Zululand, and on several occasions I tried coursing them there with two very fast crossed Amaponda greyhounds; but although the latter could run up to them when they had a fair start, they never once succeeded in bringing one to bay, or even in causing one to separate from the herd." In such districts it appears that the only way to obtain a successful shot is for the hunter to conceal himself in a ravine, and have the antelope driven in his direction.



UPPER PART OF SKULL AND HORNS OF COOKE'S HARTEBEEST. (From Günther.)

Cooke's Hartebeest.

Cooke's hartebeest (*B. cooki*), of British and German East Africa, brings us to a group of three species, readily distinguished from all the preceding forms by the wide expansion of their horns, as shown in the figure of the skull. The other two members of this group are the tora antelope (*B. tora*), of Upper Nubia and Abyssinia, which is represented on the left side of our illustration on p. 317; and Swayne's hartebeest (*B. swaynei*), of Somaliland, of which the head is shown in the accompanying woodcut and the skull on p. 159. In all these species the hair of the face is reversed only for a distance of 2 inches or less above the muzzle. In Swayne's hartebeest—the sig of the Somalis—the general colour is reddish chestnut, the face being marked by a broad purplish streak extending from a little distance below the eyes. The horns expand very widely, rising at first nearly in the plane of the face, and then forming a right angle with the middle line of the forehead; their smooth tips being bent at right angles to the base, and directed immediately backwards. Their length varies from 15 to $18\frac{1}{4}$ inches. In regard to the habitat of this species, Captain Swayne writes, that to the "south of the highest ranges of Somaliland, and at a distance of about one hundred miles from the coast, are open plains, some four thousand or five thousand feet above sea-level, alternating with broken ground covered with thorn-jungle, with an undergrowth of aloes growing sometimes to a height of six feet. This elevated country, called

the Hand, is waterless for three months, from January to March. Much of it is bush-covered wilderness, or open semi-desert, but some of the higher plains are, at the proper season, in early season, covered as far as the eye can reach with a beautiful carpet of green grass, like English pasture-land. At this time of the year pools of water may be found, as the rainfall is abundant. This kind of open grass-country is called the Ban. Not a bush is to be seen, and some of these plains are thirty or forty miles in extent each way. There is not always much game to be got in the Hand, but a year ago, coming on to ground which had not been visited by Europeans, I found one of these plains covered with herds of hartebeests, there being perhaps a dozen herds in sight at one time, each herd containing three or four hundred individuals. Hundreds of bulls were scattered singly on the outskirts, and in the spaces between the herds, grazing, fighting, or lying down. The scene I describe was at a distance of over a hundred miles from Berbera, and the game has probably been driven far beyond that point by now."



HEAD OF SWAYNE'S HARTEBEEB.—After Rowland Ward.

Cooke's hartebeest is of a reddish brown colour on the upper-parts and greyish brown beneath, the head being dark rufous in front and fulvous on the sides, and thus very different from that of the sig. The horns are also shorter and less widely expanded than in the latter. On the other hand, the tora antelope has the whole face of a uniform pale isabelline tint, like that of the body; the horns being fully as long as in the sig, but rising much more rapidly from the base, then coming farther forwards, and projecting much more in the backward direction. Tora horns vary from 12 to 19½ inches in length.

Konzi. The konzi (*B. lichtensteini*) is a very distinct species, inhabiting all the Zambesi region and Nyasaland, characterised by its small horns, which are much expanded and flattened at their bases. These horns incline at first upwards and outwards, and then inwards, with their tips directed backwards and upwards, so as to enclose a kind of vase-shaped space, their length ranging from 14 to 20 inches. The skull is also shorter than in any of the foregoing species. The general colour is a little lighter than that of the hartebeest; the tail, knees, and the front of the legs being black, while the face is without any dark markings, but the buttocks usually have a pale yellow patch, and the under-parts are likewise yellowish. In Nyasaland this species, according to Mr. Crawshay, is very generally

met with in the hills, if not too steep and rocky, and in the plains, but it appears to prefer a flat or undulating country, well-wooded and with intervening open glades. It is frequently found feeding with water-buck or zebras, and generally goes in small herds of from five or six to fifteen or twenty. Its vitality appears to be nearly equal to that of the water-buck.

Perhaps the handsomest representative of the genus is the herota, or Hunter's hartebeest (*B. hunteri*)—from the southern borders of Somaliland, on the great river Tana—which is readily distinguished by the white chevron on the forehead, and the peculiar form of the long horns.



HEAD OF HUNTER'S HARTEBEEB.
(From Sclater, *Proc. Zool. Soc.*, 1890.)

stands about 4 feet at the withers, and is of a uniform chestnut-brown colour, with a rather long white tail, and white under-parts. The chevron on the forehead has its angle directed upwards, and terminates in rings surrounding the eyes. The horns, after inclining upwards and outwards for a short distance, run vertically upwards for a much greater length, with long smooth tips. Their length is about 22 inches in the males. The face is still of considerable length, but the hind-quarters do not slope away in the same manner as in the true hartebeest. This antelope is found on the plains and in thick bush on the Tana River. Mr. Hunter says that his party first met with this antelope about one hundred and fifty miles up the Tana River. "It is only found for certain on the north bank of the river. It frequents the grassy plains principally, but is also found in thick bush. It is generally met with in herds of from fifteen to twenty-five individuals. At the time of year when I came across them (October and November) I saw several young ones in the herds. The banks of the Tana River are fringed with a thin belt of forest; then the ground rises slightly, and one sees extensive plains, dotted here and there with large patches of bush, composed principally of euphorbias and aloes. The lesser kudu (see p. 274) lives principally in these patches, and feeds outside of them

in the early mornings and evenings. When I first saw the new antelope I was stalking two examples of Waller's gazelle, and though I saw the Hunter's antelope in the distance I mistook them for impalas, which, however, are not found on the Tana on either bank. It was only when I fired at the gazelles and the Hunter's

antelope ran away, that I noticed they were new to me. They ran with rather a heavy gallop, like a hartebeest. We did not come across these antelopes again for some days, but then met with them in large numbers and got several specimens. They seemed to me to have more vitality than any other antelope I ever killed. This species certainly does not extend down to the coast, but we saw them as far as the farthest point we reached (about two hundred and fifty miles) up the river, at a place called Mussa."

Korigum. Ranging across Central Africa, from Senegal on the west to Southern Somaliland on the east, is the korigum or Senegal antelope (*B. senegalensis*), in which the comparatively short horns are regularly lyrate, ringed nearly to their tips, and curving backwards without any distinct angulation. This species is represented in the right upper corner of the illustration on p. 317. The face is only of moderate length, and the withers (as in the sassabi) are not greatly higher than the rump. The face has a broad black band, extending from the root of the horns to the nose.

Sassabi. Better known than the last is the nearly-allied sassabi or bastard hartebeest (*B. lunata*), widely distributed in South Africa as far north as the Zambesi. The horns, which seldom exceed 12 inches in length, diverge widely from their bases, and are then inclined inwards and upwards, without any angulation. The general colour of the coarse fur is dark purplish red, becoming almost black along the back, and with a broad blackish mark down the face. In height the animal stands about 3 feet 10 inches, and has horns ranging from 13 to 15½ inches in length. Mr. Selous states that the sassabi "is never found in hilly country or in thick jungle, but frequents the open downs that are quite free from bush, or else open forest-country in which treeless glades are to be met with. On the Mababi flat at the end of the dry season large herds of these animals congregate together, and I have often seen, I am sure, several hundreds of them at once. They are without exception the fleetest and most enduring antelope in South Africa." In regard to sassabi-hunting, Mr. Drummond observes that "I do not consider them a difficult animal to shoot for a good rifle-shot, as standing chances at from one hundred and fifty to two hundred yards are easy to obtain, and they will often allow one to walk up to within that distance in full view before even attempting to take to flight, while,



HEAD OF THE KORIGUM OR SENEGAL ANTELOPE.
(From Selater, *Proc. Zool. Soc.*, 1890.)

when wounded, I have found them unable to go far, and easy to finish; and their flesh may be classed with that of the best of the choicer antelopes."

Blessbok. The blessbok (*B. albifrons*) and the closely-allied bontebok (*B. pygargus*), which are represented in the right lower corner of the illustration on p. 317, are smaller South African antelopes, which are the last representatives of the genus. In both species the horns are compressed and regularly lyrate, with the rings strongly marked, and extending nearly to the tips; for a short distance they run almost parallel, and then curve backwards. Their usual length is about 15 inches, but a pair of 18½ inches is on record. Both species are characterised by their brilliant purple-red colour, and the broad white "blaze" down the face, from which the blessbok takes its name. The bontebok (the animal standing in front of the two on the right side of the illustration) is distinguished by the white blaze on the face continuing without interruption right up to the root of the horns, the white patch on the buttocks surrounding the tail, and the white legs. On the other hand, in the blessbok (shown in the hinder of the two animals standing on the right side of the plate) the blaze on the face is divided by a transverse dark line just above the eyes; there is no white on the rump above the tail, but a dark stripe runs down the outer side of the legs. In height the blessbok stands about 3 feet 2 inches or rather more at the withers, but the bontebok may reach from 3 feet 2 inches to 3 feet 11 inches.

Habits. After mentioning that blessboks resemble the smaller springbok in manners and habits, Gordon Cumming goes on to observe that they differ from the latter "in the determined and invariable way in which they scour the plains, right in the wind's eye, and also in the manner in which they carry their noses close to the ground. Throughout the greater part of the year they are very wary and difficult of approach, but more especially when the does have young ones. At that season, when a herd is disturbed and takes away up the wind, every other herd in view follows it, and the alarm extending for miles and miles down the wind, to endless herds beyond the vision of the hunter, a continued stream of blessboks may often be seen scouring up wind for upwards of an hour, and covering the landscape as far as the eye can see." On one occasion when on the Vet River the same writer states: "On my right and left the plain exhibited one purple mass of graceful blessboks, which extended without a break as far as my eye could strain. The depth of their vast legions covered a breadth of about six hundred yards."

Extinct Species. We may conclude this notice of the hartebeests and their allies by mentioning that a member of the group occurs fossil in the Pliocene strata at the foot of the Himalaya; and it may be inferred from this and the facts above mentioned that the essentially African groups of sable antelope, water-buck, and hartebeests, and probably also kudus, were once represented on the plains of India.

CHAPTER XXII.

UNGULATES,—*continued.*

THE PRONGBUCK, Family *ANTILOCAPRIDÆ*; and

THE GIRAFFE, Family *GIRAFFIDÆ*.

THE prongbuck of North America and the giraffe of Africa differ so much from all other living Ruminants, and likewise from one another, that they are referred by common consent to two distinct families, namely, the *Antilocapridæ* and the *Giraffidæ*. Whereas, however, the former is closely allied to the preceding family of the Oxen, the affinities of the latter are rather with the Deer family, to be described in the next chapter.

THE PRONGBUCK.

Family *ANTILOCAPRIDÆ*.

The prongbuck or prong-horned antelope (*Antilocapra americana*) much resembles an antelope in general appearance, but differs from all members of the family *Bovidæ* in that the sheaths of the horns give off a short branch about the middle of their length from their front edge, while the sheaths themselves are periodically shed and afterwards replaced by a new growth.

The prongbuck stands about 2 feet 10 inches in height at the shoulder, and some 3 inches more at the rump, and is of a light and graceful build, with the head carried very high. The head is of moderate length, with the muzzle hairy except for a narrow line in the middle of the upper lip, and large and pointed ears. The horns, which are present in both sexes, rise vertically above the eyes; they are much compressed from side to side, and curved slightly backwards at the tips, while the anterior process is inclined upwards and forwards at an angle of about 45 degrees with the main axis. The bony cores of the horns are dagger-shaped, without any branching. The tail is extremely short, not exceeding 3 inches in length, and the feet have small hoofs and no traces of the lateral hoofs so commonly present in the *Bovidæ*. There is no gland on the face below the eye, neither are there any tufts of hair on the knees.

The coloration of the prongbuck is decidedly handsome and striking; the general hair of the upper-parts and outer surfaces of the limbs being chestnut. The hair on the back of the neck, which is of the general chestnut tint, is lengthened into a kind of mane. The face is brownish black; but the summit of the head above the eyes, and likewise the ears, cheeks, and chin are white. White also

prevails on the lower portion of the throat, the under-parts, and the inferior half of the flanks, and extends upwards to form a large patch on the rump which includes the tail. Usually the throat is crossed by three russet-yellow transverse bars, of which the uppermost is continuous with the dark area of the lower jaw. The lower portion of the limbs is white. The horns are black, save at the tips, where they become yellowish; and their usual length is about 12 inches, but Mr. Otho Shaw has a pair measuring 17 inches, with a span of 20 inches.



GROUP OF PRONGBUCK ($\frac{1}{3}$ nat. size).

Distribution. The habitat of the prongbuck appears to be restricted to the temperate regions of the western portion of North America, and there is no evidence that it ever occurred to the eastward of the Mississippi, while it only impinges on that river in its upper reaches. According to Mr. Caton, these animals originally inhabited all the regions, except wooded districts and high mountain ranges, lying to the westward of the Mississippi within the limits of the United States. Up to the year 1855 they were abundant in California, and were not uncommon in the open parts of Oregon; but they have now almost if not com-

pletely disappeared from both these states. In latitude their range extended from the tropics to the 54th parallel; and within these limits they frequent by choice the open prairie country, avoiding thickly-timbered districts or high naked mountains.

Horns. That the horns of the prongbuck were shed annually was long and persistently urged by the hunters of Fort Union; but these statements were received with incredulity by naturalists, who scouted the idea. Eventually, however, it was proved to their satisfaction that the hunters were right and they themselves in error. In fully adult individuals, the annual shedding of the horns usually takes place during October, but in the young the horns are retained till January. In the males the horns can be felt as prominences beneath the skin even at birth, and at about four months old they burst through the skin. They are later in making their appearance in the females, and cannot be detected at birth. One of the best accounts of the shedding and replacement of the horns is given by Mr. Caton, from which the following summary is taken. On looking into the hollow of a shed horn, it will be found that the cavity does not extend much above the point of bifurcation; while it will be also noticed that the interior of the horn contains a number of coarse light-coloured hairs, all of which are firmly attached to its substance, while in the lower part many pass completely through it. The core from which the sheath was cast will also be found to be covered with similar hairs growing from an investing skin; and it will thus be evident that the sheath was more or less completely penetrated by a number of the subjacent hairs, which were of course torn asunder at the time of shedding. Indeed the horn of the prongbuck is in reality nothing more than a mass of agglomerated hairs, and thereby differs markedly from the bovine horn.

On examining the head of a prongbuck from which the horns have been freshly shed, it will be observed that the summits of the cores are already capped with small new horns, which have evidently commenced their growth considerably before the period of casting, as they reach for several inches above the tips of the cores. The summits of these new horns are perfectly hardened, but lower down they gradually become softer and softer, until they pass into the skin investing the greater part of the core. The condition presented by an animal with newly-growing horns is shown in the woodcut on the following page.

It is thus clear that as the new horn gradually increased in length above the summit of the core, it must have loosened and carried with it the old sheath, which eventually became completely detached from the core by the breaking and tearing away of the hairs passing from the skin into its substance. When nearly the whole of the hairs were detached or broken, any sudden motion of the animal would doubtless lead to the loss of the horns; but it does not appear that, at least as a rule, the process is assisted by the animal rubbing its horns against neighbouring objects. In regard to the renovating process, Mr. Caton writes that "when the old horn was cast off, the new one, as we have already seen, had made a considerable growth above the core, which was already tipped with perfected horn, while a section below it was more or less hardened, or partially converted into horn. This intervening section gradually moved down the horn, constantly invading the soft skin below, and followed above with perfected horn. All this time the horn was growing in length above the core, and assuming that posterior curvature near its upper part

which so much resembles the curvature of the horns of the chamois. After the horn is perfected down to the top of the cores, it ceases to increase in length, while the apparently converting process steadily progresses downward along or around the core. The cores being laterally compressed, the horn assumes the same form;



HEAD OF PRONGBUCK, WITH NEWLY-GROWING HORNS.
(From Selater, *Proc. Zool. Soc.*, 1880, p. 540.)

not, however, conforming precisely to the shape of the core, but extending considerably in front of it, where it is thinner than the posterior part. At the upper extremity of the wide flattened part the snag or prong is thrown out, which consists of little more than an abrupt termination of the wide part, with an elevated exterior point. By the latter part of winter, in the adult, the horn has attained about this stage of growth. From this it presses on, hardening in its downward growth till the latter part of summer, by which time the growth is perfected

down to the base, and is a complete weapon for warfare. In this state it continues until the new horn has commenced its growth and begun to displace the old one from its position, in the manner described above."

Habits. As regards habits, the prongbuck is a shy and timid creature, avoiding its enemies with great intelligence, although sometimes betrayed into danger by its extreme curiosity. It is swifter than any other native North American Ungulate; but is somewhat short-winded and cannot maintain its speed for any length of time. Prongbucks are essentially gregarious; and, according to Dr. Canfield, individuals of both sexes and of all ages congregate in herds from the beginning of September to the end of February. By the beginning of March, the same writer states, "the does separate themselves from the band one by one to drop their kids. They produce two at a birth. After a little time the does collect together with their young, probably for mutual protection against coyotes; the old bucks in the meantime go off alone, each by himself or at most two together, leaving the young bucks and young does together in small bands. The old bucks now for a month or two wander a great deal, and are seen in the timber-lands, and in other places where they never go at any other season of the year, evidently 'tired

of the world' and fleeing from society. After two or three months, the young bucks and does join the old does and their kids, and finally, by the first of September, all are together once more in bands of hundreds or thousands. Any particular band of antelopes does not leave the locality where they grow up, and never ranges more than a few miles in different directions."

At the present day prongbuck are seldom, however, met with in numbers anything like those just mentioned. During the pairing-season the bucks are combative and frequently engage in fierce contests among themselves. In defence of her young the female prongbuck is said to exhibit great boldness, sometimes even beating off the attacks of the coyote by the vigorous use of both horns and hoofs. Audubon and Backman, in describing the contests between the bucks, state that, "when a male sees another approaching, or accidentally comes upon one of his rivals, both parties run at each other with their heads lowered and their eyes flashing angrily, and while they strike with their horns they wheel and bound with prodigious rapidity, giving and receiving severe wounds; sometimes, like fencers, getting within each others' 'points,' and each hooking his antagonist with the recurved branches of his horns."

In spite of their extreme speed, prongbuck are but poor jumpers, and appear unable to leap over any large object that may be in their path; this incapacity being attributed to the open nature of the country which these animals generally frequent. Mr. Caton states that "this inability to leap over high objects may no doubt be attributable to the fact that they live upon the plains, where they rarely meet with such obstructions, and so they and their ancestors for untold generations have had no occasion to overleap high obstructions, and thus from disuse they do not know how to do it, and never attempt it when they do meet them." The same writer also states that if a prongbuck on the plains desires to cross the railroad track, when alarmed by the cars, as is sometimes the case, he will strain every muscle to outrun the train and cross ahead of it, as if he suspected a purpose to cut him off from crossing; and thus many an exciting race has been witnessed between muscle and steam. When excited during its gambols with its fellows, or by the emotions of rage or fear, the appearance of the prongbuck alters considerably. On such occasions, writes Mr. Caton, "the hair of the white patch on the rump rises up, and assumes a more or less curved radial position from a central point on each side of the vertebræ. From these points the hairs radiate in every direction, only they are as nearly erect as their curved radial position will permit. It is impossible to give a just idea of this appearance by words."

The prongbuck is readily tamed when in captivity; and all who have eaten it bear testimony as to the excellence of its flesh. The brittle nature of the hairs renders the fur of but little value; and it does not appear that the skins are much used as leather. As might be inferred from the nature of its habit, the prongbuck is exclusively a grazing animal; and in captivity avoids browsing on leaves, except when no other food is available.

Hunting. There are two chief methods of hunting the prongbuck: one by stalking or "still-hunting," and the other by coursing with greyhounds. In the north-western portion of its habitat, the proper season for hunting embraces the months of September, October, and November; but in the south-west

the period may be extended to the end of the year. In localities where they have not been much disturbed, prongbuck are comparatively tame and not very difficult to approach within range. The case is, however, very different in districts where they are frequently hunted. Thus Mr. Du Bray writes, that "the ostrich, with his vaunted power of vision, is comparatively near-sighted when compared with the antelope.¹ The giraffe may excel him, not from having superior eyes, but from their greater elevation, and therefore greater scope. The deer is simply nowhere in this respect. Even when in the habit of roaming on the prairie, he has not the knack of detecting an intruder as an antelope has. I never had any trouble in getting within 200 yards of an ostrich, in any decent place; yet, with years of experience on these, and a great deal of other prairie-shooting, I at first found it difficult to get within 600 yards of an antelope, and then it was invariably a wide-awake one, fully able to take care of himself."

For coursing the prongbuck, only the very best bred and toughest greyhounds are of any use, while it is equally essential that the horse on which the hunter is mounted should be of the swiftest. With such dogs it appears, however, that the prongbuck is by no means difficult to pull down, and it may accordingly be inferred that the speed of the animal is considerably inferior to that of the Indian black-buck, which, as we have seen, cannot be captured by greyhounds on good ground.

Fossilised remains of the prongbuck occur in some of the superficial Pleistocene deposits of North America, but palæontology has not hitherto revealed to us the existence of any nearly-allied extinct forms. It is suggested, however, that a small deer-like animal (*Cosoryx*), with short antlers, may have given rise to the prongbuck by the loss of the fork in the antlers, and the development of a superficial horny sheath.

THE GIRAFFE.

Family *GIRAFFIDÆ*.

As we have already had occasion to mention, the giraffe (*Giraffa camelopardalis*), like the prongbuck, is the sole existing representative of the family to which it belongs. Whereas, however, the latter animal stands apparently alone among Ruminants, species of giraffes were widely distributed in former epochs, while there were also several more or less closely-allied types now extinct.

Owing to the great length of its neck and limbs, coupled with its large bodily size, the giraffe is by far the tallest of all Mammals. In addition to its elongated neck and limbs, it is characterised by the depth and shortness of the body, the great elevation of the withers as compared with the hind-quarters, and the long and delicately-formed head, with its large, full, and clear eyes, and the pair of horn-like appendages covered with skin which surmount the occiput.

As it is largely owing to the peculiar nature of these horn-like appendages that the giraffe is referred to a distinct family, they require somewhat fuller notice. These horns, as they may be conveniently called, are only a few inches in length, and

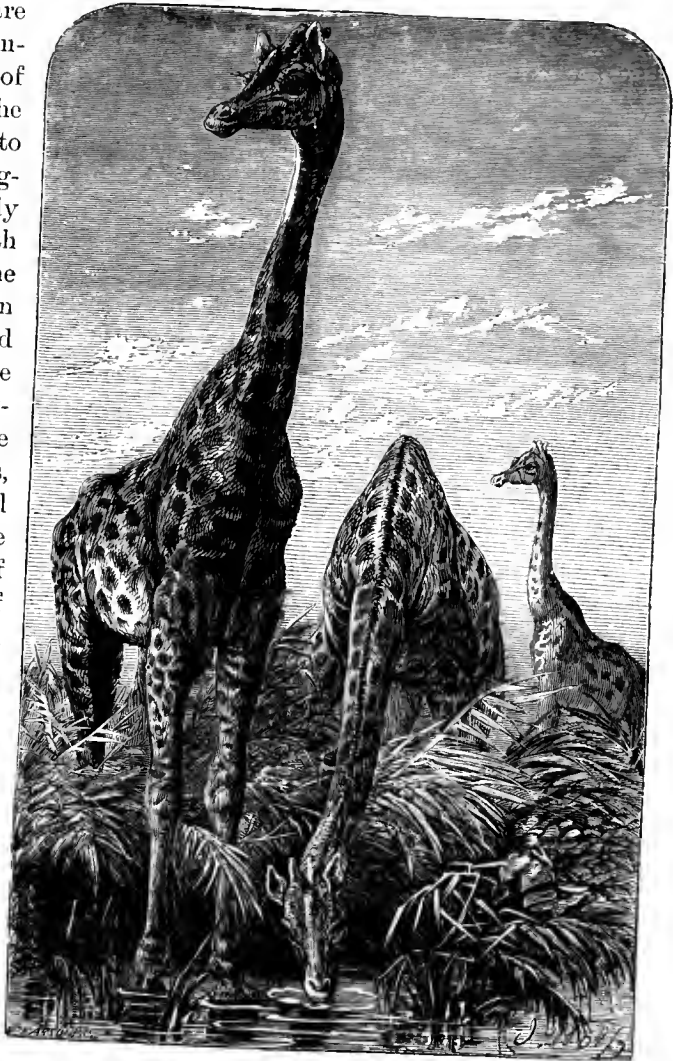
¹ In America the prongbuck is often termed the antelope, pure and simple.

are present in both sexes, making their appearance even before birth. They are erect, subconical processes of bone, which at first are entirely separate from the bones of the skull, although in later life completely uniting with them. They are thus essentially different from the horn-cores of the oxen and their allies, from which they are likewise distinguished by being invested with skin instead of horn; while, as we shall see in the next chapter, they are equally distinct from the antlers of the deer. With the exception that they are at first separate bones, instead of part and parcel of the skull, they appear on the whole to come nearest to the horn-cores of the prong-buck, which, as already mentioned, are coated with a hairy skin beneath the deciduous horny sheath. In addition to these paired horns, there is a dome-like bony protuberance occupying the middle line of the skull between the eyes, which is frequently referred to as the third horn. The position and relations of these three appendages of the skull are well indicated in our figure of the giraffe's skeleton.

The skull of the giraffe is further characterised by the great elevation of the forehead and face above the level of the eyes, this being due to the development of a number of air-cells in the bones. There is also a large unossified space immediately below the eye. As regards the teeth, those of the upper cheek-series are remarkable

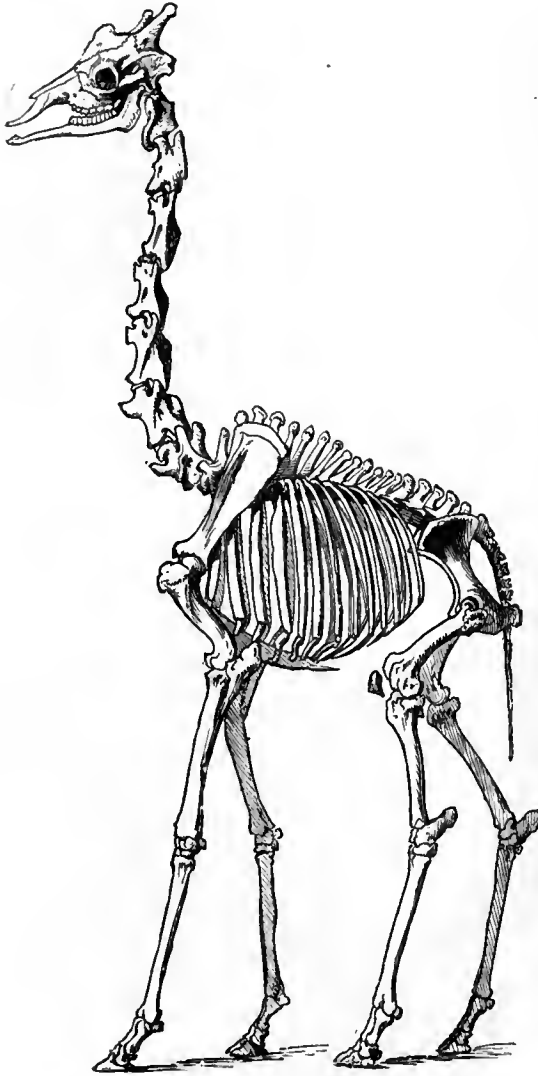
for the lowness and breadth of their crowns, and the roughness of the enamel with which they are invested; while there are no canines in the upper jaw.

Reverting to the consideration of the external characteristics of the giraffe, we note that the ears are large and pointed, and that the large and slit-like nostrils can be completely closed at the will of their owner. Moreover, the tongue is



GIRAFFES AT A POOL.

remarkable for its great length, and the distance it can be protruded beyond the lips; thus acting as a grasping organ of considerable power. From the nape of the neck to the withers runs a relatively short and erect mane; and the tail is of considerable length, and terminates in a large tuft of long hair. The feet of the giraffe are large and heavy, and have no trace of lateral hoofs.

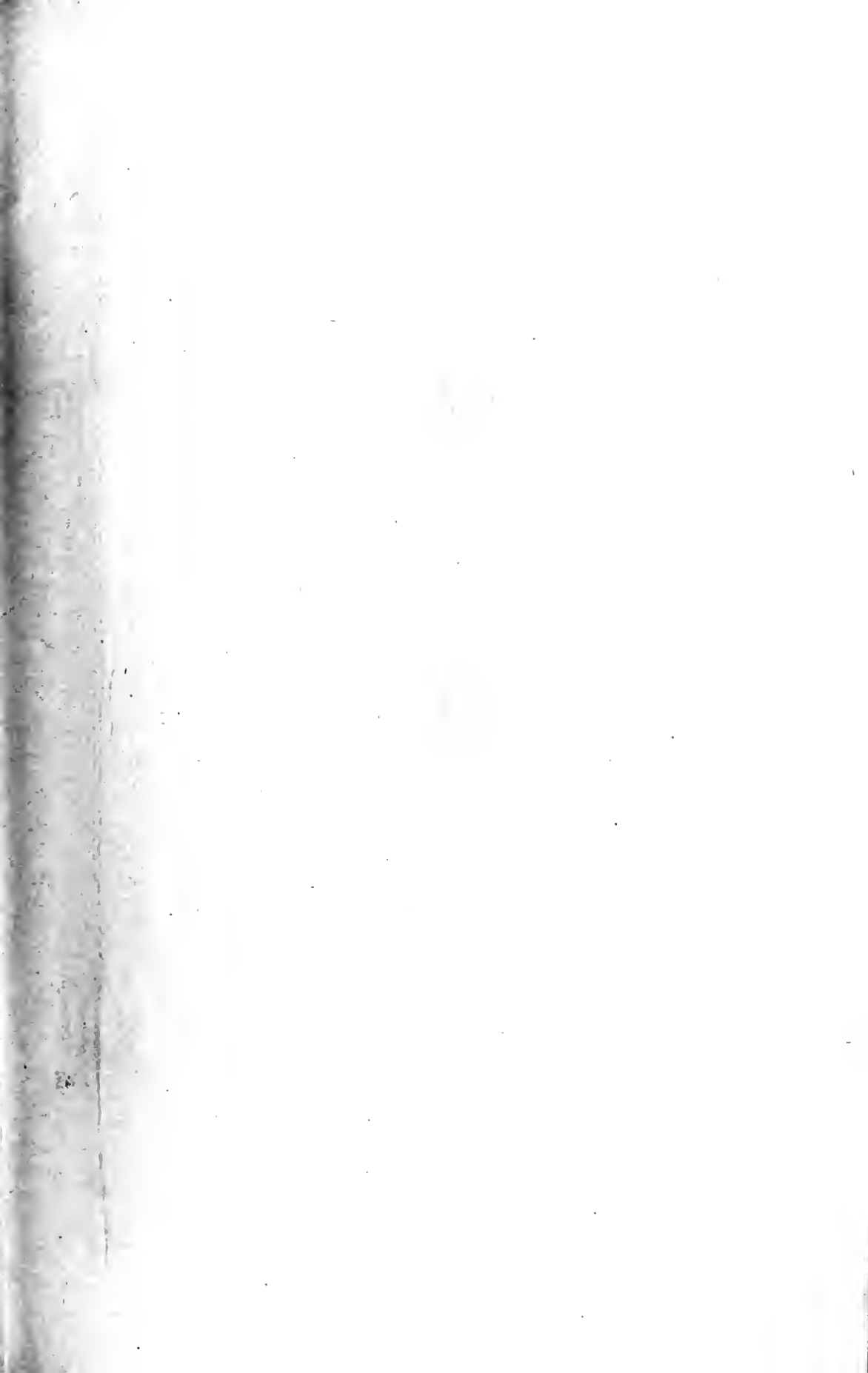


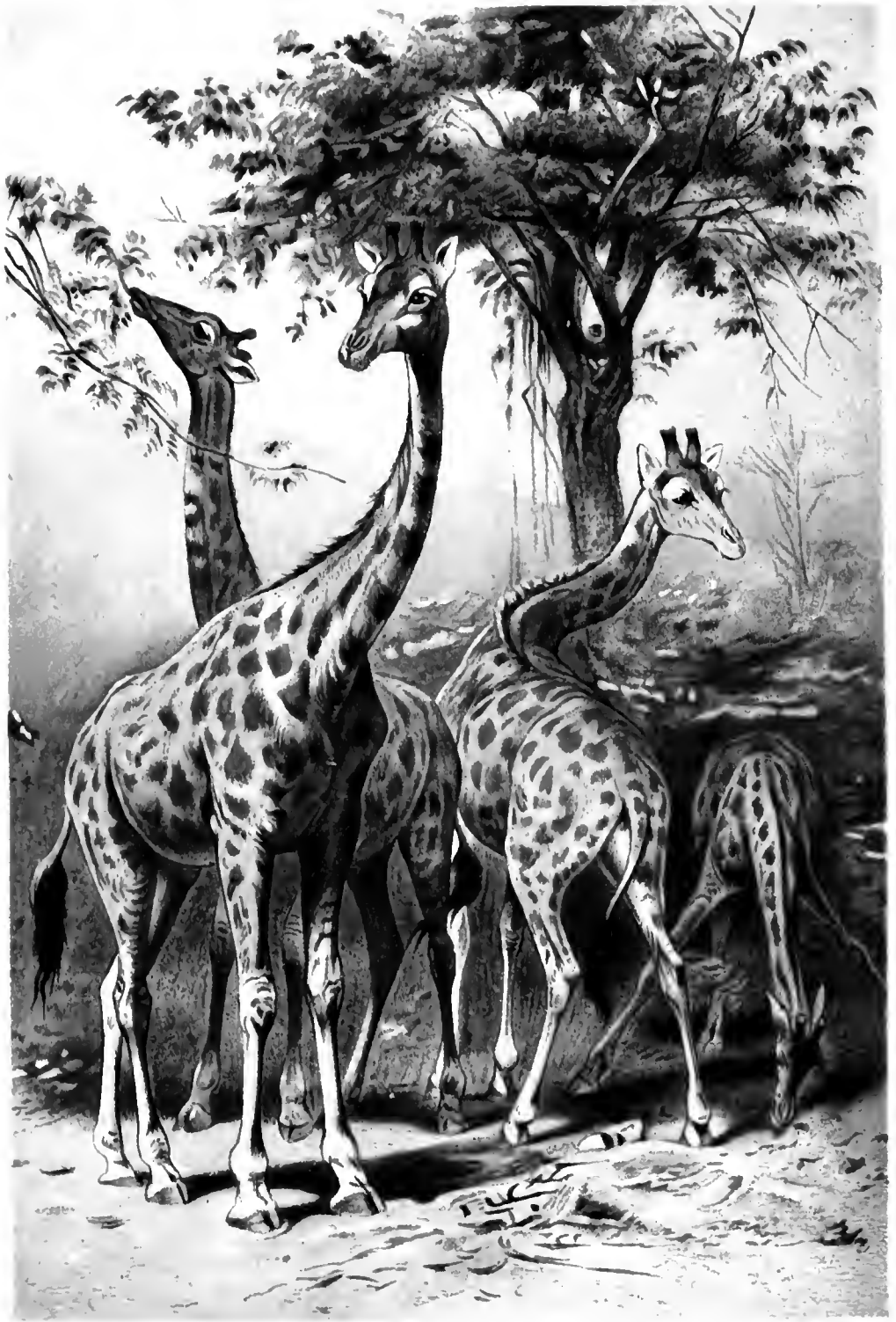
SKELETON OF GIRAFFE.

The coloration of the South-African giraffe takes the form of a number of large blotches or patches of some shade of chestnut or brown, irregularly distributed over a paler tawny ground-colour; the face being uniformly brownish, while the underparts, the inner surfaces of the limbs, and the lower portion of the limbs, are whitish and devoid of darker blotches. The mane is chestnut-coloured, but the tuft at the end of the tail is blackish. It is this variety which is represented in our coloured Plate, and in the woodcut on p. 334. On the other hand, the North-African giraffe may be described as a chestnut-coloured animal, marked by a network of fine tawny lines. A full-grown bull giraffe may measure as much as 18 or even 19 feet from the soles of the feet to the summit of the head, while females are a foot or two lower. We must not omit to mention that, as a general rule, the liver of the giraffe is unprovided with a gall-bladder; the animal agreeing in this respect with the deer, and differing from the prongbuck and the hollow-horned Ruminants.

Distribution. The giraffe is confined to Africa south of the Sahara, and was formerly distributed in open districts throughout the greater portion of that continent,

although absent from the thickly-wooded regions of the West Coast, its range extending from the Cape in the south to Abyssinia and Nubia in the north. Like the gemsbok and eland, the giraffe frequents more or less desert-like regions; but of late years its range has been greatly restricted, more especially in South and Central Africa, where Mr. Bryden considers that it will be almost exterminated within the next twenty years.





SOUTH AFRICAN GIRAFFES

Writing in the year 1881, Mr. Selous states that the giraffe was at that time "still to be found in considerable numbers, over a vast extent of country to the south of the Zambesi River. In parts of the Kalahari Desert it is said to abound, and in all the dry sandy district between Bawangwalo and Lake Ngami, and thence to the Mabebi, Chobi, and Zambesi Rivers, it is also very numerous. Along portions of the Botlebi River, and in the waterless but forest-clad sand-belts on the southern bank of the Chobi, it is particularly plentiful. In the country between the Chobi and the Zambesi, the giraffe is also found in the neighbourhood of Linyanti; but is not nearly so numerous there as on the other side of the former river. Immediately north of the Zambesi it is unknown, although it appears to be plentiful in parts of Central and Eastern Africa. In some parts of the Matabili country it is also common, but till within the last few years was never found eastwards of the river Gwelo (a tributary of the Zambesi north of Matabililand), though it was always very plentiful in the sand-belts to the westward of that river. This fact is the more curious since the soil, vegetation, and general appearance of the country are precisely similar on both sides of the river, which, during a great portion of the year, is only a succession of pools, and therefore does not offer the slightest obstacle to any animal desirous of crossing it. During the last three or four years a few giraffes have extended their range further eastwards."

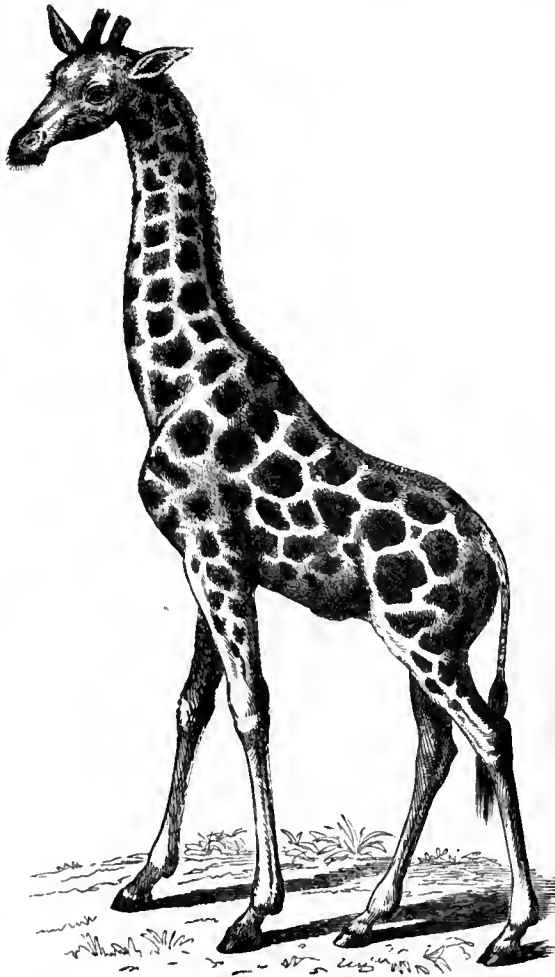
Since the above was written, Mr. Bryden states that giraffes have practically disappeared from large areas to the south of the Zambesi; and their headquarters are now the parched desert country forming the North Kalahari. Probably giraffes are most abundant in the districts lying immediately south of the Botlebi River, on the northern border of the Kalahari Desert. Most of this district is quite waterless for a great portion of the year, and cannot be hunted without water-carts accompanying the party. Here giraffes may frequently be seen in parties of fifteen or twenty, while it is stated that as many as seventy or eighty have been observed together. To the east of the Kalahari, in Khama's country, giraffe are not uncommon; as is also the case in parts of the Chobi Valley; while in Matabililand and Mashonaland they are scarce. Southward of the Limpopo, these animals have been completely exterminated.

The circumstance that the hide of a bull-giraffe now fetches from four to five pounds in the market has been the main cause of the incessant persecution to which these splendid animals have been subjected. It is probable that in Southern Africa they will linger longest in the more inaccessible portions of the Kalahari; while they are likewise likely to persist in the deserts of Kordofan and the Sudan.

Habits. The giraffes inhabiting the North Kalahari Desert cannot, according to Mr. Bryden, touch water for some seven or eight months of the year; and the same is true with regard to those found in other waterless districts. Hence the bushmen state that these animals never drink at all. This, however, is disproved by the following quotation from Mr. Selous, who writes that on a certain occasion he reached camp "a little before sundown, just in time to see three tall, graceful giraffes issue from the forest a little distance beyond, and stalk across the intervening flat, swishing their long tails to and fro, on their way down to the water. It is a curious sight to watch these long-legged animals drinking, and one that I have had several opportunities of enjoying. Though their necks are long,

they are not sufficiently so to enable them to reach the water without straddling their legs wide apart. In doing this, they sometimes place one foot in front, and the other as far back as possible, and then by a series of little jerks widen the distance between the two, until they succeed in getting their mouths down to the water; sometimes they sprawl their legs out sideways in a similar manner." A giraffe in the latter posture is depicted on the right side of the Plate; this position having to be assumed, not only when drinking, but likewise when the animal desires to pick up a leaf from the ground, or on the rare occasions when it grazes.

Writing at a time when giraffes were still abundant in South Africa, Gordon



SOUTH AFRICAN GIRAFFE.

Cumming gives the following graphic account of their habits and appearance. He says that, "in countries unmolested by the intrusive foot of man, the giraffe is found generally in herds varying from twelve to sixteen; but I have not unfrequently met with thirty, and on one occasion I counted forty individuals together; this, however, was a chance, and sixteen may be reckoned as the average number of a herd. These herds are composed of giraffes of various sizes, from the young one of 9 or 10 feet in height to the dark chestnut-coloured old bull of the herd, whose exalted head towers above his companions, generally attaining a height of upwards of 18 feet. The females are of lower stature, and more delicately formed than the males, their height averaging from 16 to 17 feet. Some writers have discovered ugliness and a want of grace in the giraffe, but I consider that he is one of the most strikingly beautiful animals in the creation; and when a herd is seen scattered through a grove of the picturesque parasol-topped acacias which adorn

their native plains, and on whose uppermost shoots they are enabled to browse through the colossal height with which nature has so admirably endowed them, he must indeed be slow of conception who fails to discover both grace and dignity in all their movements." Referring to the admirable protective resemblance of many animals to their natural surroundings, the same author goes on to observe that "in

the case of the giraffe, which is invariably met with among venerable forests, where innumerable blasted and weather-beaten trunks and stems occur, I have repeatedly been in doubt as to the presence of a troop, until I had recourse to my telescope, and on referring to my savage attendants I have known even their practised eyes deceived, at one time mistaking these dilapidated trunks for camelopards, and again confounding real camelopards with these aged veterans of the forest." It may be added that the dappled hide of the giraffe blends harmoniously with the splashes of light and shade formed by the sun glinting through the foliage of the trees beneath which the animals are wont to take their stand, and thus intensifies the illusion. It will be observed that in the foregoing account the maximum number of individuals observed in a single herd was forty. Larger numbers have, however, been seen together by other observers in Southern Africa, while in the Sudan Sir S. Baker states that on one occasion he counted seventy-three, on another one hundred and three, and on a third upwards of one hundred and fifty-four individuals in a herd.

The food of the giraffe consists almost exclusively of leaves, carefully plucked one by one from the trees by the aid of the long flexible tongue. The senses of both sight and hearing are highly developed; and the lofty position of the head gives to the soft and liquid eyes a wide field of view. The animal's only means of defence is by kicking out with its legs; and the blows thus delivered are of terrific force and power. This mode of attack is employed by the cow in defending her young against Carnivores, and likewise in the contests which take place among the males during the pairing-season.

From observations made on individuals in menageries, it appears that the pairing-time is either during March or in the early part of April, and that the young are born in May or June of the following year; the duration of the period of gestation thus being as much as from four hundred and thirty-one to four hundred and forty-four days, or fourteen and a half months, or a little less. But a single young is produced at a birth, and the little creature in three days after its appearance in the world is able to trot by the side of its dam.

The speed and endurance of giraffes are alike considerable. When running, the tail is carried twisted in a corkscrew-like manner over the back, and the neck inclined somewhat forwards. Their gait is peculiar, and takes the form of a kind of awkward gallop, "their hind-legs," writes Mr. Selous, "being straddled out at each step and coming (one on each side) in front of the fore-legs. If you only look at their bodies and necks from behind, they appear to be sailing or gliding along without making any movement at all. They get over the ground, however, at a great rate, and it requires a good horse to run one down. The great thing is to press them to their utmost speed at first, when, if fat, they soon get blown and can be ridden into, and, if the wind is favourable, driven for miles right up to one's waggons, just like an ox or an eland. At a hard gallop they can, however, spin along for miles."

Hunting. Giraffe-hunting seems to be generally undertaken on horseback, and all who have partaken of it speak of the excitement of galloping behind a line of these magnificent animals scouring across the plains. There are, however, but few who fail to be struck with the pathetic and half-reproachful

expression of a fallen giraffe, and whose hearts are so hardened as not feel some compunction at thus ruthlessly destroying one of the noblest specimens of nature's handiwork.

Mr. Selous expresses his admiration at the sight of a herd of giraffes galloping before the hunter in the following words. On the occasion to which he refers, his horse was not a particularly good one, and the pace consequently not very great. Eventually he got, however, within one hundred yards of his quarry, and he then writes that "even in the ardour of the chase it struck me as a glorious sight to see these huge beasts dashing along in front, clattering over the stones, or bursting a passage through opposing bushes, their long, graceful necks stretched forwards, sometimes bent almost to the earth to avoid horizontal branches, and their bushy black tails twisted up over their backs. And how easily and with what little exertion they seemed to get over the ground, with that long, sweeping stride of theirs! Yet they were going at a great rate, for I felt that my old nag was doing his best, and I could not lessen the distance between us by an inch."

All who have eaten of it, testify to the excellence of the flesh of the giraffe; and we have already made mention of the value attached to its hide.

The giraffe thrives well in captivity, where it breeds readily.

Captivity.

On the morning of May 24th, 1836, those Londoners who happened to be passing along what was then called the New Road, were startled by the appearance of four giraffes, with their Nubian attendants, on their way from the docks to the Zoological Society's Gardens in the Regent's Park. Of these four individuals three were males and one a female; and they respectively lived till the years 1837, 1846, 1849, and 1852. Between 1836 and 1892 the Zoological Society had upwards of thirty giraffes in their menagerie, no less than seventeen of which were bred and born there. One of the latter which was born in the spring of 1846 lived till January 1867, or close upon twenty-one years. The last of this series of giraffes died in March 1892, and owing to the inaccessible condition of the Sudan at the present time, it has hitherto been found impossible to replace its loss.

Extinct Giraffes. Fossil giraffes are found in the Pliocene rocks of Greece, Persia, the Siwalik Hills at the foot of the Himalaya, and China. All these extinct forms appear to have been closely allied to the living African species, although in some instances the length of the limbs seems to have been proportionately somewhat less.

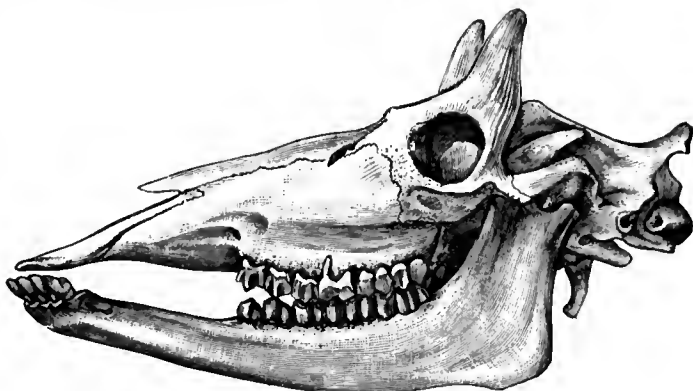
EXTINCT MAMMALS ALLIED TO THE GIRAFFE.

In addition to the fossil giraffes just mentioned, there are other extinct Mammals from the Pliocene formations of Europe and Asia which, while evidently referable to the same group of Ruminants, must be assigned to distinct genera.

One of the most giraffe-like of these creatures is the helladothere of Greece, a hornless animal, of larger dimensions than the giraffe, but with a shorter neck and limbs. The limbs agree, however, with those of the latter in the great proportionate length of the front pair, and the skull has a considerable general resemblance, although with a smaller development of cells in the bones of the forehead, and

without an unossified space in front of the eye. An allied animal, known as the libythere, has left its remains in the Pliocene strata of Algeria.

In the samothere of the Isle of Samos and Persia, of which the skull is shown in the accompanying woodcut, the fore and hind-limbs are of nearly equal length, and the forehead, owing to the absence of cells, is nearly flat, while there is no unossified space in front of the eye. The eyes were sur-



SKULL OF THE SAMOTHERE (about $\frac{1}{3}$ nat. size).

mounted by a pair of flattened bony processes, which there is some reason to believe were detached from the bones of the forehead in the young state, and which may have been clothed either with skin or with horny sheaths in the living condition. In many respects the skull of this animal approximates to that of the elk.

By far the largest of all Ruminants was the gigantic Indian sivathere, whose skull and limb-bones rival in magnitude those of the biggest rhinoceroses. The skull of this enormous creature was very short and wide, and, in the male at any rate, carried a pair of large antler-like appendages, situated immediately over the occiput, in addition to which there was a pair of simple spike-like horns above the eyes. Although the branched appendages of the skull recall the antlers of the



SKULL OF THE SIVATHERE (about $\frac{1}{3}$ nat. size).

elk, it is evident that they were never shed; and it is, therefore, probable that they were covered during life either with hairy skin or with horn. In any case, they were to a considerable extent intermediate in their nature between the horns of the oxen and the antlers of the deer. Other kindred types were the hydaspi-there and the bramathere of India, in both of which the appendages of the skull take origin from an elevated common base rising above the forehead. In the former of these animals there was a large unossified space in front of the eye, similar to that occurring in the giraffe and the deer.

CHAPTER XXIII.

UNGULATES,—*continued.*

THE DEER-TRIBE.

Family *CERVIDÆ.*

THE last representatives of the true Ruminants, or, as they are technically called, *Pecora*, include the typical deer, the elk, the reindeer, the musk-deer, etc. The



SKELETON OF MALE RED DEER.

great and distinctive feature of this group is the general presence in the male sex of the peculiar branched appendages on the skull, which are now generally known

by the name of antlers. Unfortunately, so far as simplicity of classification is concerned, these appendages are not present in all the members of the family, and the zoologist has, therefore, to rely partly on other characters in defining the group. Still, however, as these antlers are the most characteristic features of the deer-tribe as a whole, their importance cannot be overrated, and we accordingly take them first into consideration.

Antlers.

With regard to the meaning of the term antler, it appears that the word is derived from the old French *antoiller*,—a corruption of the late Latin *antocolorum* (before the eyes),—which was originally applied to that branch of the antler which descends over the forehead, and is now designated the brow-tine. At a subsequent period the word antler seems to have been employed indifferently for all the branches of these appendages, while still later it was used to designate the entire appendages themselves. It is in the latter sense that it is now employed, the various branches of the antlers being termed tines.

In addition to being generally more or less branched, the most characteristic feature of an antler when fully developed is that its outer surface is rugged and devoid of any covering of skin or horn. In fact, for all practical purposes, an antler may be regarded as a mass of dead bone borne for a certain period by a living animal. Except occasionally, as an individual peculiarity, antlers are shed once every year, and, save in the reindeer, are present only in the male sex. They arise from a pair of longer or shorter bony pedicles situated on the skull above and behind the eyes, and forming part of the skull itself.

When the antlers of a stag have been recently shed the above-mentioned bony pedicles are completely covered with skin, and merely form small prominences upon the upper part of the forehead. In a short time, however, there appear on the summits of these pedicles small velvety knobs, which are highly sensitive and tender, and are supplied by an unusual number of blood-

vessels. These knobs are formed by a deposition of bony matter, and increase very rapidly in size. In young deer and a few of the smaller forms their growth is limited to the formation of a simple spike, or a spike with one fork, but in the adults of the more typical kinds of deer they branch into a smaller or larger number of tines, until they finally assume the form of the complete antler. The



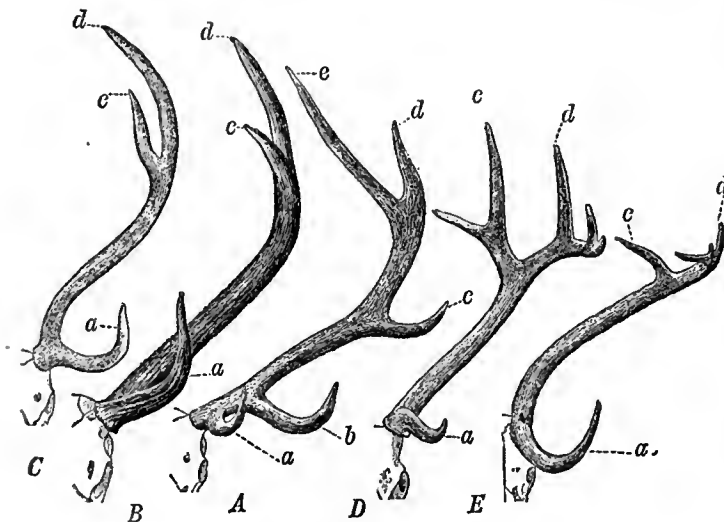
HEAD OF RED DEER WITH NEW ANTLERS IN THE "VELVET."

whole antler is then completely invested with a soft and vascular skin clothed with exceedingly fine hair, hence termed the "velvet." When, however, the growth of the antler is completed in its upper part, a deposition of bony matter takes place at its base, just above the point of union with the pedicle of the skull, in the form of a prominent ring. This ring, of course, constricts the blood-vessels supplying the velvet, and ultimately causes them to dry up. In consequence of this cutting off of the supply of blood by the ring or "burr," the velvet itself likewise dries up, and is eventually removed by the animal rubbing its newly-formed antlers against the stems of trees or other convenient objects. The antlers are then complete. They attain their full development shortly before the commencement of the pairing-season, and during that period they are employed as most efficient weapons in the contests which then take place between the males of all the species of the deer-tribe. Subsequently the living bone beneath the skin below the burr of the antlers is absorbed, when the antler itself is shed, to be renewed in the following season in the same manner as before.

In the fawns the antler takes the form merely of a simple conical spike, and this type is retained in certain South American species throughout life. In the following year the antler gives off a branch near the base, and this form also constitutes the highest development attained by some of the smaller species. In the more typical deer the antlers, however, become more and more branched with each succeeding year, till in the red deer they may occasionally have as many as forty points. The amount of bony matter annually secreted to form the antlers of the larger deer is enormous, antlers of the red deer having been obtained which weighed upwards of 74 lbs., while those of the extinct Irish deer must have probably scaled 100 lbs. during life.

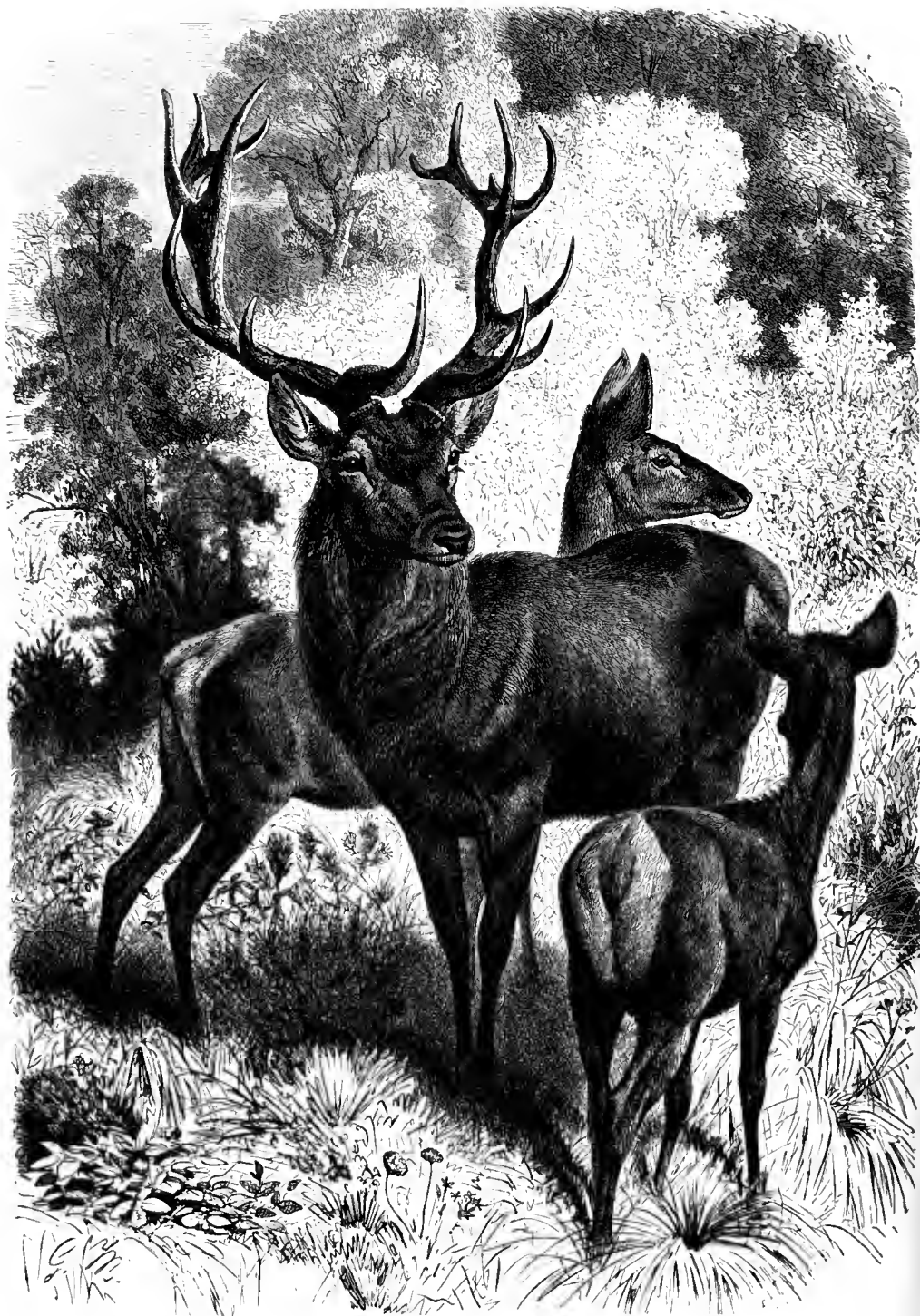
The different tines borne by the antlers of the red deer and other allied species

have received distinct names, and, as it is of the highest importance that these should be clearly understood, they may be referred to at once. In the red deer group (*A* of the accompanying figure) the shaft or beam of each antler carries three tines on its lower front edge, of which the lowest (*a*) is termed the brow-tine, the second (*b*) the bez-tine, and the third (*c*) the trez-tine, or sometimes the royal tine. The summit of



LEFT ANTLERS OF ASIATIC DEER.

A. Hangul, or Kashmir deer; *B.* sambar; *C.* spotted deer; *D.* swamp-deer; *E.* Eld's deer; *a*, brow-tine; *b*, bez-tine; *c*, trez-tine; *d*, *e*, anterior and posterior surroyals.—After Blanford and Forsyth.



A FAMILY OF RED DEER.

the beam may either be divided into two or three tines (as in the figure on p. 340), or may be split up into an almost indefinite number of snags, radiating outwards from a kind of cup; but in any case these terminal snags, irrespective of their number, are collectively spoken of as the surroyles, or the crown of the antler. It will be seen from the figure that in many deer the bez-tine of the antler is wanting; but of this and other variations in form more will be said later on.

Other Characters. Having thus noticed that the deer are more satisfactorily distinguished by the presence of antlers in the males, we have now to mention certain characters which will aid in distinguishing from other Ruminants those members of the family in which the antlers are wanting. In the first place, all deer have a very large unossified space in the skull in advance of the orbit, this space being so extensive as to prevent the lachrymal bone from coming in contact with the nasal bone, as it does in the Ox family. Of less importance is the circumstance that the first molar tooth in each jaw has a short crown. As a rule, tusks or canine teeth are usually present in the upper jaw; and since these are always developed in those forms unprovided with antlers we have a ready means of distinction from the Ox family, in which there are never upper tusks. Moreover, with the single exception of the musk-deer, no member of the family has the gall-bladder, so constantly present in the *Bovidae*. From both the prongbuck and the giraffe the deer are distinguished by the presence of well-developed lateral hoofs in both feet. It may also be mentioned that whereas in the *Bovidae* these lateral toes are represented merely by the bones of the toes themselves and the terminal hoofs, a large number of deer have remnants of the lower extremities of their supporting metacarpal and metatarsal bones lying alongside of the cannon-bone. In all deer the end of the muzzle is naked, and there is a gland in front of the eye.

Distribution. Although numerically far inferior to the *Bovidae*, the deer-tribe includes a large assemblage of species, which may be grouped under several generic headings, and have a wide geographical distribution. In the Old World deer are found over the greater part of Europe and Asia, but are quite unknown in Africa south of the Sahara—the Ethiopian region of zoologists. Three of the Old World species, representing as many genera, extend into North America; but the other New World forms, which range as far south as Chili, belong to quite a different type from any of those inhabiting the Eastern Hemisphere.

Habits. Deer are for the most part inhabitants of forests or grass-jungles, and are never found in desert districts. They are an older group than any of the other typical Ruminants, making their appearance in the lower portion of the Miocene period, where the species were of small size, and for the most part unprovided with antlers.

THE RED DEER GROUP (*Cervus elaphus*, etc.).

The well-known red deer of Europe is the typical representative of the genus *Cervus*, and belongs to a group containing several species or varieties, which is distributed over Europe, Asia (north of the Himalaya), Northern Africa, and North America, and is mainly characterised by the conformation of the antlers. These (as shown in the illustration and in A of the figure on p. 340) have both a brow and

a bez-tine, and a nearly cylindrical beam, splitting up into two or more points at the summit. The tail is short, and the buttocks are marked by a light-coloured disc-like patch, which includes the tail, while the rest of the hair is uniformly coloured. All the members of the group are of large size, and their young are spotted.

Red Deer.

The red deer is characterised by the surrovals of the antlers of the adult having at least three points, and thus forming a cup in the middle of the crown; the total number of points being not less than twelve. Such a stag is called in Scotland a Royal Hart. The number of points in the crown may,



THE RIGHT ANTLER OF A RED DEER,
FROM AN IRISH BOG.

however, be greatly increased, as shown in the accompanying figure of an antler dug up many years ago in an Irish bog. In the stag to which this antler belonged, the total number of points, if the two antlers were symmetrical, would have been thirty; but instances are recorded where there are as many as forty-five and even sixty-six points. The latter number must, however, be regarded as abnormal. At the present day no Scotch stag ever has antlers of the complexity of the one shown in the woodcut, and it would indeed be very doubtful if that specimen could even be matched among the living deer of Eastern Europe, where the heads are considerably finer than in Scotland. Such antlers, and even larger ones, were, however, not uncommon on the Continent a few centuries ago; many magnificent examples are preserved in some of the old German castles, the collection at Moritzburg being especially rich.

A fine specimen of the red deer will stand fully 4 feet at the shoulder. The hair on the throat forms a long fringe, most developed in the pairing-season. During summer the general colour of the pelage is a bright reddish brown, the head and legs being somewhat greyer, the throat pale grey, and the patch on the buttocks yellowish white. In winter, when the fur becomes longer and softer, the colour tends to a brownish grey. Wild stags are occasionally found white; the tendency to albinism increasing in the domesticated state. A fine Scotch stag will weigh some 280 lbs. (20 stone), but they range up to 420 lbs. (30 stone), and a stag was killed at Woburn, in 1836, which weighed 476 lbs. (34 stone) as it stood. These weights are, however, exceeded by the stags of Eastern Europe and Northern Asia. The large pair of antlers mentioned above have a total length of 68 inches, and examples have been obtained from Eastern Europe and Asia Minor, varying from 46 to 48½ inches in length. The antlers of Scotch and Irish stags rarely, however, exceed 33 inches, although some of the latter may reach 35 inches. A Devonshire stag with antlers of over 38 inches is on record.

Distribution. The red deer has a wide distribution in the temperate regions of Europe and Asia, but its eastward extension in the latter continent is not yet fully ascertained. Formerly it was probably found throughout the forest-

regions of Central Europe, but it has now been exterminated in many districts. In Scandinavia, it is found only in a few forests in Sweden, and in some of the Norwegian islands. It also remains in the larger forests of France and Germany, while it is more abundant in Hungary, Servia, Transylvania, Poland, and the Danubian States. In parts of Greece, Italy, and Spain, as well as the islands of Corsica and Sardinia, it is less plentifully represented. In the British Islands it is only in the Scottish Highlands to the north of the Clyde and the Forth that wild red deer are met with abundantly, and then only by the aid of protection. They are, however, also found on the moors of Devon and Somerset, in certain districts of Ireland, such as Killarney and Connemara, as well as in the Hebrides. As late as the reign of Queen Anne, wild deer were, however, common in Wolmer Forest, Hampshire, while a few lingered on in Epping Forest till the early part of the present century.

In European Russia the red deer is reported to be restricted to the Caucasus. Eastwards a large deer ranges through Siberia to Amurland and Northern China, which is probably only a variety of this species, although on account of the larger size of the light-coloured patch on the buttocks, it has been regarded as a distinct form under the name of *C. xanthopygus*. The red deer is again met with in Asia Minor, where it attains large dimensions, but it does not appear to enter Persia, or at least only infringes on the western borders of that country. The so-called Barbary deer of Morocco and Algiers, now regarded merely as a variety of the present species, is distinguished by the frequent absence of the bez-tine of the antlers.

Fossil remains of the red deer are found abundantly in the caverns and superficial deposits of the greater part of Europe; these fossil antlers being far larger than those of any modern representatives of the species, some of them measuring upwards of 40 inches in length.

Habits. Like most of the tribe, the red deer is gregarious; but, except during the pairing-season, the full-grown stags remain apart from the other members of the herd, and generally frequent higher ground. On the Continent this species is almost exclusively a forest-dweller, remaining concealed during the day in the thickest cover, and only venturing out to feed in the open glades or adjacent cultivated lands with the falling shades of evening. On the other hand, the Scottish red deer inhabits the open hills, and has for its only concealment the intervening glens and valleys.

The pairing-season commences in the later part of September or beginning of October, and lasts for about three weeks; during which period the venison is rank and unfit for table. At this season, writes Mr. Scrope, "the harts swell in their necks, have a ruff of long wiry hair about them, and are drawn up in their bodies like greyhounds. They now roll restlessly in the peat-pools till they become almost black with mire, and feed chiefly on a light-coloured moss that grows on the round tops of the hills, so that they do not differ so entirely from the reindeer in their food as some naturalists have imagined. . . . This is a very wild and picturesque season. The harts are heard roaring all over the forest, and are engaged in savage conflicts with each other, which sometimes terminate fatally. When a master hart has collected a number of hinds, another will endeavour to take them from him. They will fight till one of them, feeling himself worsted, will run in circles round

the hinds, being unwilling to leave them; the other pursues, and when he touches the fugitive with the points of his horns, the animal thus gored either bounds suddenly on one side, and then turns and faces him, or will dash off to the right or the left, and at once give up the contest. The conflict, however, generally continues for a considerable time, and nothing can be more entertaining than to witness, as I have often done, the varied success and address of the combatants. It is a sort of wild joust, in the presence of the dames who, as of old, bestow their favours on the most valiant. . . . In solitary encounters, there being no hinds to take the alarm, the harts are so occupied and possessed with such fury that they may be



RED DEER AT A POOL.

occasionally approached in a manner that it would be vain to attempt at any other time." One instance has been recorded where the antlers of two stags fighting in this manner became so firmly interlocked that the victor was unable to disengage himself from his dead antagonist, and was thus held captive until killed by a forester. After an interval of eight months and a few days from the pairing-season—that is to say, generally in the early part of June—the fawns are produced; there

being but rarely more than one at a birth. The fawn is dropped in high heather, and is left concealed there during the day by the hind, who returns to visit it in the evening. Mr. Scrope states that the dam makes her offspring "lie down by a pressure of her nose; and it will never stir or lift up its head the whole of the day, unless you come right upon it, as I have often done. It lies like a dog, with its nose to its tail. The hind, however, although she separates herself from the young fawn, does not lose sight of its welfare, but remains at a distance to windward, and goes to its succour in case of an attack of the wild cat or fox, or any other powerful vermin."

The old stags shed their antlers about February or March, according to the nature of the season, but those of the young bucks are retained for some time

longer. In spite of traditions as to the great age attained by stags, it appears that the ordinary limit of life is about twelve years, although a few individuals may survive to twenty years. Red deer are essentially shy and wary animals; and, in the open districts which they frequent in Scotland, can detect an enemy at an immense distance. When all the members of a herd are together, the chief duty of watching appears to fall on the hinds, but at other times the stags have to depend on their own alertness. When their foes are in sight, deer will watch them with the greatest coolness and circumspection, but they become anxious and restless when they have reason to suspect the near presence of a concealed enemy.

Hunting. In Scotland, deer are now killed only by driving or stalking; although wild red deer are still hunted with hounds in Devonshire, no less than 276 having been killed there in the five years ending 1892. Formerly it was the custom in Scotland to surround a large tract of country with a circle of beaters; and deer-driving on a large scale is now practised in Austria and some other parts of the continent. When hunted, as indeed at other times, red deer will take freely to the water; and when a wounded stag is hotly pursued by deer-hounds, he generally seeks refuge in the mountain streams, where his length of leg gives him a great advantage over his pursuers. Sometimes, writes Mr. Scrope, a stag "will stand upon a rock in the midst of the river, making a most majestic appearance; and in this case it will always be found that the spot on which he stands is not approachable on his rear. In this situation he takes such a sweep with his antlers, that he could exterminate a whole pack of the most powerful lurchers that were pressing too close upon him in front. He is secure from all but man; and the rifle-shot must end him. Superior dogs may pull him down when running, but not when he stands at bay." It may be added that, when disturbed, deer invariably run up wind.

Allied Species. In addition to the red deer, Asia possesses several closely allied forms, which are generally regarded as distinct species, although it may be a question whether it would not be better to consider them all as local races. One of the best known of these Asiatic deer is the hangul or Kashmir stag (*C. kashmirianus*). This species stands about 4 feet 4 inches at the shoulder, and differs from the red deer in that each antler (as shown in *A* of the figure on p. 340), usually has but five tines, so that no cup is formed at the crown, which is simply forked. Moreover, the whole beam of the antler is much curved, with the main tine of the surroyals (*e*) greatly inclined inwards; while the bez-tine is generally longer than the brow-tine, or just the reverse of the condition obtaining in the red deer. Occasionally, six or even seven points may be counted in the antlers of the hangul. In colour, this deer closely resembles the European species. Whereas, however, the call of the red deer during the pairing season is a loud squeal, ending in a more guttural tone, in the hangul it is distinctly a roar, which may be compared to that of a leopard. The antlers of the Kashmir stag average about 40 inches in length, but specimens have been obtained of which the measurements were respectively 52, 53, and 55 inches.

The true hangul is confined to the mountains surrounding the valley of Kashmir and some of the adjacent districts. There is, however, a deer from Eastern Turkestan known as the Yarkand stag, which appears to be merely a

variety of this species, distinguished by its straighter antlers and the paler colour of the fur. In Kashmir the hangul, which is essentially a forest animal, is found in summer at elevations of from 9000 to 12,000 feet. In winter, however, it descends to the valleys during heavy falls of snow; and at such times it is ruthlessly attacked by the villagers, as many as five hundred head, it is reported, having been thus slaughtered upon a single occasion. These indiscriminate slaughters, together with the more orthodox pursuit by English sportsmen, have so thinned the ranks of this fine deer, that it is now becoming comparatively rare, and unless proper means are taken for its preservation, it stands a good chance of being exterminated at no distant date.

In summer, hangul are generally found singly or in small parties, the old stags being usually solitary; but in winter they collect in herds. The antlers of the stags are usually shed about March, and the new ones do not attain their full development till October. In that month and through November the males are continually calling, and it is this time that is the proper shooting-season. The fawns are born in April, so that the period of gestation appears to be only about six months, or considerably less than in the red deer. Leith Adams states, that hangul "are seldom confined to one region, but roam from forest to forest, preferring grassy glades alternating with dense forest, where there is a copious supply of water." I have on one occasion seen a small party of these deer on the Ladak side of the mountains bounding Kashmir where there is no forest.

Far to the south-east of Kashmir, probably in the districts lying between Darjiling and Lhasa, there occurs a much larger deer, known as the shou (*C. affinis*). In addition to its superior dimensions, this deer is distinguished from the hangul by the beam of the antlers being strongly bent forwards just above the trez-tine; while the bez-tine is less constantly longer than the brow-tine. Each antler seems to have constantly but five points. Antlers have been measured of 54, 55, and $55\frac{3}{4}$ inches in length; anything like such dimensions being only very exceptionally attained by those of the Kashmir stag. The height of the animal is from $4\frac{1}{2}$ to 5 feet at the shoulder.

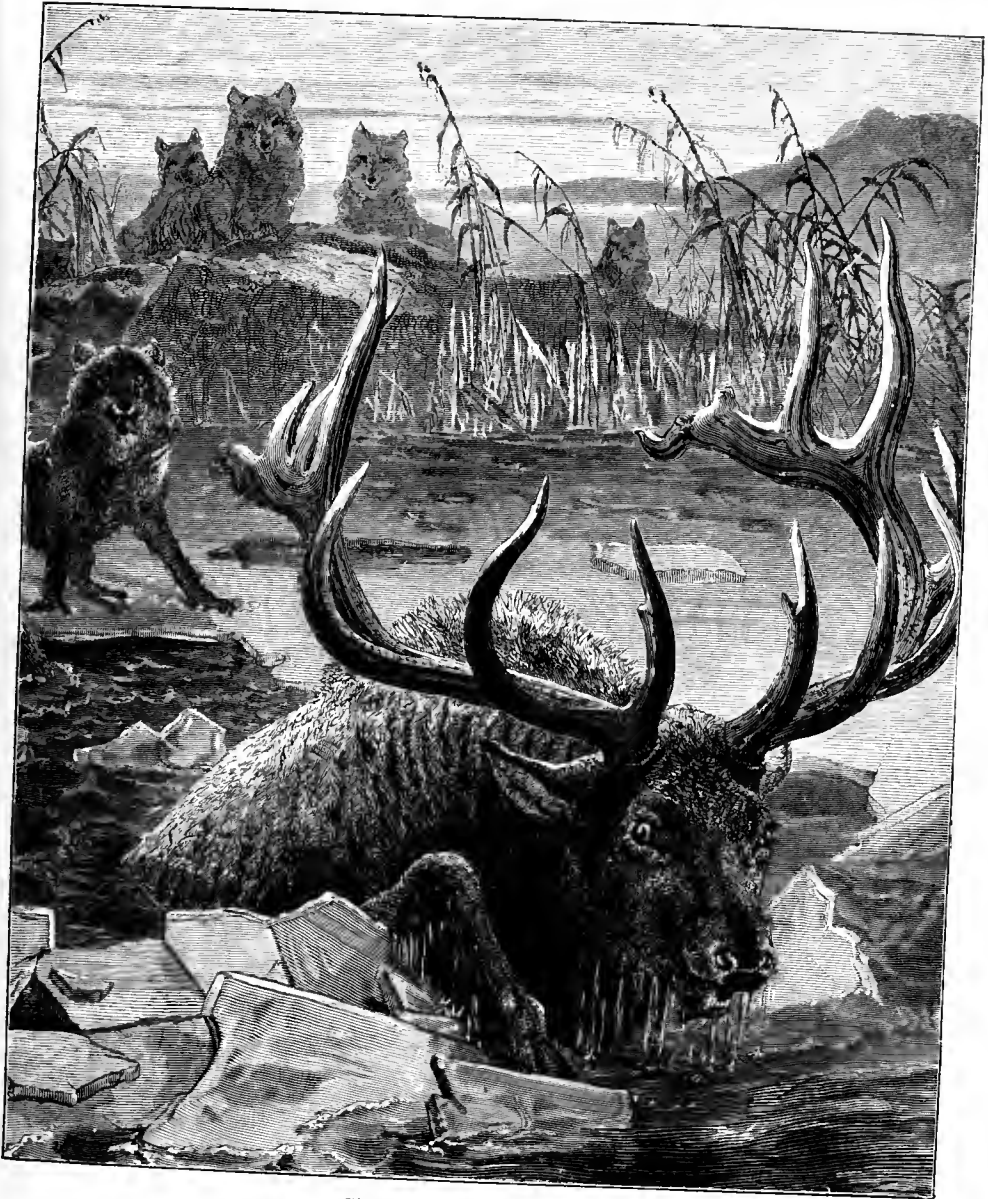
In the Caspian provinces of Persia, and probably also in Circassia, the red deer group is represented by the maral (*C. maral*). This is a large species allied to the last, but distinguished by the much greater length of the face, and by the crown of the antler having apparently always more than two tines. Specimens of this species in confinement kept entirely apart from some red deer inhabiting the same enclosure. These deer are said to be abundant in the thick forests of the Caspian provinces of Persia; but we know very little about their habits.

Another Old World deer of the present group, is the great Thian Shan stag (*C. eustephanus*), from the forest-regions of the mountain-barrier on the north-west frontier of Eastern Turkestan; the so-called Leudorf's stag (*C. leudorfi*), of Amurland, being in all probability not specifically distinct. The great peculiarity of this deer is, that it is so closely allied to the American wapiti, that it is very doubtful if it can be regarded as anything more than a variety of that species. The antlers have the peculiar characteristics (to be noticed immediately) of the latter; one pair having a length of 51 inches along the curve, with a basal

diameter of $10\frac{1}{2}$ inches on one side, and of 11 on the other. The Thian Shan stag is said to stand 6 feet at the shoulder, but this requires confirmation.

Wapiti.

The New World representative of the present group is the well-known North American wapiti (*C. canadensis*), persistently misnamed



WAPITI CHASED BY WOLVES.

elk in its native country. The wapiti is distinguished from the hangul and the shou (to which it is more closely related than it is to the red deer) by the form and proportions of its antlers, which are characterised by their general smoothness, and the tendency to a flattening and expansion of the surroyal tines, which, in

fully adult stags, are usually three or more in number; and also by the well-marked backward curvature and want of convergence in the upper-part of the beam. In colour the wapiti is dark brown on the head and neck, while the back, flanks, and thighs are creamy grey, with the under-part of the body blackish. The legs are brown, and the lower portion of the light patch on the buttocks is bordered with black. Mr. Caton gives the height of a full-grown stag as rather more than 5 feet 4 inches (16 hands), but other writers estimate the height of the largest individuals at 5 feet 8 inches (17 hands) at the shoulder. The usual weight is about 700 lbs., but it is said that large males will exceed 1000 lbs. in weight, although some full-grown females do not scale more than 400 lbs.

In the fifth year the antlers develop five points; but after that period the number increases irregularly, and there are frequently more snags on the one antler than on the other. Very rarely is there any approach to the cup in the crown of the antler distinctive of the red deer. Antlers of the wapiti attain very large dimensions. Of two fine pairs in the collection of Mr. Otho Shaw, the dimensions are as follows, in inches,—No. 1, length $49\frac{1}{2}$, span 54, basal girth 8; No. 2, length $55\frac{1}{2}$, span $48\frac{3}{4}$, basal girth $7\frac{1}{2}$. In two examples belonging to Mr. E. S. Cameron, the total lengths are respectively $53\frac{1}{2}$ and $55\frac{1}{4}$ inches, the spans $47\frac{1}{4}$ and $44\frac{1}{2}$ inches, and the basal girths just above the burr $9\frac{1}{2}$ and 10 inches. The maximum recorded lengths are, however, $60\frac{3}{4}$, $61\frac{1}{2}$, 62, and $62\frac{1}{2}$ inches.

The range of the wapiti has of late years been greatly restricted by the advance of civilisation, while the same cause, coupled with constant persecution on the part of sportsmen, has likewise reduced its numbers in a corresponding degree. Mr. W. A. Perry states, that the wapiti was formerly found in nearly all parts of the United States, in Mexico, and in British America as far north as the 60th parallel of north latitude; but it has vanished before the approach of civilisation, and is now found only in the remotest mountain fastnesses west of the Missouri River, or in the great forests of British America. The largest herds now remaining outside of the National Yellowstone Park are found in the Olympic Mountains of Washington, and among the mountains of Vancouver Island. There are still many remaining in the Cascade and Rocky ranges, but they do not congregate there in large herds as they do in the Coast ranges. Another recent writer states, that less than ten years ago there were many secluded districts in Colorado, Wyoming, and Montana, where, during the late autumn and winter, wapiti might be seen banded together in herds numbering many thousands of individuals; whereas now, it is seldom that a hundred can be found together.

The general habits of the wapiti seem to be very similar to those of the red deer, the old stags living apart from the main herd during the greater part of the year; and in the pairing-season taking exclusive possession of a party of hinds, after having vanquished their rivals in fight. The shedding of the antlers is late, generally taking place in the full-grown stags during the latter part of December or the first half of January. The new antlers begin to sprout in March or April, and are fully complete by the middle of August. At this time the old stags begin to call, the note being a roar very like that of the hangul. It has, however, been compared to the bray of a donkey; and it is suggested that it is partly from this

that the wapiti has received the nickname of "jackass deer," bestowed upon it by the traders in the Rocky Mountains.

During May Mr. Perry states that the wapiti desert the lower hills to take refuge in the higher ranges, getting as near as possible to the snow-line without leaving the upper belt of forest. The hinds then leave the herds to give birth to their fawns in the most secluded thickets. Usually there is but a single fawn produced at a birth, although two do not appear to be very unfrequent. The hind will fight to the death in the defence of her helpless offspring against the onslaught of puma, bear, or coyote. At such times she gives utterance to a loud cry, which at once brings to her aid all the members of the herd which may be in the vicinity, and all of which unite in driving off the foe.

The wapiti is a promiscuous, not to say a coarse, feeder. Mr. Caton says that "all the grasses and most of the weeds within his reach are taken freely, and the leaves and trees of all the deciduous trees are alike enjoyed. A considerable proportion of his daily food he desires to be arboreous, yet if deprived of it he will keep in good condition on herbaceous food alone. In winter he will take the coarsest food; even that which the ox and the horse reject, he will eat freely." The venison, although unlike that of other deer, is of fine flavour, and is said to be more nutritious than any other meat.

A combat between two male wapiti during the pairing-season is described by Mr. Perry as follows: "The challenger, when approaching a band, or harem, blows a loud whistle of defiance. (Take a half-pint bottle and blow strongly into it, and the sound so produced will be similar to the call of the male wapiti during the rutting-season.) This whistle is at once answered by the ruler of the herd, who steps boldly forth to do battle with the intruder. With heads lowered between their fore-feet, the two adversaries walk around waiting for an opening, and when one is thrown off his guard the other makes a savage rush; but his opponent instantly recovers, counters the charge, and as they rush together the antlers strike each other with such terrific force that the report can be heard for a long distance. Slowly retreating, bellowing, grumbling, and grinding their teeth in a paroxysm of rage, they again circle around, and when an opportunity is afforded, make another charge, which is countered as before. The challenging wapiti usually does most of the offensive fighting until he finds (if such be the case) that he is the weaker; then he sullenly retires, bellowing as he goes. These battles are seldom fatal, and during the rutting-season are an everyday occurrence. Ugly wounds often result from them, and sometimes a prong of an antler is broken in the affray."

Wapiti differ from the majority of the deer tribe in that they do not feed during the night, although they are on the move with the first streak of dawn. From that time till about eight in the morning they continue feeding almost without interruption, after which they indulge in a midday siesta. During this midday rest they can be easily approached. About four o'clock in the evening they once more commence feeding, in which occupation they continue till dusk. In winter they are often pressed for food; and when the snow lies deep on the ground each party occupies a small area, over which the snow is trampled down as hard as ice, while all the trees are gnawed bare both of bark and leaves as high as the animals can reach.

When wapiti were found on the great prairies, the Indians were accustomed to hunt them on horseback by forming a wide circle of mounted men, from whom a certain number were detached to harass the unfortunate animals until they were brought to a standstill. Another favourite method was by forming a cordon of horsemen and driving a whole herd over a precipice. At the present day the more sportsman-like method of hunting is, however, almost exclusively employed; and it appears that the wapiti is an animal far less difficult to approach than the red deer, while it is killed by a comparatively slight wound.

THE JAPANESE DEER GROUP (*Cervus sika*, etc.).

The prettily-marked Japanese deer represents a group differing from the last by the antlers having no bez-tine, so that each has usually but four points; and also by the coat being spotted with white in summer, although uniformly brown during winter. Moreover, the proportionate length of the tail is much greater than in the red deer group; and the large white patch on the buttocks is completely bordered with black. All the deer of this group are of medium dimensions, and for the most part inhabitants of Eastern Asia.

The Japanese deer, from Japan and North China, stands somewhat lower at the shoulder than a fallow deer, and has the ground-colour of the fur dark or yellowish brown, with the greater part of the tail white. These deer are very abundant in North Japan and parts of China, where they frequent dense forest, generally in hilly regions. The only way of shooting them is by beating the country with a large number of men. The Japanese deer has been introduced into several parks in Ireland and England, where it thrives well, sometimes interbreeding with the red deer.

Mantchurian Deer. The Mantchurian deer (*C. mantchuricus*), of Northern China, may probably be regarded merely as a larger variety of the last, in which the coat is generally darker coloured, with a larger dark area on the upper surface of the tail.

Dybowski's Deer. Dybowski's deer (*C. dybowskii*), from Mantchuria, appears, however, to be a distinct species of relatively large size, easily recognised by its pure white muzzle. The ordinary length of the antlers is about 22 inches, but a pair, having five tines each, which have been referred to this species, measure upwards of 35½ inches.

Formosan Deer. Better known than the last is the Formosan deer (*C. taïwanus*) from the mountains of the island from which it takes its name. The body-colour is lighter than in the other species, while the spots have a tendency to persist during the winter; the tail being white with a black streak down the middle of the upper surface. These deer are caught in traps by the inhabitants of Formosa, by whom, as well as by the dwellers on the island of Samasana, they are kept as pets.

Caspian Deer. Lastly, we have the imperfectly-known Caspian deer (*C. caspicus*) from the Talish Mountains, near the south-western extremity of the Caspian Sea in Northern Persia, which has been provisionally assigned to the present group. If rightly thus placed, this species is of interest as showing that the group is represented in Western, as well as in Eastern Asia. The one skull, on

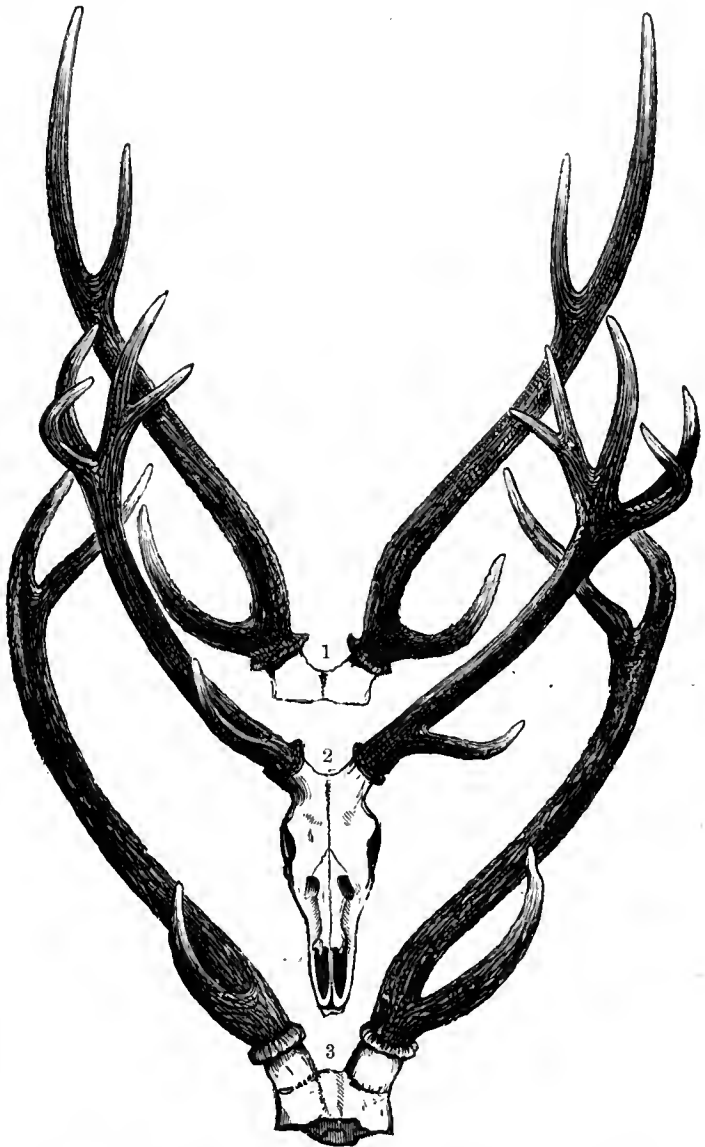
the evidence of which the Caspian deer was considered to represent a distinct species, differs from that of the other members of the group in that the antlers have only three points when fully adult, namely, a brow-tine and a fork at the extremity.

THE INDIAN SPOTTED DEER, OR CHITAL (*Cervus axis*).

The spotted, or axis deer, of India and Ceylon, is our first representative of two very closely allied groups of Indian deer, in which the cylindrical antlers have but three tines on each side; the bez-tine being absent, and the beam terminating in a simple fork. In the spotted deer, of which a single antler is shown in C of the figure on p. 340 and a pair in the upper figure of the accompanying woodcut, the bez-tine of the antlers is given off nearly at a right angle with the beam. The whole length of the antlers is about three times that of the skull in average specimens; and the hinder tine of the terminal fork is considerably longer than the one in front.

The spotted deer or, as it is called in India, the chital or chitra, varies considerably in height in different localities, buек from Northern and Central India standing, according to Blanford, from 3 feet to 3 feet 2 inches

at the withers, whereas in Southern India the height seldom exceeds from 2 feet 6 inches to 2 feet 8 inches. The neck and throat of this deer are devoid of any



ANTLERS OF INDIAN SPOTTED DEER (1), SWAMP-DEER (2), AND SAMBAR (3).

mane; the tail is relatively long, pointed, and thin; and the cheek-teeth are characterised by the great height of their crowns. The ground-colour of the fur is a rufous fawn; the whole of the body being marked by a number of large white spots, which are present at all ages of the animal throughout the year, and tend to arrange themselves in longitudinal lines. The head and neck are of a uniform brownish colour, and there is a black line running from the nape of the neck to the end of the tail. White prevails on the inside of the ears, the chin, the upper part of the throat, the under-parts of the body, and the insides of the limbs, as well as on the under surface of the tail. As in the case of the fallow deer, a blackish variety is occasionally met with, in which the spots are only very faintly indicated. An individual standing close upon 3 feet in height weighed 145 lbs.

Although the antlers of the spotted deer are typically but three-tined, there are not unfrequently a number of small points or "sports" at the junction of the brow-tine with the beam; but such sports are rare higher up. The average length of the antlers of the larger race of this species may be given as about 30 inches; but examples reaching 38 and $38\frac{3}{4}$ inches in length, with a girth of $5\frac{3}{4}$ inches above the burr, have been recorded. Great difference exists in regard to the degree of divergence or span of the antlers; thus, in two examples of which the respective lengths were 34 and $34\frac{1}{2}$ inches, the span in the former case was only 24 inches, against $30\frac{1}{2}$ inches in the other.

Distribution. This deer is found nearly throughout India and Ceylon, but in the Himalaya it only occurs on the outermost spurs; and it is unknown on the plains of the Punjab, Sind, a large part of Rajputana, Assam, and the whole of the countries to the eastward of the Bay of Bengal. On the hills of Southern India it is found at elevations of from three to four thousand feet above the sea. It has been introduced by Sir E. G. Loder into his park near Horsham.

Habits. The native name *chital* refers to the dappled hide of this deer, which is, perhaps, the handsomest member of its tribe as regards colour and form, and is certainly one of the most characteristic of the mammals of India. Mr. Blanford states that it is most generally found among bushes or trees in the neighbourhood of water, and in bamboo-jungles, while it frequents both hilly tracts and plains, and never wanders far from its drinking places. "So long," writes the author named, "as it has a wild tract of bush or ravines for shelter, it appears to care little for the neighbourhood of man. Many of its favourite haunts are in some of the most beautiful wild scenery of the Indian plains, and lower hills, on the margins of rippling streams with their banks overgrown by lofty trees, or in the grassy glades that open out amidst the exquisite foliage of bamboo clumps. Spotted deer are thoroughly gregarious and associate at all times of the year in herds, sometimes of several hundreds. They are less nocturnal than sambar, and may be found feeding for three or four hours after sunrise, and again in the afternoon for an hour or two before sunset. They generally drink between eight and ten o'clock in the morning, the time varying with the season of year, and repose during the day in deep shade. They swim well, and take readily to water. They both graze and browse."

It appears that there is a great range of individual variation as regards the date of the pairing-season and the shedding of the antlers; bucks with fully-

developed antlers being met with at all times of the year. In Northern India the pairing-season seems, however, to be generally during the winter; although young fawns may apparently be met with at any season.

As regards its usual habits, General Kinloch writes that "the chital is a shy and retiring animal, lying quiet in the densest thickets during the heat of the day, and if disturbed generally attempting to elude observation by concealment, or by trying to sneak quietly away. I have often, when beating for tigers, seen a cunning old stag with his head down silently creeping away through the jungle, sometimes passing almost under the elephants. When on foot, I have known a



THE INDIAN SPOTTED DEER ($\frac{1}{2}$ nat. size).

herd come quietly past within two or three yards of me in thick cover, and even at that short distance have had difficulty in getting a shot. It might be supposed that such a brightly-coloured animal would be very conspicuous in the forest, but this is far from being the case; unless it moves, few beasts are more difficult to see; the colour of the skin harmonises with the dead leaves and grass, while the white spots are indistinguishable from the little flecks of light caused by the sunshine passing through the leafy branches. Chital generally assemble in herds of from ten to thirty, among which are probably two or three stags, but occasionally herds of hundreds are met with. On being disturbed, and especially on detecting the presence of a beast of prey, the chital utters a sort of shrill bark, and many a time

has this cry betrayed a tiger to the sportsmen. The stag's cry is a peculiar moaning sort of bellow, and is generally to be heard at night. Immense numbers of spotted deer are frequently met with when beating for tigers, and many are shot off elephants in this way. In long grass it is of course only possible to shoot them from elephants, but however satisfactory it may be to bowl over a stag in full career by a clever snap-shot from the howda, it cannot, in my opinion, compare with the pleasure of stalking and shooting the same animal on foot, where the nature of the country renders it possible." The months of March, April, and May are the best for chital-shooting on foot in the valleys and low hills on the flanks of the Himalaya. Remains of deer apparently nearly allied to the chital are found in the Pliocene formations of the south of France.

THE SAMBAR GROUP (*Cervus unicolor*, etc.).

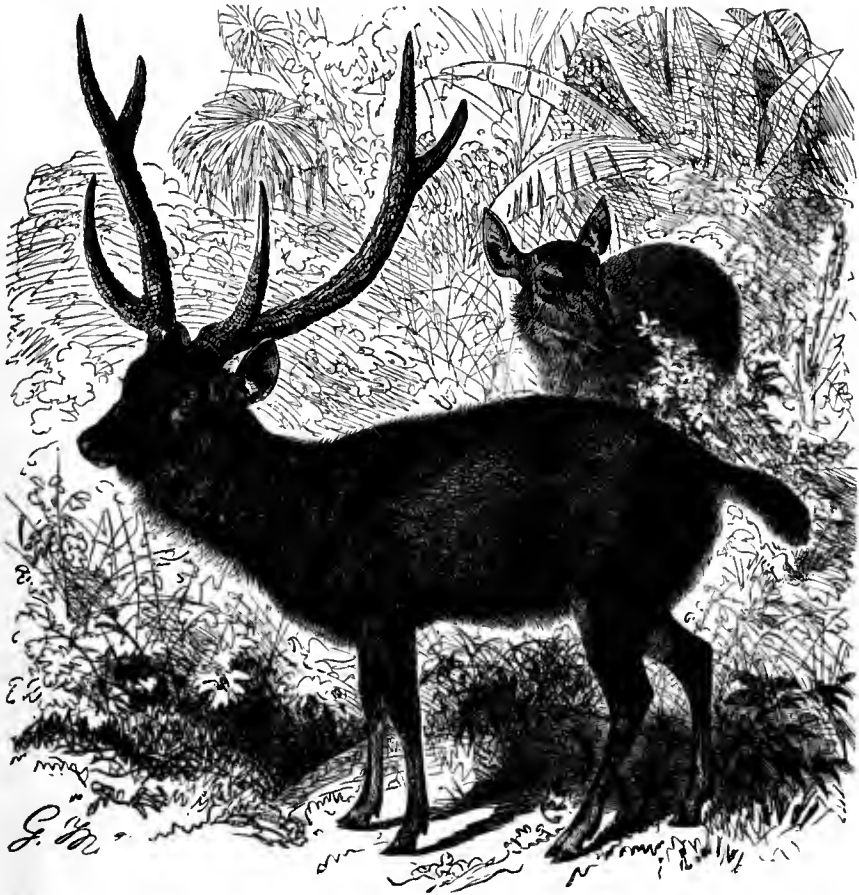
Nearly allied to the chital is a group of deer from South-Eastern Asia, distinguished by the brow-tine of the three-pronged antlers forming an acute angle, instead of nearly a right angle, with the beam, as shown in the figures on pp. 340, 353. The majority of this group are peculiar in that they are uniformly coloured at all ages, although in two forms the young are spotted, while in one case this type of coloration persists in the adult.

The well-known Indian sambar is the largest member of this group, as it is the largest of all the true deer, next to the representatives of the red deer group. Externally the sambar is characterised by its coarse wiry hair, which on the neck and throat of the adult male is elongated to form an erectile mane. The ears are large and broad, and the tail thick and of moderate length. In colour the fur is a nearly uniform dark brown throughout, tending, however, in some individuals to a more or less well-marked yellowish, and in others to a greyish tinge. The chin, under-parts, and inner surfaces of the limbs, are always yellower, and may be yellowish white. In the ordinary form the young are likewise uniformly coloured, but there is said to be a variety in Cachar of which the fawns are spotted. The height of the buck varies from 4 to 5 feet, and possibly rather more at the withers; and large specimens have been killed weighing 560 lbs. (40 stone) and 700 lbs. (51 stone).

The antlers are generally characterised by their rough external surface, and their freedom from sports; while in Indian examples the two tines of the terminal fork are nearly equal in length, although in other districts there is great variability in this respect. In India fine horns attain a length of about 36 inches, but these dimensions are seldom reached in the countries to the eastward of the Bay of Bengal. As regards shape and girth, there is a great amount of variation in sambar horns. In a fine pair, of which the extreme length was $38\frac{1}{2}$ inches, the span was $37\frac{3}{4}$ inches, and the basal girth $8\frac{7}{8}$ inches; whereas in another pair, while the length was only $32\frac{1}{2}$ inches the span was 38 inches and the girth 9 inches. The longest recorded pair measured 48 inches in length, but their girth at the middle of the beam was only 6 inches, against $8\frac{1}{2}$ inches in a pair measuring 38 inches in length. Perhaps, however, the finest known pair is one in which the length is 44 inches, the span $45\frac{3}{4}$ inches, and the girth just above the brow-tine $7\frac{3}{4}$ inches. There is

likewise an equally-marked difference in regard to the degree of development of the ridges and furrows on the antlers.

Distribution. The sambar occurs typically in the wooded undulating or hilly districts of India and Ceylon; but Mr. Blanford concludes that the smaller Malayan and Burmese forms, which have been described under the names of *C. hippelaphus* and *C. equinus*, are not specifically separate; although the front-tine of the terminal fork of the antlers is much shorter than the back one, instead of



THE SAMBAR ($\frac{1}{8}$ nat. size).

the two being subequal. The range of the sambar accordingly extends from India to the Malayan Islands, and thus covers nearly the entire Oriental region. In the Himalaya it may range to elevations of nine thousand or ten thousand feet; and it is commonly found on the highest mountains of Southern India and Ceylon. It is but seldom seen on the alluvial plains frequented by the elital, and is absent from the sandy plains of Sind, the Punjab, and Rajputana.

Habits. Mr. Blanford observes that the sambar "is the woodland deer of South-Eastern Asia generally, and is more widely and generally distributed than any other species. Although it does not shun the neighbourhood of

man to the same degree as *Bos gaurus* does, it is only common in wild tracts of country. It comes out on the grass slopes, where such exist, as in the Nilgiris and other hill-ranges, to graze, but always takes refuge in the woods. It is but rarely found associating in any numbers; both stags and hinds are often found singly, but small herds from four or five to a dozen in number are commonly met with. Its habits are nocturnal; it may be seen feeding in the morning and evening, but it grazes chiefly at night, and at that time often visits small patches of cultivation in the half-cleared tracts, returning for the day to wilder parts, and often ascending hills to make a lair in grass amongst trees, where it generally selects a spot well shaded from the sun's rays. It feeds on grass, especially the green grass near water, and various wild fruits of which it is very fond, but it also browses greatly on shoots and leaves of trees. It drinks, I believe, daily, though Mr. Sterndale doubts this; it certainly travels long distances to its drinking-places at times." As regards the date of the pairing-season and the time of shedding the antlers, there appears to be even a still greater amount of variation than is the case with the chital; and it is stated on good authority that stags have been known to retain their antlers for two or more years. It appears, however, that in peninsular India the pairing-season usually takes place in October and November, although in the Himalaya it occurs in the spring. Similarly, while in the former area the antlers are most frequently shed in March, in the latter the shedding-time is deferred for a month later. Usually there is but one fawn at a birth.

During the pairing-season sambar assemble in large numbers, and at that time the old stags utter at morning and evening, and sometimes in the night, loud roarings, which have been described as a "metallic-sounding bellow."

Sambar are very tenacious of life, and require a well-placed bullet to bring them to the ground. They are usually either stalked or driven by a line of beaters; but Sir Samuel Baker, when in Ceylon, was in the habit of hunting them with hounds, and giving the *coup-de-grâce* with a knife. Describing his experiences in that country, Sir Samuel writes that "we never drove the jungles with beaters, but simply strolled through the most promising country, either upon ponies or on foot, and took our chance of any game that we might meet. I rarely met sambar in the low country; and when living on the mountains at Newera Ellia, 6200 feet above the sea, shooting was out of the question. Although the interminable forests of that elevated district abounded with these animals, I have never seen one, unless discovered by the hounds. The jungles are thick, and it is impossible to get through them without noise and considerable exertion. The animals of course are alarmed, and retreat before you are near enough to hear their rush. I have often taken my rifle and sallied out before sunrise upon the wild *patinas* (open ground), where nature rested in profound solitude; but I have never seen a sambar in the open."

The hunting was conducted with a mixed pack of about fourteen couple of hounds of various breeds, which were found better suited to this kind of sport than pure-bred foxhounds; and the pack was always directed to the neighbourhood of a stream, where the scent would be freshest, as the sambar drinks before retiring to the densest depths of the jungle, in order to enjoy its day's repose. The speed of the sambar is, according to Mr. Blanford, but very moderate; and on the rare

occasions when these deer are found in open country, any good horse which is not overweighted by its rider, ought to have no difficulty in running them down.

Allied Species. In the islands of the Malayan region there occur several small sambar-like deer, in regard to which it is difficult to determine whether they indicate races of the ordinary sambar which have been introduced by the natives, and have gradually dwindled in size, or whether they are entitled to rank as distinct species. Such is the Timor deer (*C. timorensis*), a small, thick-set animal, scarcely half the size of the smaller race of the true sambar; and also the Moluccan deer (*C. moluccensis*), in which the general build is more slight and graceful. In the Philippine and Ladrone Islands, there occurs another of these small sambar-like deer (*C. philippinus*), belonging to the variety in which the anterior tines of the antlers are shorter than the posterior. This form is scarcely larger than the under-mentioned hog-deer, but its build is more slender, and the colour a uniform dark brown, save for a pale ring round each eye, and the white on the under-parts of the tail and the inner surface of the thighs.

On the other hand, there can be no doubt as to the specific distinctness of Kuhl's deer (*C. kuhli*), from the Bavian Islands between Borneo and Java. This deer, while resembling most of the forms noticed above, in that its fur has the same uniform coloration throughout life, differs in having a skull resembling that of the hog-deer; and displaying the same absence of tusks in the upper jaw. The colour of the fur in this deer is pale brown; but the individual hairs are ringed with alternate tints, instead of having the uniform hue of those of the hog-deer.

Very different from all the other members of this group is Prince Alfred's deer (*C. alfredi*), from the Philippines, which resembles the chital in having at all ages and all seasons a spotted coat. This deer stands about $2\frac{1}{2}$ feet at the withers; and its colour is a dark chocolate-brown, with about six longitudinal rows of somewhat indistinctly-marked yellowish spots. The antlers are comparatively short, and have the front tine of the terminal fork directed inwardly, while the outer surfaces of the ears are nearly devoid of hairs.

Hog-Deer. The last and smallest representative of this group is the hog-deer, or para (*C. porcinus*), of India and Burma, which stands only some 24 inches in height at the withers. In build, this species is characterised by the relative shortness of its legs, while the tail is rather long, and there is no mane on the neck and throat. The comparatively short antlers are mounted on very long bony pedicles, and after giving off the brow-tine have a nearly straight beam till the small terminal fork, the front branch of which is longer than the hind one. There are no tusks in the upper jaw. In colour, the fur of the para is brownish, with a more or less decided yellowish or reddish tinge; each hair being tipped with white, so as to produce a speckly appearance. The under-parts are paler, and the under surface of the tail and the insides of the ears white. The fur becomes paler in summer, and is then generally marked with light brown or white spots, which may be limited to one or two rows on either side of a dark streak down the back. The young have the whole body spotted, till they attain the age of some six months. The antlers seldom exceed 10 or 12 inches in length.

In India the hog-deer is confined to the great Indo-Gangetic plain, where it

ranges from Assam to the Punjab and Sind, and is quite unknown in the peninsula, though a small colony has been introduced into Ceylon. It occurs along the Terai at the foot of the Himalaya; and from Assam its range extends into Burma and Tenasserim.

The para swarms on many of the low alluvial plains of India, to which situations it is mainly, if not exclusively, restricted. Here it frequents the grass-jungles of moderate height, avoiding the taller ones which give shelter to the buffalo and rhinoceros. Sometimes, however, they may be met with among trees. As a rule, hog-deer are solitary creatures, and it is but seldom that more than two or three are found together, although several may inhabit one patch of jungle. The pairing-season is said to be in September and October; and the antlers are generally shed in April.

The hog-deer is an ungainly animal when moving, and General Kinloch states that both "its English and specific names have been derived from the hog-like manner in which it rushes through the long grass when disturbed; keeping its head low down, and galloping without that bounding action which characterises most deer." Hog-deer are generally shot from elephants and afford good sport, although they are difficult to hit, since as a rule the only indication of their presence is a sudden rush in the long grass, in the direction of which the sportsman must fire. General Kinloch says, that "hog-deer may be speared on favourable ground, and give splendid runs; they are very fast, and usually give a much longer chase than a boar. I have heard of instances of their deliberately charging a horse; and with their sharp horns they can inflict a very severe wound."

THE SWAMP-DEER GROUP (*Cervus duvauceli*, etc.).

The swamp-deer, of which the antlers are figured in the woodcuts on pp. 340 and 353, differs from all the Indian deer hitherto noticed, in that the antlers carry more than three tines. This distinctive character of the swamp-deer has not escaped the notice of the natives of India, by whom it is designated barasingha, that is, "twelve-tined." This deer is a rather large species, the bucks standing from 3 feet 8 inches to 3 feet 10 inches at the withers. The neck is maned, the tail of moderate length, the muzzle long, and the hair rather fine and rather woolly. The antlers are smooth and somewhat flattened, and give off the brow-tine nearly at right angles to the beam; after which the beam continues without branching for a considerable distance, finally dividing into a fork, of which the two prongs again branch. Generally, as in the figure on p. 353, the inner branch of the main fork has two, and the outer three tines, but the number of points is often much greater, reaching from sixteen to twenty, or even more. In its winter dress the colour of the swamp-deer is yellowish brown above and paler underneath; but in summer the upper-parts are reddish brown, generally more or less spotted with white, while the under-parts and the lower surface of the tail are pure white. The young are spotted.

Average-sized antlers of the barasingha measure about 30 inches along the curve; but a length of 38 inches has been recorded. Large stags have weighed from 460 to 570 lbs. (32 stone 12 lbs. to 40 stone 10 lbs.).

Distribution. The swamp-deer is confined to India, where it has a local distribution; being found along the foot of the Himalaya, from Assam to some distance west of the Jumna, and in some districts in the Indo-Gangetic plains, such as the Bengal sandarbans and Rohri in Sind. It is also common in certain portions of Central India, especially in the valley of the Narbada, where its habitat is limited to the area clothed with forests of the sal tree.

Habits. The swamp-deer, although sometimes found in open forest, generally keeps in the outskirts of the woods, and frequents flat or undulating grass-lands, more or less interspersed with trees. In winter it is gregarious, herds of from thirty to fifty head being frequently met with, while in some districts herds of several hundreds have been observed during September and October. In Assam the bucks are met with singly, with the antlers for the most part still in the velvet, so that the shedding-time is probably, as a rule, not later than February. The swamp-deer is mainly a grazer, and it is said to be much less nocturnal in its habits than the sambar, being not unfrequently seen grazing in the forenoon, and again early in the afternoon.

Schomburgk's Deer. Schomburgk's deer (*C. schomburgki*), of Siam, is an allied species, of which the antlers, as shown in the figure on this page, are distinguished by the extreme shortness of the beam below the bifurcation, and the great length of the brow-tine. Each antler usually carries five points; and specimens vary in length from 27 to 30 inches in good examples.

Eld's Deer. An altogether unique form of antler is that of Eld's deer (*C. eldi*), as shown in the figure on p. 340. Here the brow-tine curves down over the forehead, so as to form an almost continuous sweep with the beam; the latter being curved at first backwards and outwards, and then slightly forwards, after which it divides into a short fork, of which the two prongs may split up into as many as eight or ten points. The upper surface of the brow-tine often carries a number of short points, and there is very generally a distinct snag at the point where that tine joins the beam. In some cases the upper part of the beam is much flattened. In height this species stands nearly the same as the swamp-deer. In winter the colour of the fur of the bucks is dark brown, tending to black, but in summer it is fawn-coloured, nearly like that



HEAD OF SCHOMBURGK'S DEER.
(From Sclater, *Proc. Zool. Soc.*, 1877.)

of the does at all seasons; the under-parts being pale brown in winter and white in summer. The fawns lose their spots at an early age. In the winter the hair is coarse and very shaggy. Average-sized antlers measure about 40 inches from the tip of the brow-tine along the curve to the extremity; but one specimen of 54, and another of 59 inches have been recorded.

Eld's deer frequents low swampy grounds in Manipur, ¹Burma, the Malay Peninsula, Cambodia, and the island of Hainan. Mr. Blanford states that they are "usually seen in herds of from ten to fifty or more; but occasionally much larger numbers are found associating. They may enter the fringe of the forest in places for shade, during the day, but they generally keep in the open plain. In some places in the Irawadi delta, and in Martaban, they are found in plains, where, during the dry season, no fresh water is procurable. They are frequently seen in swamps, and feed on wild rice and other plants growing in such places." The period of shedding the antlers varies from June in Manipur to September in Lower Burma. The hinds utter a short barking grunt, while the call of the stags is a more prolonged sound of the same nature.

DAVID'S DEER (*Cervus davidianus*).

Mantchuria, or some neighbouring region in Northern China, is the habitat of a remarkable deer differing from all other Old World types in the absence of a brow-tine to the antlers. Instead of the brow-tine, each antler has a single very long and nearly straight tine given off just above the beam, and directed backwards; above which the beam ascends for a considerable distance, and then forks. The normal number of points on each antler is accordingly three, but this may be increased by a splitting of each tine of the fork. It appears that the long back-tine represents the hinder branch of the antler of the swamp-deer, and the terminal fork the front branch of the latter. David's deer is of about the same size as the swamp-deer, and is clothed with long and rather shaggy hair, while the tail is of unusual length, and also thickly haired. It has been stated that the fawns are uniformly coloured, but this requires confirmation.

These deer are kept in the imperial hunting-park at Peking, and specimens have been exhibited alive in England, but we have no information as to their habits in the wild state. The largest antlers on record have a length of 32 $\frac{3}{4}$ inches.

THE FALLOW DEER GROUP (*Cervus dama*, etc.).

The fallow deer is the representative of a distinct group of the genus *Cervus*, characterised by the antlers being rounded at the base, but widening in the upper part into a flattened palmate expansion. In front there is a large brow-antler, forming rather more than a right angle with the beam, above which there is a trez-tine given off at some distance below the commencement of the palmation; while the hinder edge of the latter carries three or four small sharp snags, of which the lowest is longer and placed considerably below the others, so that it may rank as a distinct back-tine.

In height the fallow deer usually stands nearly 3 feet at the withers, and has

a small head, large ears, and a relatively long tail. The general colour of the fur is some shade of fawn or yellowish brown, darker on the head and neck, and marked on the body with a number of large white spots. The under-parts, inner sides of the limbs, and the under surface of the tail are white; and there is a dark line running down the back from the nape of the neck to the end of the tail. There is, however, a dark brown variety in which the spots are scarcely distinguishable, or wanting, and specimens may be seen exhibiting every gradation in colour from pure white nearly to black. The hair is comparatively short and fine, and there is no mane on the neck and throat. The upper jaw has no tusks. Good antlers vary in length from 19 to 27 inches, $28\frac{1}{4}$ being the maximum length on record.

Distribution. The fallow deer is a native of Northern Africa and the countries bordering the Mediterranean, and in a wild state is still abundant in Sardinia, Spain, and some of the islands of the Grecian Archipelago. From these countries it has been introduced into Central Europe, where it flourishes well, although needing some protection during the winter in the more northerly regions. At what period this introduction took place is, however, quite uncertain, although in Britain it was evidently many centuries ago. From the occurrence of antlers of the general type of those of the fallow deer in some of the superficial deposits, it has been supposed that this species was really an indigenous British animal. These fossil antlers belong, however, to an extinct although nearly-allied species, known as *C. browni*, and there is no evidence of the occurrence of fossil remains of the true fallow deer in this country.

Bell observes that "fallow deer are gregarious to a great extent, associating in large herds, the bucks apart from the does, except in the pairing-season and early winter, when the sexes consort in company. Most persons must be familiar with their boldness and the confident manner in which they will approach mankind, where they are well accustomed to his presence. . . . Like the other species, the fallow deer feeds on herbage. It has been noted that it is especially fond of horse-chestnuts, which the bucks knock down from the branches with their antlers, and this tree is consequently frequently planted in deer-parks. The pairing-season begins in September, and the doe goes eight months with young." As a general rule but a single fawn is produced at a birth, although there may occasionally be two. The alleged instances of triplets appear to be incorrect. The young male exhibits the first signs of his antlers in his second year, when they make their appearance as simple snags; the animal being then called a pricket. In the fifth year the antlers attain their full development, although some additional small points may be added in the following season.

It has been stated that the dark variety of the fallow deer was introduced from Norway by James the First, on account of its hardy constitution. This, however, has been proved to be incorrect by Mr. Harting, who has shown that this breed existed in Windsor Park as far back as the year 1465. The fallow deer of Windsor Park include both the spotted and the brown breeds; but in Epping Forest only the latter occur.

Writing of the fallow deer of Epping, Mr. Harting states that they "have held their own, in spite of all difficulties, until the present time, and have strangely

preserved their ancient character in regard to size and colour. Locally they are referred to as 'the old forest breed,' and are comparatively small in size, of a uniformly dark brown colour, and with very attenuated antlers—peculiarities which have no doubt been brought about by continued isolation, without the admixture of any fresh stock for many generations. It is remarkable that no individuals of the true fallow colour (*i.e.* yellow dun) or spotted with white are ever seen in this forest. This in some measure proves the antiquity of the stock, which would otherwise show in their progeny a reversion to one or other of these varieties, which elsewhere are so common. The keepers assert that not only are there no spotted or fallow varieties here, but that they have never observed any spotted fawns, the latter being dark like their parents. If this observation be correct, it is very remarkable; for it is generally supposed that the fawns of all fallow deer are spotted at birth, and that, except in the permanently spotted variety, the spots disappear with age. The attenuation of the antlers is also very noticeable, the palmation being reduced from a hand's-breadth to about the width of two fingers. There can be no doubt that, from long isolation and continued breeding in and in, the herd has considerably degenerated. . . . At present [1884] the number of fallow deer in Epping Forest is estimated to be about eighty or one hundred head. They do not associate in one herd, but roam about in small parties, keeping to the thickest underwood and most unfrequented parts of the forest." The venison of the fallow deer is generally considered superior to that of the red deer.

Persian Fallow Deer. The Persian fallow deer (*C. mesopotamicus*), from the mountains of Luristan, in Mesopotamian Persia, differs from the ordinary kind in that the trez-tine of the antlers is placed nearer to the small brow-tine, and that the main palmation of the beam takes place below instead of above the middle of the length. The two species are, however, very closely allied, and will freely breed together. The Persian species appears to be always spotted.

Extinct Irish Deer. In this place may be noticed two extinct deer from the superficial deposits of Europe, which appear to be nearly related to the fallow deer, although of course it is impossible to tell now whether they had spotted or uniformly-coloured coats. The first and largest of these is the gigantic Irish deer (*C. giganteus*), often, but incorrectly, spoken of as the Irish elk, in which the widely-palmated antlers were larger and more massive than in any other species. In this magnificent deer the antlers have a short and nearly cylindrical basal portion of the beam, given off almost at right angles to the axis of the skull. Above the burr there is a descending brow-tine (*b*) which is flattened and generally forked. As soon as the beam expands it gives off from the front edge a trez-tine (*c*), and nearly opposite to it, on the hinder edge, a back-tine (*h*), corresponding to the one similarly situated in the fallow deer. Above these tines the antlers expand to their fullest width, and generally terminate in five or six snags, of which the topmost have a nearly upright direction. In unusually fine examples the antlers of the Irish deer may have a span of over 11 feet from tip to tip, and the height of the animal was fully 6 feet at the shoulder.

Although the Irish deer takes its name from the common occurrence of its remains in the bogs of Ireland, it is by no means confined to that country, but is found in the caverns and superficial deposits of England and parts of Scotland, as

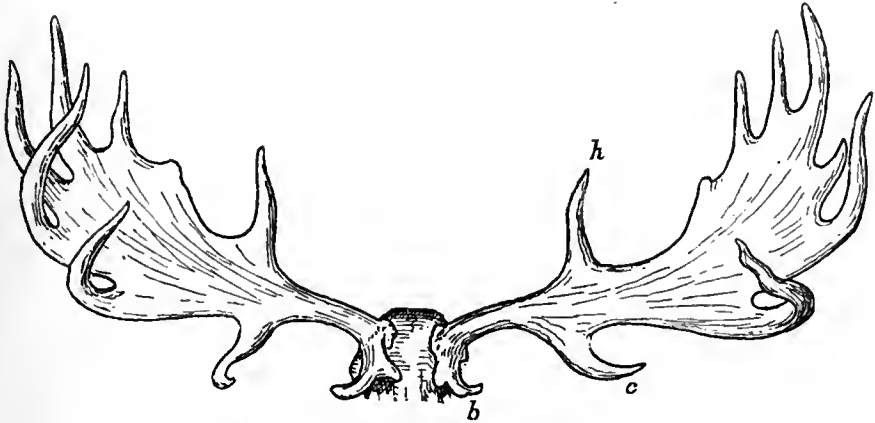
FALLOW DEER.





well as on the Continent, where its range extends from Italy in the south to Russia in the north. That the Irish deer lived within the human period is proved by the occurrence of its remains in association with stone implements. It has, indeed, been considered that the word *Schelk*, which occurs in the Nibelungenlied of the 13th century, refers to the Irish deer, but Prof. Nehring is of opinion that it more probably means either an elk or a wild stallion.

The Irish deer differs considerably from the fallow deer in the form and direction of its antlers, but a connecting link between them is found in Ruff's



ANTLERS OF THE IRISH DEER. (From Nehring.)

deer (*C. ruffi*), from the superficial deposits of Germany, which was of somewhat inferior dimensions to the former. In Ruff's deer the antlers are directed upwards and outwards nearly after the fashion obtaining in the fallow deer, while the plane of the palmated portion is placed in the same longitudinal direction as in the latter. Moreover, the terminal snags are shorter and inclined more inwardly than in the Irish deer, but the flattened and expanded form of the brow-tine indicates a closer connection with the latter.

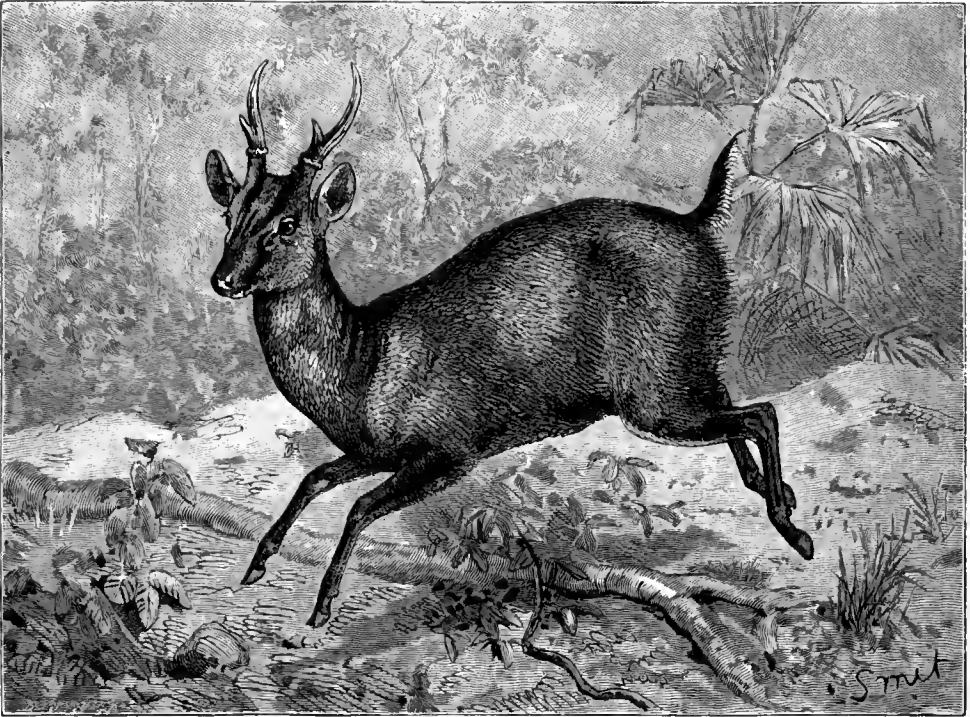
THE MUNTJACS.

Genus *Cervulus*.

The small Asiatic deer, commonly known as muntjaes, differ so decidedly from all those hitherto noticed that they are referred to a distinct genus. They are distinguished from all the members of the genus *Cervus* by their short, simple, two-tined antlers being mounted on pedicles of the skull, which are as long or longer than the antlers themselves, and diverge from the middle line of the lower part of the forehead, where they commence as rib-like bars. From this feature these animals are often spoken of as rib-faced deer. The brow-tine of the antlers is short and directed upwards, while the tip of the undivided beam is more or less inclined inwards. The skull has a very large depression for the reception of the gland below the eye; and the bucks are furnished with long projecting tusks in the upper jaw. The lateral toes are peculiar in that they consist of only the hoofs, without any trace of the bones of the digits themselves.

The muntjaes are confined to India, Burma, and the Malayan region, and evidently indicate a very ancient and generalised type of the Deer family. They appear to be represented in the Pliocene formations of Europe, and are probably nearly related to a still earlier group of extinct European deer, known as *Palaomeryx*, in which the antlers were either totally wanting, or of very small dimensions.

Indian Muntjac. The best known representative of the group is the common Indian muntjac, also known as the barking deer, and in Hindustan as the kakar (*Cervulus muntjac*). This animal stands from 20 to 22 inches in height at the shoulder; and has fur of a deep chestnut colour, becoming darker on the back, and paler and less brilliant below; the chin and upper part of the throat, as



THE INDIAN MUNTJAC

well as the hinder portion of the under surface of the body, and the inner sides of the thighs and lower surface of the tail, being white. The face and limbs are brown, and there is a black line on the inner surface of the pedicles of the antlers, extending some distance down the ribs on the face. The antlers are generally only some 3 or 4 inches in length, on pedicles of some 4 or 5 inches, but sometimes reach the length of 5, and, it is said, even 11 inches.

Distribution. The kakar is essentially a forest-dwelling deer, and appears to be restricted to hilly regions. Its range includes suitable districts throughout India, Ceylon, and Burma, whence it extends through the Malay Peninsula to the islands of Sumatra, Java, Borneo, and Hainan.

Habits. These deer are solitary creatures, usually found singly or in pairs; the name of barking deer being derived from their peculiar cry. On

this point General Kinloch observes that many visitors to the various hill-stations of the Himalaya, who may never have seen a kakar, must probably be well acquainted with its voice, which is wonderfully powerful for such a small animal. It is rather difficult to convey a correct idea of it by words, but it may perhaps be best described as a hoarse resonant bark. The cry may frequently be heard in the mornings and evenings, and it is also often uttered when the deer is alarmed, when it hears any loud or unusual sound, or suspects the existence of any danger. Occasionally a kakar will continue to bark, at short intervals, for an hour at a time, and advantage may be taken of his betraying his whereabouts to stalk him.

Kakar are adepts at making their way at speed through the most dense jungle, and run with their head low and their hind-quarters elevated. When running, a peculiar rattling sound is produced by these animals, which is thought to originate in the mouth, although in what manner is still unknown. The bucks, when attacked by dogs, appear to use their tusks, which curve outwards in a peculiar manner, as their chief weapons of defence, and are able with them to inflict gashes of considerable depth. Although young kakar are apparently to be met with at all seasons of the year, the chief pairing-time in Northern India is during the months of January and February; the fawns, which may be one or two in number, being born in the following June or July. The bucks shed their antlers in May, and their renewal is completed by August. The venison of the kakar is considered superior to that of most of the Indian deer.



HEAD OF HAIRY-FRONTED MUNTJAC.
(From Sclater, *Proc. Zool. Soc.*, 1885.)

Hunting.

In regard to the sport afforded by these deer, General Kinloch writes: "I have stalked and shot kakar at various times, and have also had them driven out of cover; many may be found in this manner, but, unless one knows their usual runs, it is difficult to know where to post oneself. Like many other animals, the kakar objects to being driven, and will break back through the beaters in order to make his point. As they probably only give a chance of a snap-shot at short range, it is easier to kill them with a charge of shot than with a rifle-bullet."

Other Species.

There are four other species of muntjac, in addition to the common Indian form. Of these, Fea's muntjac (*C. fea*), from Tenasserim, is rather smaller and darker than the Indian species, with a short tuft of hair between the antlers, and a much shorter tail; the latter appendage being altogether white, save for a narrow streak of black down the middle of its upper surface.

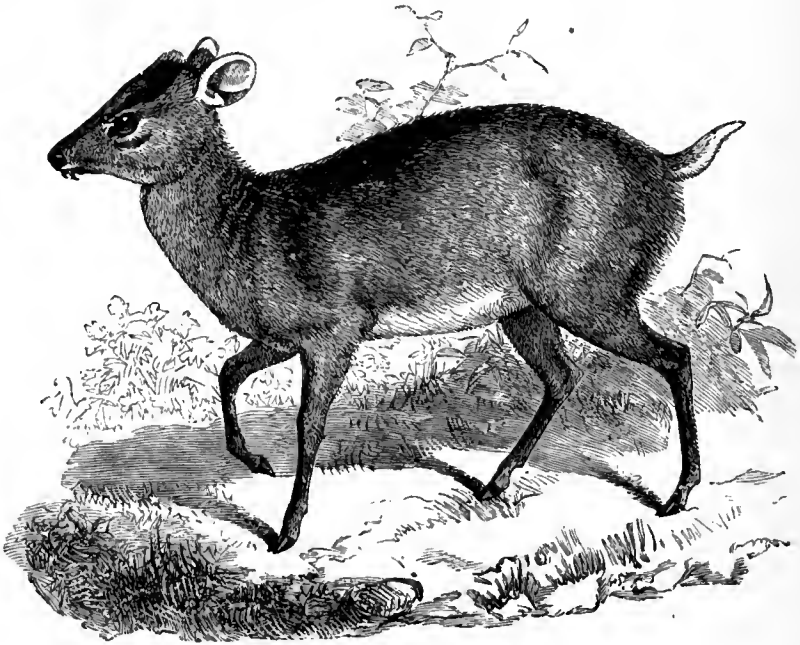
The other three species are Chinese. In Eastern Tibet and the neighbourhood of Hangehow there occurs Selater's muntjac (*C. lacrymans*), characterised by the bright yellowish-coloured hair of the head and neck, while that clothing the body and limbs is of a much more sombre hue. The smallest member of the group is Reeves's muntjac (*C. reevesi*), from Southern China and Formosa, in which the colour of the whole fur is brighter than in any other species, while the pedicles of the antlers diverge less from one another, and the hollow in the skull for the gland below the eye is of unusually large size.

Finally, the hairy-fronted muntjac (*C. erinifrons*), which is perhaps the handsomest of all and comes from the neighbourhood of Ningpo, is distinguished at a glance by the long tuft of hair on the forehead and top of the head, in which the minute antlers are almost entirely hidden. This species stands about 24 inches in height at the shoulder; and the general colour of its fur is brown. The upper part of the head is, however, of a bright chestnut, which, with the white of the under-parts and lower surface of the tail, forms a striking contrast to the sombre coloration of the body.

THE TUFTED DEER.

Genus *Elaphodus*.

Nearly related to the muntjacs are two small deer from Chinese territory, of which the one known as Michie's deer (*Elaphodus michianus*) inhabits Eastern



MICHIE'S DEER. (From Selater, *Proc. Zool. Soc.*, 1876.)

China, while the other, which may be called the Tibetan tufted deer (*E. cephalophus*), is from Moupin, in Eastern Tibet. In the males of these deer, as represented in the

accompanying illustration, the antlers are extremely minute and unbranched, while their supports take the form of long pedicles, which, instead of diverging as in the muntjacs, are convergent. Then, again, the rib-like ridges occurring on the face of the muntjacs are absent, as are likewise some small glands found on the forehead of the latter. Like the muntjacs, the bucks of these two deer are furnished with long tusks in the upper jaw, although their extremities are not turned outwards. In both species the hair is so coarse as to have been compared to small quills; and on the forehead the hair is lengthened so as to form a kind of horseshoe-like crest on the tuft.

In Michie's deer the general colour of the fur is greyish black, each individual hair being white for a considerable distance above its base, and the face and neck uniformly dark grey; while the crest on the forehead and portions of the ears are dark brown. In the Tibetan tufted deer the fur on the head, neck, and fore-quarters is dark brown, each hair being brown above and whitish beneath, while a pure white ring divides the two colours; consequently there is a speckled appearance in the fur of the anterior part of the animal. In the hinder part of the body the white rings on the hairs are absent, and the colour of the fur is consequently uniform dark brown, becoming of a still deeper shade on the feet and the crest on the forehead. The ears have a transverse black bar, with white tips and edges; the under-parts of the body and the lower surface of the tail being likewise white.

Michie's deer is abundant in the reeds bordering the rivers in the neighbourhood of Ningpo and other parts of Eastern China.

THE REINDEER.

Genus *Rangifer*.

The reindeer (*Rangifer tarandus*) differs from all other members of the deer-tribe in that the antlers are not borne only by the male, although those of the female are of smaller dimensions; and together with all the deer remaining for notice, it differs from those already described in the structure of the fore-foot. In these, which, with the single exception of the wapiti, are Old World types, the lateral metacarpal bones of the fore-foot, which originally supported the lateral toes, are represented only by two small splints lying on either side of the upper end of the cannon-bone, as shown in the foot of the sheep on p. 370. On the other hand, in the reindeer and the under-mentioned genera, these same lateral metacarpal bones are represented only by their lower extremities, and thus still support the toe-bones of the lateral hoofs, as shown in the figure on the next page. This difference may not, perhaps, appear to be of much significance, but as there are other indications of affinity between the members of the two groups into which the deer family is thereby divided, it is probably of considerable importance in classification. The majority of the deer belonging to the present group are either common to the northern regions of both hemispheres, or are restricted to the New World, the roe and the Chinese water-deer being the only exclusively Old World forms.

Reverting to the consideration of the reindeer, we have first to observe that in addition to the presence of antlers in both sexes, the genus is distinguished from

all other deer by the form and position of these appendages. Thus instead of being placed low down on the forehead, the antlers take their origin on the upper part of the skull, immediately over the occipital ridge, and are accordingly far behind the

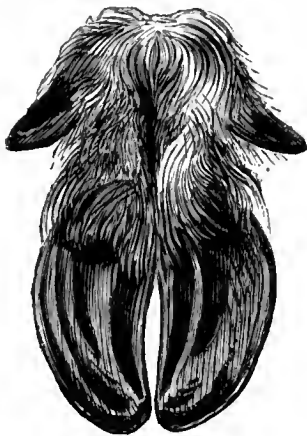


THE BONES OF THE
LEFT FORE-FOOT OF
THE ROEBUCK. (From
Dawkins.)

eyes; while as regards form they are distinguished by the great development of the brow-tines in the males, which are more or less laterally compressed, branched, and palmated, and descend to a greater or less degree over the face, so that their lower edge sometimes almost touches the nose. Then, again, there is such an amount of individual variation that scarcely any two reindeer can be found in which the antlers are precisely similar; while frequently the two antlers of the same individual are widely different from one another.

The antlers are very long in proportion to the length of the skull, and above the brow-tine, which is also branched and often palmated, after giving off the bez-tine, the narrow beam is continued backwards for some distance, till it bends forward at an angle, usually giving off a small back-tine at the bend. The beam is then continued upwards and forwards till it becomes palmated near the extremity, with a variable number of points on its hinder border. In the reindeer of the New World the antlers exhibit the greatest complexity of structure, the brow-tine of one side becoming enormously developed and greatly palmated, while on the other it is aborted.

In build the reindeer is a somewhat heavy animal, with short and rather stout limbs, terminating in large hoofs.



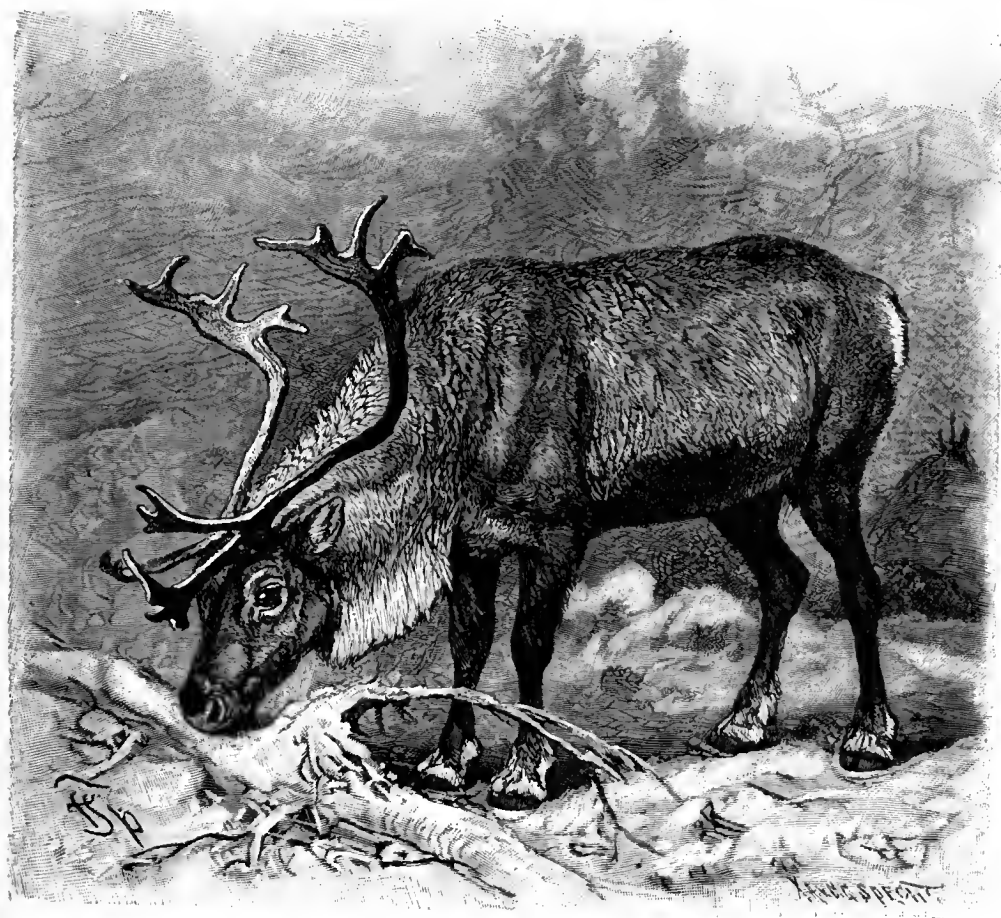
UNDER SURFACE OF FOOT OF
REINDEER.

The main pair of hoofs, as shown in our figure, are rounded, broad and short, with the intervening cleft very deep and wide; while the lateral hoofs are unusually large and flattened from front to back. In traversing snowfields the two main hoofs spread out sideways, while the lateral pair come in contact with the snow, by which means a large extent of surface is afforded to support the weight. The muzzle of the reindeer differs from that of all the deer hitherto mentioned in being clothed with soft hairs of moderate length. The neck has no distinct mane, but the throat is fringed with long and rather stiff hair. The ears are smaller than in any other deer, and thickly covered on both sides with hair. The hair clothing the body is from an inch to an inch and a half in length, and is somewhat crimped or waved, while beneath this is a coat of woolly under-fur. The general colour of the

reindeer is brownish grey, with the face, neck, and throat whitish, and the nose, ears, and limbs brown. There are, however, great individual variations as regards colour, some specimens being nearly or quite white throughout. In general the tail is white, with a tinge of brown at the root and on the upper surface; and there is a distinct white ring round each fetlock. The hoofs are black, and the antlers

yellowish, wearing white in places. Reindeer fawns are uniformly coloured like the adult.

The various races of reindeer differ considerably from one another in respect of height; but the bucks of the larger American variety stand about $4\frac{1}{2}$ feet at the withers, and usually weigh some 350 lbs., although unusually fine specimens may reach nearly 400 lbs. In regard to the length of the antlers, it appears that fine examples vary from 48 to just over 57 inches, although one pair is known in which



REINDEER ($\frac{1}{2}$ nat. size).

the length reaches to upwards of 60 inches. There is great variation in regard to the span of antlers, and the number of points they carry; while it is not unfrequently the case that the longest specimens have by no means the greatest girth.

Distribution. Reindeer inhabit the northern regions of both the Eastern and Western Hemispheres, and English zoologists are pretty generally agreed that there is but a single species. In America, however, where they are known by the French-Canadian name caribou (a corruption of *carrebauf*, literally "square-ox"), it is considered that there are either one or two species distinct from the Old World form. Thus, whereas Mr. Caton regards the smaller North

American form, known as the barren-ground caribou, as a distinct species, while he identifies the larger southern kind termed the woodland caribou with *R. tarandus*, other writers, like Dr. Hart Merriam, consider that both the American forms are entitled to rank as distinct species. We shall, however, follow the view that all kinds of reindeer are merely local varieties or races of a single widely spread species.

In the Old World reindeer are found nearly as far north as the extreme limits of land, while they extend from Scandinavia in the west to Eastern Siberia. In the Ural region their southern limit reaches in the Kirghiz steppes to about the 52nd parallel of north latitude, and they are still to be met with in the wild state, in the neighbourhood of Orenburg. In European Russia they are found in the forests of the Government of Kazan as far south as latitude 54°; and it is stated that in this district they attain very large dimensions, while the females are without antlers. In Scandinavia wild reindeer are, however, now becoming rare. Domesticated reindeer are kept in Siberia, Lapland, and part of Norway, as well as in the northern districts of the Government of Perm, but appear to be unknown in the Orenburg region. They were introduced into Iceland in 1870, where they flourish well, and in 1892 sixteen head were landed in Alaska. The Scandinavian domesticated breed, which is chiefly used by the Laps for purposes of draught, is considerably smaller than the wild race; but in Siberia there is a tamed breed of larger size, mainly used for riding. The importance of the reindeer to the Laplander has been so often written of that we may be excused for making any further mention of it.

In regard to the northern extension of the Old World reindeer, Baron Nordenskiöld observes that although it has not been found in Francis Joseph Land, it occurs at Cape Chelyuskin, as well as in Novaia Zemlia and Spitzbergen, and in the still more northerly Phipps and Parry Islands, which lie between the 80th and 81st parallels of north latitude. In some of these desolate regions reindeer are still very numerous, even where, as in Spitzbergen, they are incessantly hunted. Regarding their abundance in the islands last-named, Baron Nordenskiöld says that it has been suggested that they immigrate from Novaia Zemlia; but he considers it more probable that if such an immigration does take place, it must be from some unknown Arctic land to the north-north-east.

The same writer observes that "the life of the wild reindeer is best known in Spitzbergen. During the summer it betakes itself to the grassy plains in the ice-free valleys of the island; in late autumn it withdraws—according to the walrus-hunter's statements—to the sea-coast, in order to eat the seaweed that is thrown up on the beach. In winter it goes back to the lichen-clad mountain heights in the interior of the country, where it appears to thrive exceedingly well, though the cold during winter must be excessively severe; for when the reindeer in spring return to the coast they are still very fat, but some weeks afterwards, when the snow has frozen on the surface, and a crust of ice makes it difficult for them to get at the mountain-sides, they become so poor as to be scarcely eatable. In summer, however, they speedily eat themselves back into condition, and in autumn they are so fat that they would certainly take prizes at an exhibition of fat cattle."

Further observations on the mode of life of the reindeer will be deferred till we

come to the American varieties, but it is important that the periodical migrations of these animals which take place in Siberia should be noticed here. Admiral von Wrangel, when in Eastern Siberia, had an opportunity of seeing such migrations on more than one occasion; and he relates that the moving masses might be reckoned to include thousands of individuals, split up into herds of two or three hundred head. On one of these occasions the Admiral states that "two large migrating bodies of reindeer passed at no great distance. They were descending the hills from the north-west, and crossing the plain on their way to the forests, where they spend the winter. Both bodies of deer extended further than the eye could reach, and formed a compact mass narrowing to the front. They moved slowly and majestically along, their broad antlers resembling a moving wood of leafless trees. Each body was led by a deer of unusual size, which my guides assured me was always a female."

These southerly winter migrations of the reindeer are of considerable importance in regard to the former occurrence of this animal in Southern Europe; for since its remains are not unfrequently found in association with those of the hippopotamus, we can scarcely assume that in such localities at any rate the climate could have been otherwise than comparatively mild. Accordingly, the most probable hypothesis seems to be that in the Pleistocene period the reindeer, driven by the intense cold of the more northern portions of its habitat, must have travelled so far south during the winter till it reached regions where the rivers were suitable for the habitation of the hippopotamus.

At the present day reindeer are unknown in the Old World to the south of a parallel running a little below the southern shore of the Baltic; it appears, however, that in the time of Cæsar they were met with in the Black Forest of Northern Germany, although whether as permanent residents or as winter immigrants, cannot, of course, be now ascertained. In the British Isles, remains of reindeer are commonly met with in England, Scotland, and Ireland, and it was long considered that in Caithness this deer survived till the middle of the 12th century, although the latest researches tend to discountenance this idea. Reindeer remains are also found over the Continent, occurring as far south as the valleys of the Dordogne and Garonne in France.

Caribou.

Turning now to the American reindeer, which, as aforesaid, are characterised by the great development and palmation of one brow-tine of the antlers, and the abortion of the other, we find there are two well-marked varieties. The first and smaller of these is the barren-ground caribou, the *R. groenlandicus* of those who regard it as a distinct species. This reindeer is found only in the barren Arctic districts lying to the northwards of the forest-region of North America. It is abundant in the desolate regions to the northward of Fort Churchill, whence it extends to the confines of the Arctic Ocean. This form, although much inferior in point of size to the woodland caribou, has larger antlers; and it is mainly on the latter ground that American zoologists urge its right to be reckoned as a distinct species. Although confined in summer to the so-called "barren-grounds," this variety of the reindeer makes extensive southerly migrations in autumn, in order to spend the winter in the forest-regions tenanted by the woodland caribou. It appears, however, that even when inhabiting the

same districts, the two races invariably remain completely apart from one another, and show no tendency to intermingle.

Woodland Caribou. The larger woodland caribou, of which the dimensions have already been mentioned, is an inhabitant of the forest districts lying to the south of the barren northern lands. Mr. Lett states that "it inhabits Labrador and Northern Canada, and thence may be found south to Nova Scotia, New Brunswick, and Newfoundland, the northern part of the State of Maine and Lower Canada on both sides of the St. Lawrence, thence westerly in the country north of Quebec to the vicinity of Lake Superior. It never migrates towards the north in summer, as is the habit of the barren-ground caribou, but makes its migration in a southerly direction." This difference in the direction of the migration of the two varieties is certainly very remarkable; and when taken in conjunction with the difference in the size of their antlers, and their refusal to mingle together, indicates their marked distinctness from one another.

Habits. Mr. Caton says, that the woodland caribou feeds on leaves, "grasses, and aquatic plants, but its great resource is lichens. It frequents marshy and swampy grounds more than any other of the Deer family; for which it is admirably adapted, and where it is well protected from pursuit. In the winter it resorts to the dense forests on higher ground." Like the European variety, the American reindeer is an animal of great endurance and speed, and can trot faster than most horses. In disposition, the caribou is shy and wary, and to ensure a successful stalk requires all the powers of the sportsman. To hunt these animals in deep snow on foot, or on the open ground with dogs, is said to be mere waste of time, as in the one case the animal, by the aid of its broad hoofs, makes its way over the snow without difficulty, while in the other it easily distances and tires out its pursuers.

Woodland caribou migrate in herds of from one hundred to two hundred, or even as many as five hundred head. During these periodical migrations, Mr. Lett says that "they are easily killed in vast numbers by taking advantage of the wind, and shooting them as they pass along. They are also frequently surprised crossing rivers or lakes that intersect their line of march, when they become an easy prey to hunters in canoes. In winter they are often seen upon the ice on inland lakes. On such occasions they can be easily shot, provided they neither see nor smell the hunter. The instant, however, they catch the scent of their hidden foe, they vanish like a streak of light. I have heard it said by those who have seen them scudding over the ice, like shadows, that in an incredibly short space of time they appeared to the naked eye not larger than rabbits." Indeed, so swift are they on the ice, that when caribou once set foot on it, the hunter who knows his business immediately gives up the pursuit as hopeless. Solitary caribou are more wary, and consequently more difficult to stalk, than those in a herd.

The time when caribou are most easily killed is during the months of March and April, the snow having then a thin cake of ice on the surface, through which the animals are constantly breaking, and are thus run down without much difficulty by hunters on snow-shoes.

There appears to be a lack of information as to the breeding-habits both of

the caribou and of the wild reindeer of the Old World. The pairing-season of the barren-ground caribou is, however, said to be in the winter; while that of the woodland variety is in September. In the case of the latter, the antlers of the bucks are shed in December, while those of the does do not fall until the spring. The fawns are produced in May, and are either one or two in number.

Owing to incessant pursuit, in season and out of season, the numbers of the caribou have been greatly reduced in many districts; but, in Newfoundland, these animals are now protected by special laws.

THE ELK OR MOOSE.

Genus *Alces*.

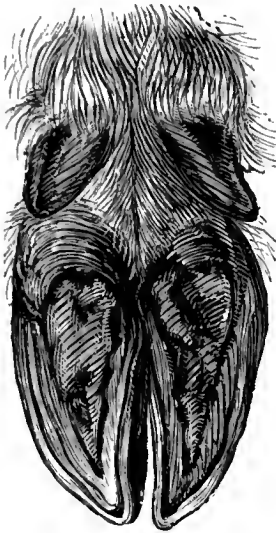
The largest living representative of the Deer family is the somewhat ungainly-looking animal known in Europe as the elk, and in North America as the moose (*Alces machlis*). This fine animal differs from all other deer in the form and setting-on of the antlers of the male; and it is not improbable that these appendages have really no connection with those of the true deer, but were independently acquired.

In build, the elk is characterised by the length of its limbs, its short neck, very long and flapping ears, and the great length and narrowness of the head, which terminates in a broad overhanging muzzle, completely covered with short fine hair, save for a small triangular spot just below the nostrils. The extremity of the muzzle is flexible, and the eyes are small and sunken. The antlers, instead of emerging from the forehead at an acute angle with its middle line and inclining forwards, as is the case with all living representatives of the genus *Cervus*, project on either side at right angles to the middle line of the forehead, and in the same plane as its surface. Their basal portion consists of a short, cylindrical beam, without any tine, and beyond this beam they expand into an enormous basin-like palmation. In young animals, and more especially in the Swedish elk, the antlers have their palmated portion divided into a smaller anterior and a larger posterior moiety; but in the adult of the American form these two coalesce into a single palmation, elongated from back to front, and containing a number of short and irregular snags on its outer edge. The antlers of fine specimens may weigh as much as 60 lbs.; and in a head in the possession of Mr. Otho Shaw the antlers have a span of 65 inches, a length along the palmation of 41 inches, and a width across the same of 24 inches, but a span of 66 inches is on record. The antlers do not attain their full dimensions till the animal has attained its ninth year.

The skull of the elk differs from that of other deer in the extreme shortness of the nasal bones, and the consequently very large size of the cavity of the nose. The upper molar teeth have very low and broad crowns. The tail is so short that it is scarcely more than a rudiment.

The elk carries its short neck nearly horizontally, and therefore somewhat lower than the elevated withers; and it is this feature which so largely contributes to the ungainly and ugly appearance of the animal. The feet have long and

sharply-pointed hoofs, very different in appearance from those of the reindeer; and the lateral hoofs are relatively large and loosely attached. In the male the hair is long, coarse, and somewhat brittle, and is elongated into a slight mane on the neck, shoulders, and throat; while in colour it varies from very dark brown to yellowish grey. The female is lighter coloured than the male during the winter season. In both sexes the hair is softer and finer in the summer than in the winter; and during the later season an abundant supply of woolly under-fur is developed. Young animals have also brighter-coloured and sleeker coats than aged individuals; and in the latter the fading of the winter coat with the advance of spring is much more noticeable than in the former. The fawns are uniformly coloured like the adults.



UNDER SURFACE OF FOOT
OF ELK.

Dimensions. The height of the elk has been much exaggerated, some writers asserting that the male may stand as much as 8 feet at the withers. Mr. Caton observes, however, that it is safe to say that it may attain a height of 6 feet, or occasionally rather more, and we may probably put the extreme limits as not exceeding $6\frac{1}{2}$ feet. The weight of an average adult male

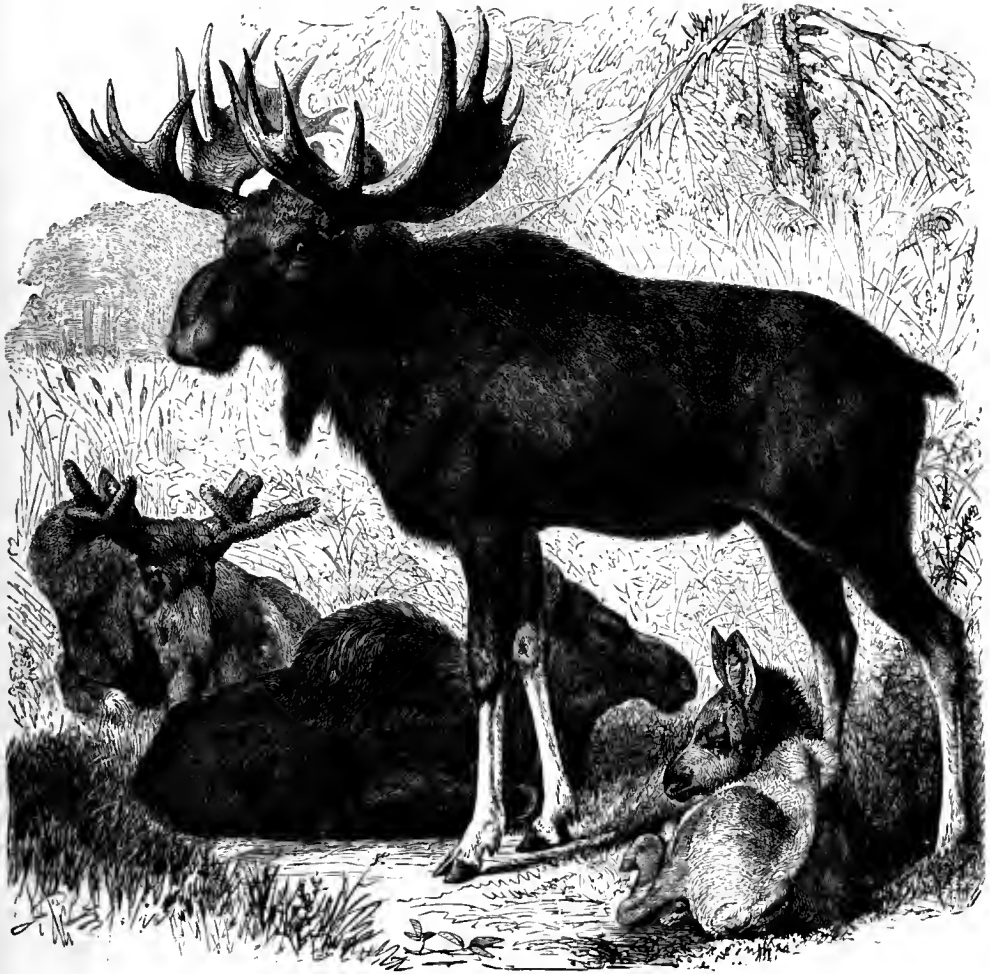
elk is given by the writer last cited as 700 lbs., but large specimens will reach 900 or 1000, and, it is said, even as much as 1200 lbs.

Adult male elk, and occasionally the females, have a curious pendulous appendage on the throat formed by a dilatation of the skin, and covered with long and coarse blackish hairs. This appendage may vary in length from 4 to 10 inches, and is known to the American hunters as the bell; its use is unknown.

Distribution. The elk has a distribution very nearly the same as that of the reindeer, although it does not extend so far north, and is, indeed, limited by the northern extension of trees, being essentially a forest animal. In Europe, although now greatly diminished in numbers, it is found locally in Scandinavia, Eastern Prussia, Lithuania, and parts of Russia, such as the neighbourhood of Orenburg, the government forest near Moscow, and the districts bordering the river Samara in Astrakhan. Thence it extends eastwards into the subarctic portions of Siberia, although its extreme limits in this direction are not fully ascertained. A few years ago an elk was shot in Galicia, which had probably wandered from more northern latitudes. In the time of Pallas, elk were also found on the northern slopes of the Caucasus; while Cæsar mentions them as inhabiting the Black Forest. During the prehistoric period, their distribution was still more extensive in Europe; and their remains have been found in many parts of England, the most southern point being Walthamstow in Essex. In the still earlier deposits of the Norfolk forest-bed, the species was preceded by the broad-fronted elk (*A. latifrons*).

In North America the range of the elk appears to have extended originally from about the 43rd to the 70th parallel of latitude, its northern limit being marked by the southern border of the so-called barren grounds. Mr. Caton says

that elk have been seen as far south as the Ohio, and as far north as the Mackenzie River. Writing in the year 1865, Mr. J. G. Lockhart states that elk were then common over the whole of British America as far north as the barren grounds, although absent from particular localities. Thus they were especially abundant on the west side of the Rocky Mountains, and continued so to Behring Strait, but were unknown on the shores of Hudson Bay in the neighbourhood of York



A FAMILY OF ELK ($\frac{1}{2}$ nat. size.)

Factory. Although specially protected in Ontario, the elk is, however, now rapidly disappearing from the forests of North America; and this is not to be wondered at, when we learn that some years ago several hundreds of these animals were shot on one occasion in New Brunswick merely for the sake of their hides; their carcasses being left to rot on the ground. Elk are still comparatively common in Alaska, but have more or less completely disappeared from certain districts where they were formerly abundant. As far back as 1881, Mr. Caton wrote, that "they have probably entirely ceased their visits to Newfoundland; but

in Labrador many still remain, though gradually retreating thence towards the more secluded and inaccessible portions of the country. From Upper Canada all are gone, and but few remain in Lower Canada, where, fifty years since, they were abundant. What are left have retreated to the great dense forests of the north."

Habits. Elk feed more upon the leaves and twigs of trees than upon grass; and their length of limb enables them to pluck such nutriment with facility, while the shortness of their necks renders them unfitted for grazing, unless in places where the grass is unusually tall, when they merely pluck the tops. In Northern Europe and Asia birch, willows, aspens, and poplars afford a large proportion of the leafy food of the elk; but in North America both evergreen and deciduous trees contribute their quota. Various lichens and mosses are, however, also eaten; but in winter, when the whole country is deeply buried in snow, the elk have to depend solely on twigs and buds of trees. In order to obtain the foliage of saplings which are above their reach, elk in America, at least, have a curious habit of straddling on either side of the stem with their fore-legs, and then gradually pressing down the tree with the weight of their body.

In America elk commence feeding with the first signs of dawn, and continue till sunrise, after which they repose or ruminate till ten or eleven o'clock. From that time they again feed till about two, when they take another period of repose till four or five, and then feed till dusk, when they lie down for the night. Mr. Lockhart says that elk "generally lie down with their tails to windward, trusting to their senses of hearing and smelling, which are remarkably acute, to warn them of approaching danger from that quarter. They can use their eyes to warn them from danger to leeward, where hearing, and especially smelling, would be of little use. While sleeping or chewing the cud, their ears are in perpetual motion, one backward, the other forward, alternately. They also have the remarkable instinct to make a short turn and sleep below the wind of their fresh track, so that any one falling thereon and following it up is sure to be heard or smelt before he can get within shooting distance."

In summer the favourite resorts of the American elk are in the neighbourhood of swamps, rivers, or lakes, where long grasses which can be easily reached grow in rank abundance. In winter, however, they generally betake themselves to higher grounds, although always those clothed with dense and almost impenetrable forest. When disturbed, the elk, in spite of his great bulk, makes off with extreme rapidity and almost perfect silence, even in the thickest cover, always when possible selecting moss-clad and yielding ground over which to make its way.

In winter, elk in America are in the habit of consorting in small parties, often comprising a male, female, and the young of two seasons, and taking up their quarters in what is termed a moose-yard. "The yard," writes Mr. C. C. Ward, "is situated in some part of the country where there is an abundant growth of young deciduous trees, such as the white birch, poplars, maple, and mountain-ash; these, together with a few of the coniferous trees, the balsam-fir and juniper, form the staple diet of the moose. Some writers maintain that the bull moose never yards with the female and young, but this is disproved by my own experience as a moose-hunter. . . . I have on many occasions found and killed males occupying the same

yard with the old and young females." It appears, however, that very old males generally make a yard for themselves, and remain alone throughout the winter.

The antlers of the adult elk are shed in America during January, and the new pair attain their full development in August. During the time that the antlers have been in the velvet, the male elk has spent most of his time in the marshes and swamps, feeding on the leaves of the yellow water-lily, and frequently protecting himself from the attacks of mosquitoes and other insect torments by standing neck-deep in the water. With the complete development of his antlers, he sallies forth from these retreats to commence calling, and to enter upon a series of com-



A MOOSE-YARD.

bats with his rivals for the possession of the females. These contests appear to be fully as fierce and determined as those of the red deer: and Mr. Ward records finding in a lake the skulls of two elk, with their antlers inextricably interlocked, which had evidently perished after one of these encounters. The fawns are born in the following May, and are either one or two, or, very exceptionally, three in number. They are of a dark fawn-colour, but, according to Mr. Ward, with a slight dappling. The females, before the birth of the fawns, seek out the most sequestered spots, such as islands in lakes and rivers, and swamps and prairies, which are liable to be overflowed at certain seasons of the year, where they will most likely be free from the attacks of wolves and bears. Some writers aver that at such seasons they likewise endeavour to avoid the males, but this is denied by

Mr. Ward, who believes that the male is never very far away from his consort. Mr. Lockhart says that when the fawns are very young and helpless, "the mother in their defence will even attack man. At such times her appearance reminds one forcibly of a vicious horse. She raises her head, throws back her ears upon her neck, and sniffs or blows like a horse; then she bounds towards her enemy, striking the ground with her fore-feet, and her eyes glittering with rage."

The favourite pace of the elk when in rapid motion is a long swinging trot; and it is said that so long as the animal keeps to this pace it cannot be overtaken by any ordinary horse. If, however, it can be forced into a gallop, the elk soon becomes blown, and can then be readily ridden down.

We have already alluded to the ungainly appearance of the elk; and this ungainliness is certainly most strongly marked in specimens exhibited alive in menageries or mounted in museums. Mr. Ward states, however, that when seen among his native forests no one can fail to be impressed with the majesty and grandeur of the male elk in all the glory of his spreading antlers.

Hunting. In Sweden and Norway elk are either hunted by being driven or stalked. In the autumn of 1885 the elk in the forest of Huncberg, which had been preserved for thirty-five years, were hunted by a royal party, when fifty-one head were shot; and in 1888 upwards of sixty-six were killed in the same forest. In America there are now three legitimate methods of elk-hunting, namely, stalking or still-hunting, fire-hunting, and calling; the wholesale slaughter of the animals when imprisoned in their yards by the snows of winter having fortunately been prohibited by the legislature. In the "Far West," the best season for elk-hunting is during the months of October and November; the first snowfalls occurring in the mountains during the latter month, and the males being then incessantly calling or fighting with their fellows. To be successful in elk-stalking requires the aid of an experienced Indian guide, as very few men of European descent can attain that marvellous skill in tracking which appears to come naturally to the Indian.

It appears to be only in the north-eastern districts that the practice of calling with a birch-bark pipe is followed, as the custom is said to be quite unknown in the Rocky Mountains. In regard to the mode of procedure, Mr. Ward says that "the Indian, having selected a favourable position for his purpose, generally on the margin of a lake, heath, or bog, where he can readily conceal himself, puts his birchen trumpet to his mouth, and gives the call of the cow moose in a manner so startling and truthful that only the educated ear of an Indian could detect the counterfeit. If the call is successful, presently the responsive bull moose is heard crashing through the forest, uttering his blood-curdling bellow or roar, and rattling his antlers against the trees in challenge to all rivals." In other districts the call of the male is imitated by drawing the shoulder-bone of a moose against the dry bark of a young tree, and any male that may be in the neighbourhood advances to answer the challenge of the supposed rival. In the Rocky Mountains the male moose instead of uttering the bellowing call mentioned above, only gives vent to a loud and prolonged kind of whistle, while the female is completely silent.

Fire-hunting, or hunting by torchlight, is practised, says Mr. Ward, by exhibiting a bright light, formed by burning bunches of birch-bark in places known

to be frequented by moose. The brilliant light seems to fascinate the animal, and he will readily approach within range of the rifle. The torch placed in the bow of a canoe is also used as a lure on a lake or a river, but is attended with considerable danger, as a wounded or enraged moose will not unfrequently upset the canoe.

A favourite mode of moose-hunting, when the snow lay very deep on the ground, was by running them down in snow-shoes. Accidents were, however, frequent in this kind of hunting, more especially during the spring, when the snow is covered with a thin crust. At such times, if the hunter happened incautiously to run too near the moose, the animal would turn suddenly, and leaping upon his pursuer trample him under foot. Mr. Lockhart also says that in British America the Indians during the winter were accustomed in deep snow to make a kind of fence of three poles, tied equidistant from each other, a little taller than a man, stretching perhaps for two days' march between lakes, or a lake and a river, or between two mountains, or in any particular place where the moose were accustomed to pass. Spaces were left vacant here and there in this fence, and in these snares were set, in which the unfortunate animals became entangled.

The flesh of the elk, in spite of some coarseness of grain, is generally regarded as forming excellent venison, although it is said to have a slightly musky taste. The large and fleshy nose is, however, esteemed the greatest delicacy, and is reported by those who have had the opportunity of tasting it to be absolutely unrivalled. Elk manage to maintain themselves in fair condition throughout the winter, so that their flesh is eatable when that of the ordinary American deer is so poor and dry as to be unpalatable.

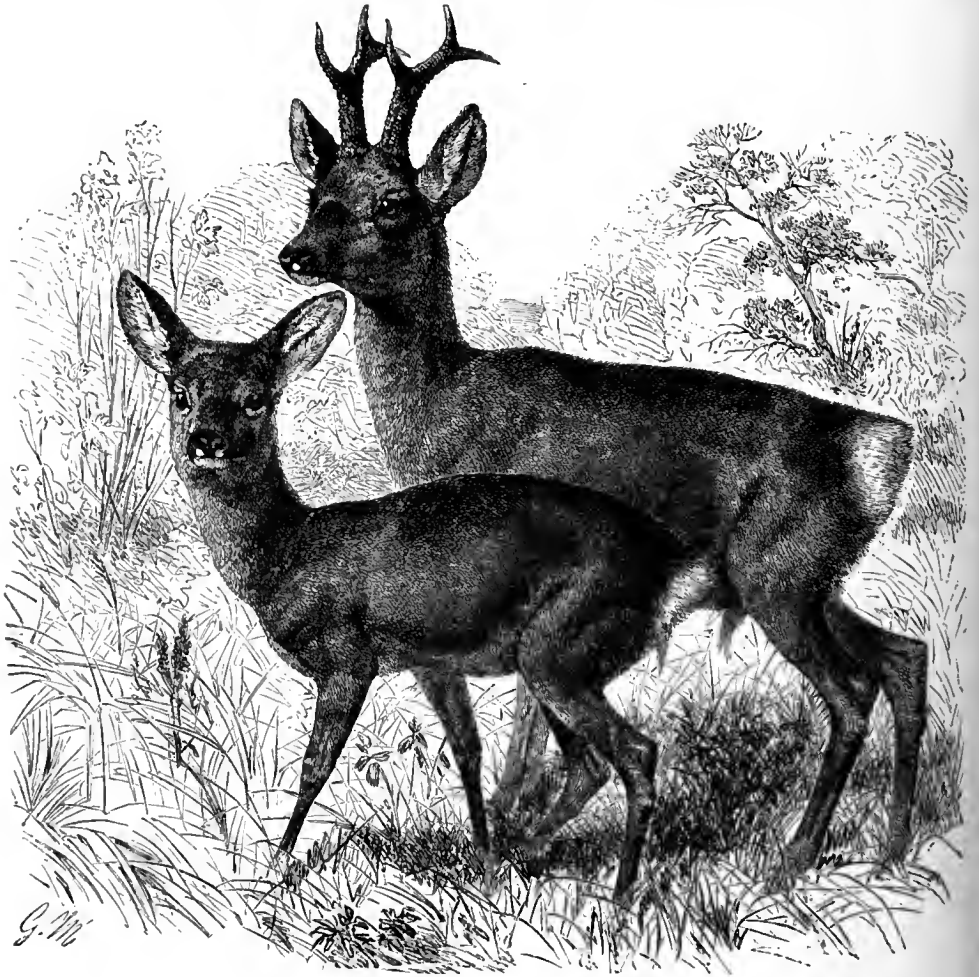
THE ROE DEER.

Genus *Capreolus*.

The roe deer (*Capreolus caprea*), while agreeing with the reindeer and the elk in the conformation of the bones of the lower part of the fore-legs, differs entirely from both in the form of its antlers, as well as by its greatly inferior dimensions, being, in fact, one of the smallest representatives of the family. Moreover, whereas the two genera just mentioned have a circumpolar distribution, the roe is strictly confined to the Old World.

The roebuck when fully adult stands about 26 inches in height; and has antlers somewhat less than twice the length of the head. These antlers are rough, and have a straight and nearly cylindrical beam, rising for some distance nearly vertically from the skull, and then giving off one forwardly-directed tine from its front edge; after which the beam curves backwards and terminates in a simple fork. The roe's antler is therefore three-tined like that of the Indian spotted deer, but differs in that instead of having a true brow-tine, the first tine is not given off till about the middle of the entire length. The average length of the antlers is from 8 to 9 inches, but it is said that a pair from Austria have been recorded in which the length was 15 inches. The antlers of the roe are more subject to malformations than those of any other species; and they sometimes show a mass of ill-formed tines.

The roe has a relatively short head, with moderate ears, a very small gland below the eye, and the naked portion of the sharp muzzle small and not extending beyond the nostrils. Normally there are no tusks in the upper jaw; and the tail is short and rudimentary. The neck is rather long and slender, and carried high above the level of the back; and the limbs are likewise slight and delicately formed. In summer the colour of the fur is reddish brown, but in winter, when it becomes



MALE AND FEMALE ROE DEER ($\frac{1}{2}$ nat. size).

thicker and finer, the tint changes to yellowish grey. There are some black and white markings on the lips, and there is a large patch of white on the buttocks enclosing the tail, while the under-parts and the insides of the limbs are pale yellowish fawn. The fur of the fawns is spotted with white. The weight of a full-grown buck may reach 60 lbs.

Distribution. The common roe is an indigenous inhabitant of the British Isles and the greater part of Europe, extending northwards to the south of Sweden, and southwards to Italy and Spain. In Russia it is confined to the regions

of the Caucasus and the Ukraine, and it extends into Western Asia in Persia. Its fossil remains occur in the superficial deposits of England and the Continent; but at the present day roe deer are found wild within the limits of the British Isles only in Scotland, and in the neighbourhood of the Blackmoor Vale, in Dorsetshire, where they were reintroduced in the early part of the century. In the year 1884 a few head were, however, turned out in Epping Forest; and some are kept in certain English parks.

Tartarian Roe. In Turkestan and the mountains separating Russia from China, the place of the ordinary roe is taken by the nearly-allied Tartarian roe (*C. pygargus*), distinguished by its superior size, the more hairy ears, and the larger white patch on the rump. In Mantchuria there is a third form, of small size, and differing somewhat in coloration from both the others.

Habits. In Scotland roe deer are found chiefly in the woods, or on the immediately adjacent moors, but never wander far out on the open hills, although they will venture on to the cultivated lands in search of food. They feed in the early morning and towards evening, and generally associate in small family parties, while they make regular tracks through the woods to their feeding grounds. Their usual food is grass and other herbage, as well as the young shoots of such trees and bushes as they are able to reach. The speed of the roe is not great; but the animal is a great leaper, and, when running, its usual pace is a bounding gallop.

The antlers of the adult bucks are shed about the end of the year, and the new ones are generally fully developed by the latter part of February. The pairing-season takes place during July and August, at which time the bucks are exceedingly pugnacious. Scrope relates that in the summer of 1820 two were found dead in a hollow after one of these contests, lying one on the top of the other, with the antlers of the one firmly driven into the shoulder of the other, and *vice versa*. The fawns are born in the spring, usually early in May; and in Scotland about one doe out of five or six will produce two fawns at a birth in favourable seasons. No account of the roe would be complete without some reference to the extraordinary fact that although the pairing-season takes place in July or August, and the young are not produced till the following May, yet the period of gestation is only five months. The explanation of this appears to be that the ovum lies dormant for some four and a half months, that is until December, after which it develops in the ordinary manner.

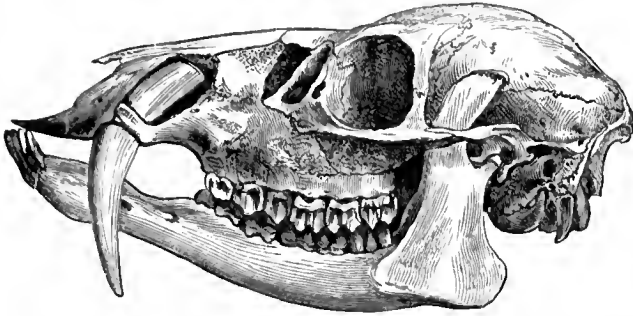
Certain extinct deer found in the Pliocene deposits of the Continent have been considered to belong to the same genus as the roe.

THE CHINESE WATER-DEER.

Genus *Hydropotes*.

Among the tall reeds fringing the banks of the Yang-tse-Kiang, there occur numbers of a small deer differing from any of the species hitherto noticed in that while both sexes are totally devoid of antlers, the males are provided with long scimitar-like tusks in the upper jaw, as shown in the figure on the next page. This

deer is the Chinese water-deer (*Hydropotes inermis*), which in both these features resembles the musk-deer, although in other respects it is allied to the more typical representatives of the present section of the family.



SKULL OF THE CHINESE WATER-DEER WITH PART OF THE UPPER JAW CUT AWAY TO SHOW THE BASE OF THE TUSK. (From Sir V. Brooke, *Proc. Zool. Soc.*, 1872.)

The Chinese water-deer is of the approximate dimensions of the Indian muntjac (p. 366); and is a long-bodied and short-limbed creature, with light reddish-brown fur. One of the most remarkable peculiarities about this small deer is that the does produce from three to six fawns at a birth.

The pelage of the young is faintly marked with white spots, arranged in ill-defined rows. The number of young produced, coupled with the absence of antlers in the bucks, indicates that the Chinese water-deer is in all probability a survivor from a very ancient type of the Deer family. These deer are commonly found on the Yang-tse-Kiang, in parties of two or three. When disturbed, they arch their backs and scud away at a great pace in a series of quick leaps. They are usually killed with buckshot.

The resemblance of the skull of the male water-deer to that of the musk-deer, is merely due to both forms being apparently direct descendants of the common ancestral type, from which the more specialised members of the family have been evolved; it being well ascertained that in most or all of the early Tertiary deer the males were devoid of antlers and furnished with long upper tusks. When antlers were developed to their full extent, so as to become efficient weapons of defence, the need for tusks disappeared, and the tusks consequently dwindled or were lost. The muntjacs, in which the antlers are short, present a kind of middle stage of evolution, the tusks having become much smaller than in the Chinese water-deer, though larger than in many species of superior size.

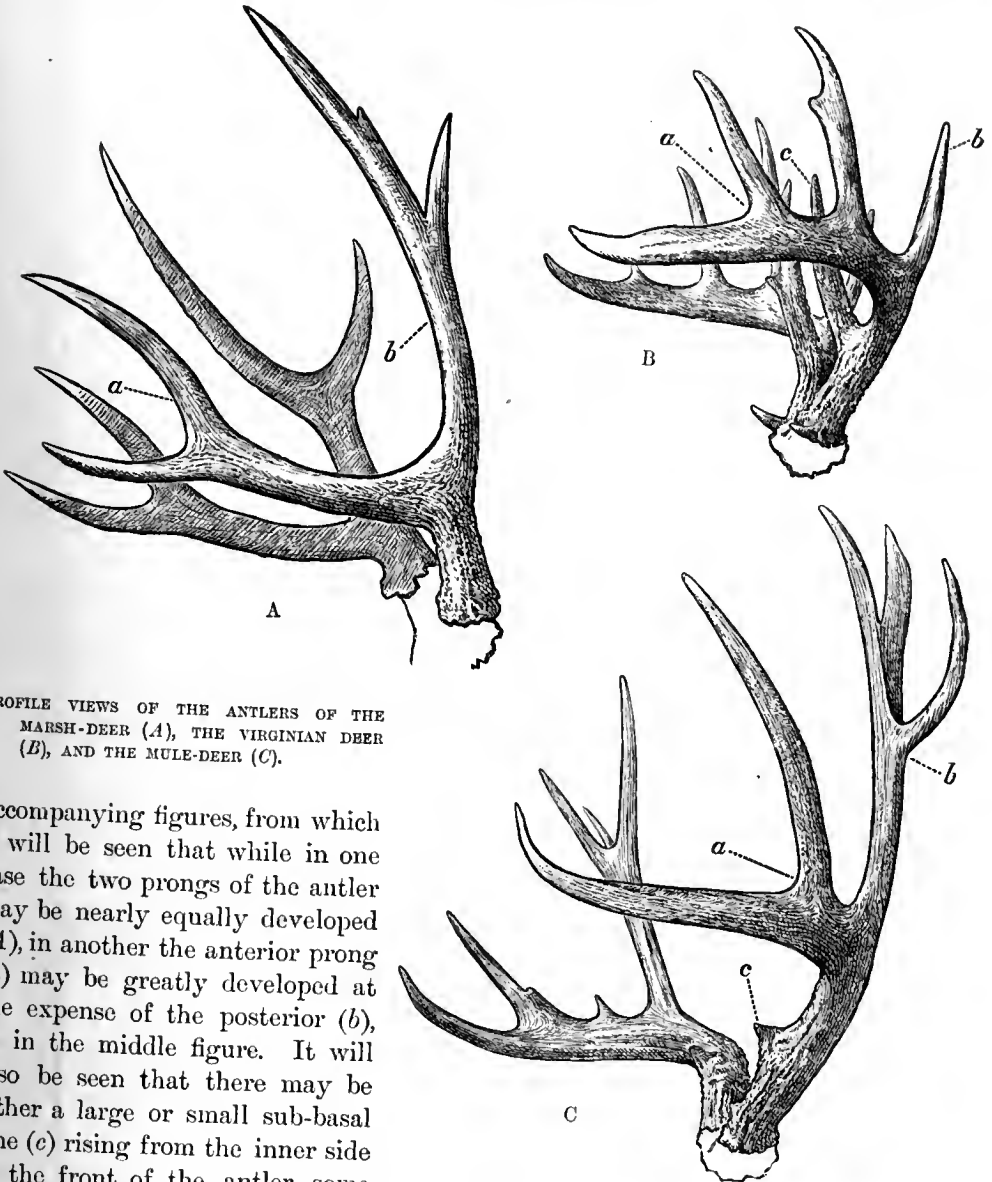
THE AMERICAN DEER.

Genus *Cariacus*.

With the exception of the wapiti, the reindeer, and the elk, which are either closely allied to, or identical with, Old World types, the whole of the deer of America differ essentially from those of Asia and Europe, and are referred (with the exception of one small species which forms a genus by itself) to a totally distinct genus, *Cariacus*.

These deer resemble the reindeer in the structure of the bones of the lower part of the fore-limb; and also in that in the dry skull the aperture of the nasal passage is completely divided by a longitudinal vertical partition of bone. The latter feature is, indeed, peculiar to the reindeer and the American deer, and serves at once to distinguish their skulls from those of any species of the genus *Cervus*.

The American deer are, however, still better distinguished from their Old World cousins, by the characters of their antlers, which are either in the form of simple spikes, or are divided in a fork-like manner, with the anterior prong directed forwards, and no brow-tine. These characteristic features are well shown in the

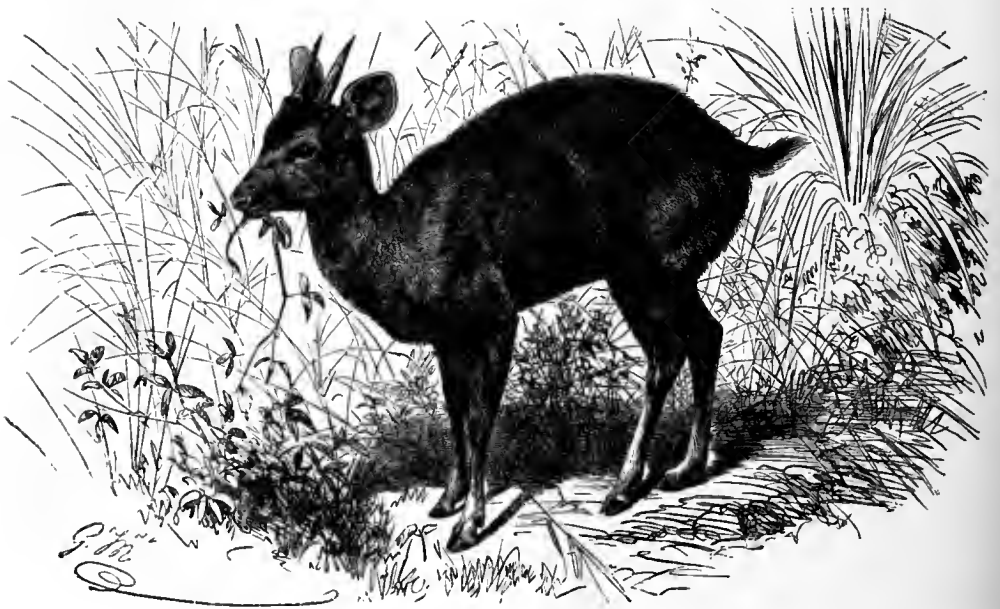


PROFILE VIEWS OF THE ANTLERS OF THE MARSH-DEER (A), THE VIRGINIAN DEER (B), AND THE MULE-DEER (C).

accompanying figures, from which it will be seen that while in one case the two prongs of the antler may be nearly equally developed (A), in another the anterior prong (a) may be greatly developed at the expense of the posterior (b), as in the middle figure. It will also be seen that there may be either a large or small sub-basal tine (c) rising from the inner side of the front of the antler, some distance above the burr, and directed upwardly. It was long considered that this sub-basal tine represented the brow-tine of the antlers of the Old World deer, and attempts were made to correlate the other tines of the American deer with those of the genus *Cervus*. Mr. Allan Gordon Cameron has, however, pointed out that this is a totally erroneous notion; the truth being, that while the members of the genus

Cervus have originated in Europe from an early antlerless deer-like creature (*Palæomeryx*), the representatives of *Cariacus* have been independently derived in North America from a totally distinct ancestral deer (*Blastomeryx*), which was likewise unprovided with antlers. And it will accordingly be self-apparent that the antlers of the Old and New World deer are not mutually comparable. Starting from the simple spike-like antlers of the brockets of South America, we shall find that there is a transition through a simply-forked antler to the complex type exhibited by the mule-deer; and it will accordingly be most convenient to commence our notice of these deer with those in which the antlers are simple, and finish with those in which they are most complex.

Before proceeding to the various species, it may, however, be added that all



THE RED BROCKET ($\frac{1}{3}$ nat. size).

the American deer are uniformly coloured above in the adult condition, and that they all have narrow and naked muzzles. The length of the tail is subject to a great amount of specific variation. In addition to the peculiar feature already noticed as distinguishing the hinder aperture of the nasal passage, the skulls of the American deer are characterised by the large dimensions of the unossified space in front of the eye, and the small size of the pit for the reception of the gland.

Brockets.

The first group of the American deer is represented by several small species known as brockets, which are confined to the southern half of the continent, and are distinguished by their unbranched spike-like antlers, and by the hair on the middle line of the face radiating in all directions from two points, one of which is situated on the crown of the head, and the other just below the eyes. They are further characterised by the large extent of the naked portion of the muzzle, which completely surrounds the nostrils; and likewise by the spotted coat of the fawns. The tail is of medium length; and the upper jaw may or may

not carry tusks. The best known species is the common red brocket (*C. rufus*)—the one represented in our illustration—of North-Eastern Brazil and Guiana, where it ranges from Surinam to Pernambuco. It is a rather clumsily-built animal, standing 27 inches in height at the withers, and of a uniform reddish brown colour. The nearly allied Brazilian brocket (*C. simplicicornis*), is a rather smaller species, standing only 21 inches in height, and distinguished by its lighter and more elegant shape, as well as by the more decided brown colour of the fur, especially in the young. This species ranges over the greater part of Brazil, and extends westwards into Colombia. The other two species are the Ecuador brocket (*C. rufinus*), found in Ecuador, Colombia, Venezuela, and Guatemala; and the wood-brocket (*C. nemorivagus*), from Surinam and Trinidad, both of which are only 19 inches in height. The former has fur of a full glossy red colour, with the face and legs shaded bluish brown; while the latter differs from all the rest by the pepper-and-salt colour of its hair. Fossil remains of brockets occur in the caverns of Lagoa Santa, in Brazil, which probably belong to species still inhabiting the same districts.

Habits.

Brockets are found either alone or in pairs, and never collect in herds; a male and female apparently associating for life. The does produce usually but a single fawn at a birth, in December or January; and the young are able to follow their mother in from three to five days. The speed of the brockets is considerable, but not enduring, and they can be easily ridden down by a good horse, while, when the cover is not too thick, hounds will generally capture them within half an hour.

Costa Rica Deer.

The Costa Rica deer (*C. clavatus*), of Central America, is another small species with spike-like antlers, which appears to form a group by itself, connecting the brockets with the succeeding groups. This deer is of a uniform reddish yellow colour, like the Virginian deer; and differs from the brockets, and agrees with the following groups in that the hair of the face is directed uniformly backwards, while it likewise resembles those that follow in the smaller size of the naked portion of the muzzle, and in the less arched profile of the face.

Guemals.

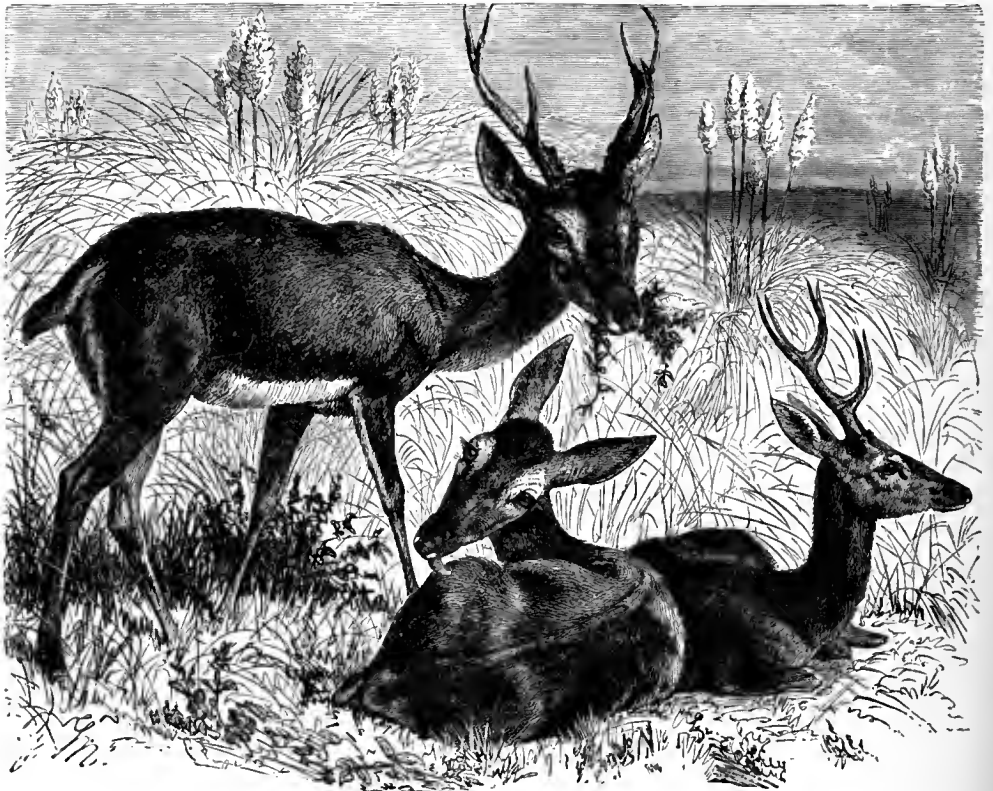
The third group of the genus is represented by two South American species of medium size, which are confined to the Andes, where they are known as guemals. They are distinguished by the antlers forming a single fork, of which the front prong is the longer, and is projected forwards in the manner characteristic of the genus; by the presence of tusks in the upper jaws of both sexes, and also by the uniform coloration of the fawns. Of the two species, the Chilian guemal (*C. chilensis*) ranges from Santiago to Magellan, but is far more scarce in the northern than the southern portion of this tract; while the Peruvian guemal (*C. antisiensis*) is a northern form from the highlands of Peru.

Pampas Deer.

The pampas, or Guazuti deer (*C. campestris*), represented in the illustration on the next page, brings us to a fourth group of the genus, confined to South America, and characterised by the antlers being regularly forked, with the hinder prong—and sometimes also the front one—again forking; while there is no sub-basal snag above the burr. The two species of this group are further characterised by the absence of tusks in the upper jaw, the shortness of the tail, and the uniform coloration of the fawns. They are confined to the eastern

and southern portions of South America; and do not attain such large dimensions as the members of the next group.

The pampas deer is the smaller of the two species, standing about $2\frac{1}{2}$ feet at the shoulder; and its range extends from Paraguay and Uruguay through Argentina into Northern Patagonia. The antlers (as shown in the profile view in our illustration) are characterised by the great development of the forked posterior tine, at the expense of the unbranched front-tine; the number of points thus being three. The hair is thick, coarse, and glossy; its colour on the upper-parts



THE PAMPAS DEER ($\frac{1}{2}$ nat. size).

being light reddish brown. The lower parts of the flanks, as well as the chin, throat, chest, and a stripe on the limbs, are dusky; while the under-parts, inner sides of the limbs, under side and tip of the tail, and insides of the ears are white.

Habits.

The pampas deer is the largest and most common ruminant in the districts from which it takes its name. It frequents dry and open parts of the country, and is generally found in pairs or small parties, the old bucks being, however, solitary. Mr. Darwin says that "if a person crawling close along the ground, slowly advances towards a herd, the deer frequently, out of curiosity, approach to reconnoitre him. I have by this means killed, from one spot, three out of the same herd. Although so tame and inquisitive, yet when approached on horseback they are exceedingly wary. In this country nobody

goes on foot, and the deer knows man as its enemy only when he is mounted and armed with the bolas."

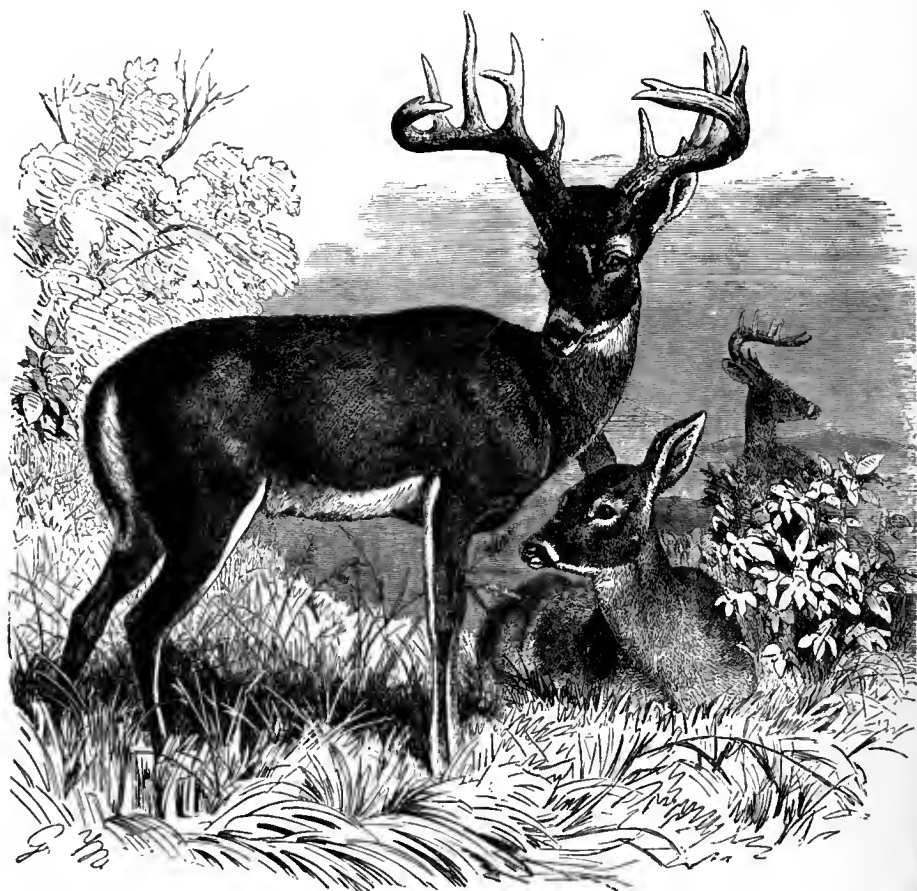
The male of the pampas deer possesses an unpleasant and penetrating effluvium, which, as we can personally attest, can be detected at a distance of several miles. During the day these deer generally lie concealed among the tall pampas-grass, coming out to feed at sunset, and continuing throughout the night. Their speed is very great, and it is only by the very best horses they can be ridden down, while even then, if they have any considerable start, they are pretty sure to escape. The fawns are born in the winter and spring, and it does not appear that there is ever more than one at a birth. Both parents aid in protecting their young, and the doe is especially clever in aiding the escape of her fawn, as the following narrative by Mr. Hudson shows. "When the doe with fawn is approached by a horseman," writes this observer, "even when accompanied by dogs, she stands perfectly motionless, gazing fixedly at the enemy, the fawn motionless at her side; and suddenly, as if at a preconcerted signal, the fawn rushes directly away from her at its utmost speed; and going to a distance of six hundred to a thousand yards conceals itself in a hollow in the ground, or among the long grass, lying down very close with neck stretched out horizontally, and will thus remain until sought by the dam. When very young, if found in its hiding-place, it will allow itself to be taken, making no further effort to escape. After the fawn has run away, the doe still maintains her statuesque attitude, as if resolved to await the onset, and only when the dogs are close to her side she also rushes away, but invariably in a direction as nearly opposite to that taken by the fawn as possible. At first she runs slowly, with a limping gait, and frequently pausing, as if to entice her enemies on; but as they begin to press her more closely, her speed increases, becoming greater the further she succeeds in leading them from the starting-point." The alarm-cry of the pampas deer is a low, whistling bark, but this is never uttered when the doe has a fawn by her side.

Marsh-Deer. The marsh, or guazu deer (*C. palustris*) is a somewhat larger species, found in South Brazil, Paraguay, Rio Grande do Sul, and Uruguay; its westerly range being limited by the Parana River. The antlers of this deer, of which an example is represented in the figure on p. 385, are larger and more complex than those of the pampas-deer, both prongs of the main fork being strongly developed, and each again subdividing; the hinder prong being also generally rather the heavier of the two. In contrast to the pampas-deer, the marsh-deer seeks out swamps and lakes, where it delights to enter the water or wallow in the mud.

Virginian Deer. The last main group of the American deer is typically represented by the well-known Virginian deer (*C. virginianus*), with its numerous varieties, and includes the largest representatives of the genus, as well as the whole of those found in the northern half of the continent. The group is distinguished by the large size and complexity of the antlers, which differ from those of the other groups by the presence of a larger or smaller sub-basal snag (c of the figure on p. 385), and likewise by the absence of tusks in the upper jaw, and the spotted coat of the fawns.

The Virginian deer occurs typically in eastern North America, but the so-called

white-tailed deer (*C. leucurus*) of the western side of the continent can scarcely be regarded as anything more than a variety, while it is doubtful if the more southern form known as the Mexican deer (*C. mexicanus*) is really entitled to specific distinction. Considering all these forms as referable to a single species, the Virginian deer will have a range extending right across the American continent from east to west, and from south to north from Canada to Mexico. The main distinctive characteristic of this species is to be found in the antlers (shown in profile



VIRGINIAN DEER ($\frac{1}{15}$ nat. size).

in the figure on p. 385, and from the front in the figure of the entire animal), in which the anterior prong of the main fork shows a great development at the expense of the hinder one. This abortion of the hinder prong is, however, compensated by a corresponding growth of the sub-basal snag. These snags, like the main prongs of the antler, are subject to extraordinary abnormal developments, so that the variations which occur in the antlers of the Virginian deer are only paralleled by those found in the reindeer. The tail is long. The summer pelage of the Virginian deer is a bright bay, from which it derives its common local title of red deer, but in winter the coat becomes of a greyer tinge. At all seasons of the

year the throat, a ring above the muzzle, a spot above and below the eye, portions of the inside of the ear, the inner surfaces of the limbs and the under-parts are, however, white. The upper surface of the tail is dark brown, and even in winter there is a more or less reddish tinge throughout the pelage. In build this deer is the most elegant and graceful of all its compatriots. Its variation in size is so great that it would be useless to give any measurements, although it may be mentioned that unusually fine bucks are said to weigh as much as 200 lbs., and occasionally more.

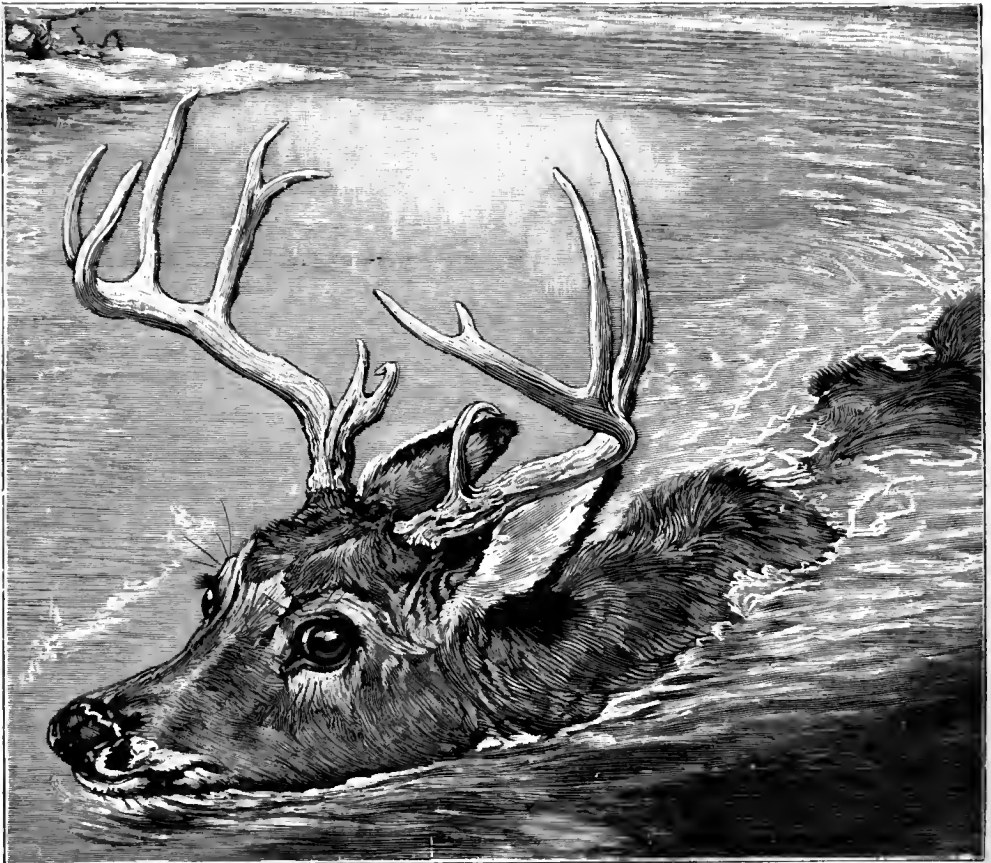
With regard to the variation in size and colour in this, the commonest North American species, Mr. Caton writes that, although in a given neighbourhood there is a great difference in the size of individuals, in widely different localities there is a permanent and constant difference of size. Thus, whereas in the north all the deer are large, as we proceed south there is a progressive diminution, till in Northern Mexico and the neighbourhood of the Gulf of Mexico the deer have so diminished that it is at first difficult to believe that they are specifically identical with their northern representatives. Similarly we find in the mountainous regions of the west an increase in the amount of white on the tail and body, which has given rise to the notion that the so-called white-tailed deer is a distinct species; but Mr. Caton states that this difference is not constant even among the deer of the west, where many specimens cannot be distinguished from those found in Illinois or Wisconsin. The more northerly race appears, however, to be characterised by the absence of the black markings on the face and tail, which so frequently occur in the southern and eastern portion of the animal's range.

Habits. In the Adirondack region of New York Dr. Hart Merriam says that the Virginian deer "is found high upon the mountain-sides, as well as in the lowest valleys and river-bottoms. It frequents alike the densest and most impenetrable thickets and the open beaver-meadows and frontier clearings. From the 1st of May to the 1st of November its food consists of a great variety of herbs, grasses, marsh and aquatic plants, the leaves of many deciduous trees and shrubs, blueberries, blackberries, other fruits that grow within its reach, and the nutritious beech-nut. While snow covers the ground—which it commonly does about half the year—the fare is necessarily restricted, and it is forced to subsist chiefly upon the twigs and buds of low deciduous trees and shrubs, the twigs and foliage of the arbor vitæ, hemlock, and balsam, and a few mosses and lichens. In winters succeeding a good yield of nuts the mast constitutes its staple article of diet, and is obtained by following the beech ridges and pawing up the snow beneath the trees."

Although shy and timid in the extreme, and at first retreating rapidly before the advance of cultivation, these deer soon regain confidence, and come back to their ancient haunts. Their speed is great, and they are excellent and rapid swimmers, even young fawns while still in the spotted coat taking readily to the water. During long-continued deep snow these deer frequently collect together in parties, sometimes of considerable size, and form "yards," like the elk.

There is considerable variation in the time of changing the grey dress of winter for the red coat of summer, as there is in the date when the antlers of the bucks are shed, these differences being apparently mainly due to the severity or mildness of the winters. The pairing-season, during which the bucks, like those of other deer, are exceedingly pugnacious, lasts from the latter part of October till the beginning

of December. The fawns, which are nearly always two in number, are mostly born in May. They retain their white spots till September, when both young and old assume their winter dress. The fawns are easily tamed, if captured sufficiently young. In bucks of the first year the antlers form unbranched spikes, while in the second year they are simply forked, without any branching of the two prongs, although the sub-basal snag makes its appearance at the same time.



VIRGINIAN DEER SWIMMING.

Hunting. The most legitimate mode of hunting the Virginia deer is by stalking, but in the south they are frequently pursued by hounds, followed by mounted hunters armed with rifles. In other cases hounds are employed to drive the deer to water or down the paths in the woods, where the sportsmen lie in wait. In summer, when deer are abundant, many are killed by what is termed "jacking"; that is to say, a lantern or some other light is carried, upon seeing which the deer becomes dazzled, and, while standing to gaze, offers a ready shot. Finally, "breasting" is employed, according to Mr. G. B. Grinnell, "where the deer make their home among very high grass, such as is to be found on some of the prairies of the south-west or in the great beds of the dry lakes of Northern and Western Nebraska. Here the thick cane-grass stands seven or eight

feet high, and the head of a mounted man is only just visible above the tops. Several huntsmen armed with shot-guns form a line on the leeward side of the space to be hunted over, and ride through it, a little more than a gun-shot apart. The deer that lie in their course are started from the grass, and bound off ahead of the hunters, every now and then showing their backs above the tops of the grass. The horsemen have to shoot from the saddle, and very quickly, to secure their game." Sometimes these deer are shot from canoes as they swim from island to island.

Naked-Eared Deer. The naked-eared deer (*C. gymnotis*) from Colombia and Ecuador appears to be a distinct species, distinguished from the Virginian deer by the large flapping ears, of which the outer surface is naked, by the extreme narrowness of the head, and the more slender form.

Mule-Deer. The most specialised of all the American deer as regards size and complexity of antlers is the mule-deer (*C. macrotis*), so called on account of the enormous size of its ears. In this deer the antlers (as shown in a

front view in the accompanying figure, and in profile in the figure on p. 385), when compared with those of the Virginian deer, have recovered the relative importance of the posterior prong, concomitantly with a proportionate reduction of the subbasal snag, and are therefore much more regularly forked "At the same time," writes Mr. A. G. Cameron, "the main strength of the beam is drawn into the anterior prong, and intermediate forms occur both in this and the last-named species, which bridge the gap between the extremes on either side, and leave no doubt as to their intimate relationship." In general the front prong is simply forked, while the second divides into three or more snags in adult bucks; but instances occur where the hinder prong is unbranched, while in



HEAD OF MULE-DEER.

some individuals of the Virginian deer the same prong is divided. The antlers of the second year are simply forked, in the third year the hinder prong is also forked; but the forking of the front prong and the development of the subbasal snag does not take place till the assumption of the fourth set of antlers. In the left antler represented in the figure on p. 385, which is from a head in the collection of Mr. A. G. Cameron, the length of the upper prong is 28, and that of the lower prong 29 inches along the curve, the basal girth being $5\frac{3}{4}$ inches; but in the

opposite one the upper prong measures 29 and the lower 27 inches. The extreme span of these antlers is 32 inches. In another head in the same collection the total length of the antlers is 32 inches, with an extreme span of 37 inches. The right antler of this head has an additional tine depending from just below the main fork—an aberration not unfrequently found in the Virginian deer, where it may occur on both sides.

In height the mule-deer is fully equal to the Virginian deer, but it is a more stoutly built and much less graceful animal, with proportionately shorter limbs, while the ears are nearly double the dimensions of those of the latter. The tail is short, and quite unlike that of any other deer, being cylindrical, naked below, and covered above with short white hairs, terminating in a long brush of black ones. In summer the coat of the mule-deer is very thin and sparse, and generally of a reddish colour, with a large white patch on the buttocks; but in winter the general colour is steel-grey, the individual hairs being tipped with black. There is much more white on the face than in the Virginian deer. In a variety from California the colour of the pelage is more decidedly red, and there is a black line running along the middle of the upper surface of the tail.

Habits.

Mr. Grinnell states that the mule-deer "is found throughout the greater part of the Missouri River district, and thence westward on the plains, in the Rocky Mountains, and in the Sierra Nevada. It is an inhabitant of rough, broken country, and on the plains is usually only to be found about high buttes, in the bad-lands, or where the country is diversified with rocky ridges, dotted here and there with scattered pines or junipers. Its favourite resorts are the *coulées*, gulches, and cañons which so often break up the high table-lands of the central plateau of the continent; but it is as often to be found among the green valleys high up on the mountain-sides, or, in summer, among the low trees that grow just below the snow-line. It is to such localities as the last-named that the bucks resort during the summer when they are growing their antlers, and when their thin coat of hair affords them little or no protection against the flies."

It appears that the habitat of this deer has not been very much restricted by advancing civilisation, as it is much less alarmed by the invasion of its haunts than is the wapiti. Instead of running in the even manner of the Virginian deer, mule-deer progress by a series of bounds, all their feet leaving the ground simultaneously. For a short distance their paces are rapid, but they soon slacken. As in the case of the Virginian deer, the number of fawns produced at a birth is nearly always two. These are born at the end of May or beginning of June, and retain their spots till September. The pairing-season is in September and October.

By the hunters in Colorado this deer is commonly spoken of as the black-tail, although that name properly belongs to *C. columbianus*.

Black-Tailed Deer.

The Columbian black-tailed deer (*C. columbianus*) is a species with a very restricted distribution, being apparently confined to the mountain-ranges bordering the Pacific in the neighbourhood of the Columbia River, and unknown to the eastwards of the Sierra Nevada. This deer is rather smaller than the mule-deer, with relatively smaller ears, but nearly similar antlers. The comparatively short cylindrical tail is black throughout, except for a short strip of about one-fourth the circumference running along the under surface. The general

colour of the pelage in winter is tawny grey, with white on the under-parts and throat, and the face is grey, with a darker forehead, the legs being dark cinnamon colour. In summer the colour changes to bay.

Habits.

In habits and gait this deer closely resembles the mule-deer, but it is said to occasionally produce as many as three fawns at a birth. Mr. Grinnell states that the black-tail is chiefly found in the deepest recesses of the coniferous forests of the Pacific ranges, and seldom wanders far away from the protection of the woods. Where they have been but little molested, these deer frequently come down to the shore to feed upon a particular kind of seaweed, and during such visits many are killed by the Indians, who paddle stealthily along the shore in their canoes.

THE PUDU DEER.*Genus Pudua.*

The tiny little deer from the Chilian Andes, known as the pudu (*Pudua humilis*), although allied to the brockets, is so distinct from all others as to necessitate its reference to a separate genus. This deer, which is scarcely larger than a hare, has a rounded head, with rather large ears, between which in the males are a pair of minute spike-like antlers, placed comparatively near together. The fur is of a reddish brown colour, becoming paler on the under-parts. There are no tusks in the upper jaw, and the skull differs from those of all the other American deer except the guemals in that the premaxillary bones, which form the extremity of the muzzle, extend upwards to join the nasal bones covering the cavity of the nose. The ankle-joint exhibits certain peculiarities of structure unknown in any other species.



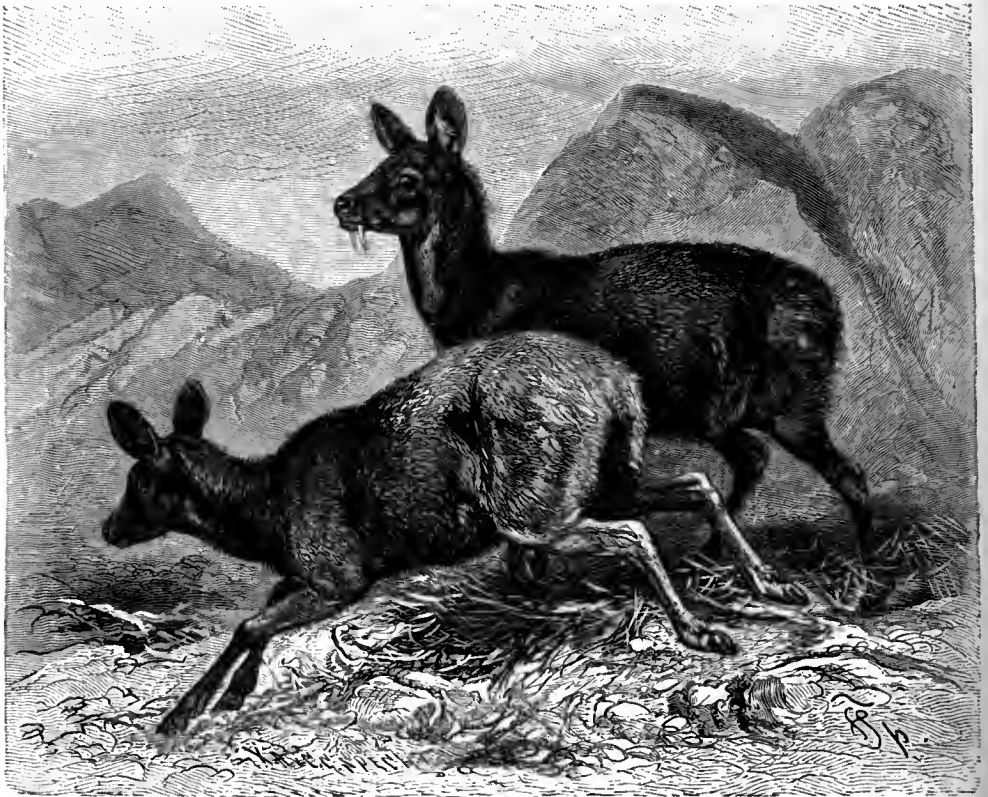
HEAD OF THE PUDU DEER. (From Selater, *Proc. Zool. Soc.*, 1866.)

THE MUSK-DEER.*Genus Moschus.*

The musk-deer (*Moschus moschiferus*) of the Himalaya differs so remarkably in several important points from all other deer that it must certainly be regarded as forming a subfamily by itself, while some authorities consider it entitled to rank as the representative of a distinct family. These peculiarities are chiefly internal. Among the most important is the presence of a gall-bladder to the liver, as in the Ox family, while the brain is much less convoluted than in other deer. The absence of antlers in both sexes cannot, however, be taken as a character of more than generic importance, since the same feature occurs in the Chinese water-deer.

The musk-deer is a somewhat clumsily built animal, standing about 20 inches

in height at the shoulder, and clothed with peculiarly coarse, brittle, and rather long hair, somewhat resembling pith in structure. In addition to the absence of antlers, the skull is characterised by the presence of tusks, which in the males may be as much as 3 inches in length, and project considerably below the mouth. All the limbs are of considerable length, and the hinder pair are longer than the front ones; the hoofs are narrow and pointed, and the lateral pair unusually large. The ears are very large and the tail is short, terminating in the male in a tuft, but



MALE AND FEMALE MUSK DEER ($\frac{1}{2}$ nat. size).

hairy throughout in the female. The male has a peculiar sac-like gland in the skin of the abdomen, which yields the musk of commerce. The general colour of the fur is a rich dark brown, more or less speckled and mottled with grey and tawny; the individual hairs having black tips, beneath which is a ring of white, while for three-quarters of their length they are white at the base. The chin, the inner borders of the ears and the inside of the thighs, and not unfrequently a spot on each side of the throat, are whitish, while the under-parts and the inner surfaces of the limbs are paler than the body. Some individuals are, however, considerably paler than ordinary, while in others there is a more or less marked yellowish tint; and others, again, are blacker. The young are spotted.

Distribution. The musk-deer is found throughout the Himalaya as far west as Gilgit, and thence extends through Central Asia into Siberia. In

Kansu, on the north-west of China, it is replaced by a nearly allied species (*M. sifanicus*). In the Himalaya it is seldom found below elevations of eight thousand feet in summer, and in Sikhim it occurs above twelve thousand feet.

Habits. Musk-deer are found either in pairs or alone, and in the Kashmir Himalaya are generally met with in the birch-forests above the zone of pines. Sometimes, however, they may be seen at lower levels among thick cover. In habits they have been compared by General Kinloch to hares, and, like these animals, they make a "form," in which they lie concealed during the day, their feeding-time being in the morning and evening. Musk-deer seem capable of enduring almost any degree of cold, against which the peculiar nature of their thick fur is doubtless a sufficient protection. In early spring they may be seen among the steep birch-forests around Kashmir, when the ground is deeply buried in snow, making their way from tree to tree in search of the young twigs and buds upon which they then chiefly subsist. On such ground they are very active and sure-footed, their large lateral hoofs being apparently adapted to aid them in obtaining a foothold on hard snow-slopes and smooth slippery rocks.

General Kinloch states that musk-deer utter a kind of hiss when alarmed, and it is ascertained that when captured they give vent to a series of screams; with these exceptions they appear to be silent, even in the pairing-season. From observations on some musk-deer kept in captivity in Nipal, it appears that the sexes come together in January, and that the fawns are born in June. Usually there is but a single young one at a birth, but occasionally two are produced.

Musk. The musk, which, as already mentioned, is found in the male alone, when fresh is soft and moist, of a brownish colour, and with a rather unpleasant smell. It soon, however, hardens and dries, and at the same time acquires the all-powerful scent of musk. When removed from the dead animal, the secretion is tied up in a portion of the hairy skin covering the gland, and is then known as a "musk-pod." Each pod will contain on an average about an ounce of musk, and in India will fetch some sixteen rupees in the market.

Hunting. English sportsmen hunt musk-deer either by walking through the forests they frequent, and carefully examining every ravine and hollow, or by having the jungles driven by natives. On the other hand, the natives themselves capture these little deer in a wholesale manner, which is described as follows by General Macintyre. "A low fence is made of boughs, etc., along the ridge of a hill, sometimes a mile or more in length. At intervals of 100 or 150 yards are gaps. The musk-deer, crossing the ridge from one valley to another, come across this fence, and, to save themselves the trouble of jumping over it, walk alongside until, seeing a little gap, they try to go through it. But in each gap a noose of strong string is placed on the ground and tied to a stout sapling bent downwards. The noose is so arranged that, when the deer tread inside it, the sapling is loosed and flies back, leaving the noose tied tightly round the animal's leg. The people visit these fences every two or three days, and secure the deer thus caught, and repair the fences and nooses, which are often carried away or destroyed by larger game." In spite of the constant persecution to which they are subject, musk-deer are still fairly common in many parts of the Himalaya, where they are known by the name of *kastura*.

CHAPTER XXIV.

UNGULATES,—*continued.*

CHEVROTAINS AND CAMELS.

Families *TRAGULIDÆ* AND *CAMELIDÆ*.

WITH the Deer family we took leave of the last of the two Ruminants—the Pecora of the scientific zoologist—and we now come to two smaller groups of Ungulates, which, although Ruminants in the general sense of that term, yet differ so widely from the Pecora, and also from one another, that they are each regarded as constituting sections of equal value with the latter. These two groups are, firstly, the small deer-like animals commonly known as chevrotains, and, secondly, the camels; the latter term including not only the true camels of the Old World, but likewise the South American llamas.

Both these groups agree with the true Ruminants in having crescent-like (selenodont) molar teeth; but whereas the chevrotains are probably descended from the same ancestral stock as that which gave rise to the deer, it appears that the camels have originated from a totally different stock, and have thus acquired their crescent-like teeth quite independently of the true Ruminants. In addition to forming two distinct families, these two groups have also received names of a superior grade, thus bringing them on to a platform equivalent to that occupied by the Pecora. For the chevrotains the term *Tragulina* is adopted, while that of *Tylopoda* is taken for the camels.

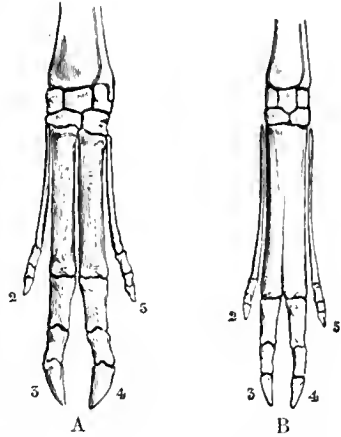
THE CHEVROTAINS.

Family *Tragulidæ*.

The elegant little creatures known as chevrotains, or mouse-deer, are so like small antlerless deer in general outward appearance, that they are commonly regarded as nearly allied to the musk-deer, near which they were indeed long placed by zoologists. In zoology, as in many other things, outward appearance is, however, very often deceptive; and when the chevrotains are examined anatomically they are found to depart very widely from the deer family.

Chevrotains agree with the true Ruminants in the absence of any incisor teeth in the upper jaw; and they resemble the musk-deer in the presence of upper tusks, or canine teeth, which in the males attain a considerable length, and project below the mouth. They likewise agree with the true Ruminants in that the canine teeth of the lower jaw resemble the incisors, to the outermost pair of which they are

approximated so as to form a continuous series. When we have added that the three molar teeth and the last premolar tooth in the upper jaw, together with the lower molars, are of a crescent-like type, the resemblances to the true Ruminants cease. In the first place, the three premolar teeth, with the exception of the last in the upper jaw, instead of being crescent-like, have their crowns elongated and narrow, with sharp cutting edges. Then the second, or axis, vertebra of the neck has a simple conical peg (odontoid process) projecting in front, by which it articulates with the first, or atlas, vertebra; whereas in all the true Ruminants the same process is spout-like. On examining the limbs in the skeleton of a chevrotain, it will be found that the fibula, or smaller bone of the lower leg, is complete, instead of being represented only by its lower end. Moreover, each foot has four complete digits, that is to say, the metacarpal and metatarsal bones, respectively supporting the toes of the fore and hind-feet, are complete, and extend alongside of the cannon-bone from the basal joints of the toes to the wrist and ankle joints; whereas, as we have seen, in the true Ruminants these bones are represented either by their upper or lower extremities alone, or are wanting. Then, again, in one of the chevrotains the cannon-bone of the fore-limb is divided into its two component metacarpal elements; while in the other it is wider and less completely soldered than in the true Ruminants. These differences will be apparent by comparing the figures herewith given, with the one on p. 213. Finally, instead of the four distinct compartments characteristic of the true Ruminants, the stomach of the chevrotains has but three such chambers.



LEFT FORE-FOOT OF THE WATER-CHEVROTAIN (A) AND INDIAN CHEVROTAIN (B).

2 and 5 indicate the lateral digits and 3 and 4 the middle pair. (From Dawkins.)

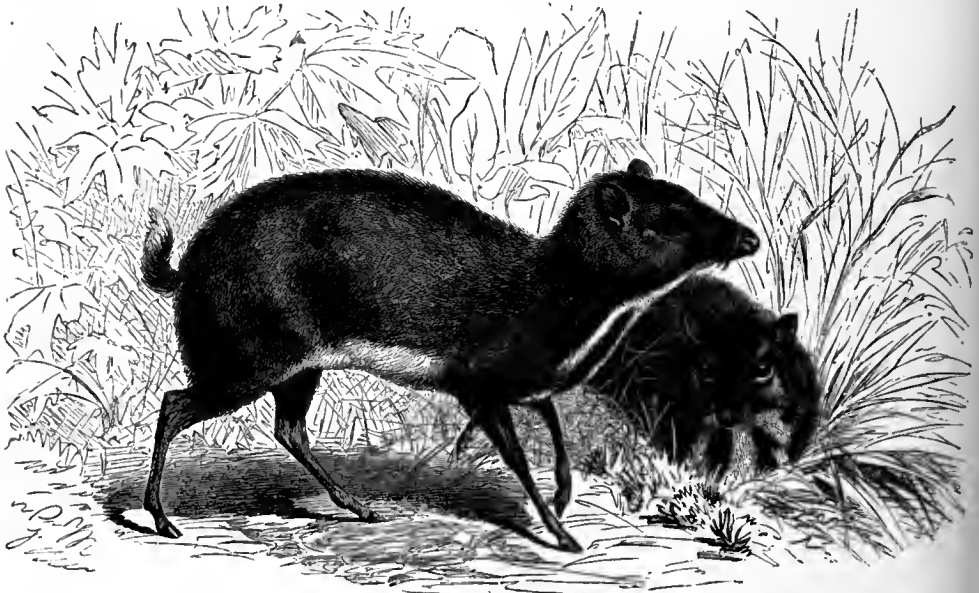
THE TRUE CHEVROTAINS.

Genus *Tragulus*.

The chevrotains are divided into two genera, the first of which is Asiatic and the second African. The true or Asiatic chevrotains are represented by five species, of which the range extends from India and Ceylon through the Malayan Archipelago to the Philippines. They are characterised by the two median metacarpal bones of the fore-limb being fused into a cannon-bone (B of the figure), and also the small size of the lateral toes. With one exception, they are the smallest of living Ungulates, and much resemble the American Rodents known as agutis in general appearance and habits.

Of the five living species of the genus, one is confined to India and Ceylon, while the others are found in the regions to the eastward of the Bay of Bengal. The Indian chevrotain (*Tragulus meminna*) differs from all the others in having the body spotted with white, and the whole of the chin and throat uniformly

covered with hair. It is of medium height, standing from 10 to 12 inches at the withers, and weighing from 5 to 6 lbs. In colour, the upper-parts are brown of variable shade, minutely speckled with yellow; while the flanks are spotted with white or buff on a brown ground; the spots being more or less elongated, and often passing into short longitudinal stripes. This chevrotain is found in Southern India and Ceylon at elevations below two thousand feet, extending northwards as far as Orissa on the east coast, and to the Western Ghats near Bombay on the west. The other four species have the upper-parts of the body uniformly coloured, and the skin between the two branches of the lower jaw completely naked and glandular. Of these the largest species is the larger Malayan chevrotain (*T. napu*), standing 13 inches in height at the shoulder, and characterised by its dark smoky-



THE SMALLER MALAYAN CHEVROTAIN ($\frac{1}{2}$ nat. size).

grey colour, with the under-parts greyish-white without any rufous or fulvous edging. This species occurs in South Tenasserim, the Malay Peninsula, and the islands of Sumatra and Borneo.

The two other Malayan species are rufous either over the whole of the upper-parts or on the flanks and the edges of the white area of the under-parts. Stanley's chevrotain (*T. stanleyanus*), from some of the Malayan Islands, is intermediate in size between the preceding and following species, and has all the upper-parts bright rufous. On the other hand, the smaller Malayan chevrotain (*T. javanicus*), which is the one represented in our illustration, is the most diminutive member of the group, and is greyish above, with the sides brightening to rufous, and a dark line, which may be nearly black, running along the nape of the neck. The under-parts are whitish, more or less mixed with rufous, but there is generally (as in our illustration) a broad reddish or brown stripe running up the front of the chest. With the exception of the royal antelope (p. 307), this chevrotain is the

smallest of all living Ungulates; it has a very wide geographical distribution, being found in Cambodia, Cochin-China, South Tenasserim, the Malay Peninsula, Sumatra, Java, and Borneo. The last species is the Philippine chevrotain (*T. nigricans*), confined to the islands from which it takes its name. Remains of a fossil chevrotain have been discovered in the Pliocene rocks of the Siwalik Hills at the foot of the Himalaya.

Habits.

All the chevrotains appear to be very similar in their habits. They have a peculiar way of walking in a mincing manner on the extreme tips of their hoofs, which communicates a stiff and rigid appearance to the legs, and has thus given rise to the popular notion that these animals have no joints. Chevrotains lie concealed in grass or jungle, and only venture out to feed in the evenings and mornings. They are timid and shy, but in confinement soon become tame and gentle, and have been known to breed. Writing of the Indian species, Colonel Tickell observes that it "is found throughout the jungly districts of Central India (*i.e.*, Chutia Nagpur), but from its retired habits is not often seen. It never ventures into open country, but keeps among rocks, in the crevices of which it passes the heat of the day, and into which it retires on the approach of an enemy. In these the female brings forth her young (two in number), generally at the close of the rains or the commencement of the cold season. The male keeps with the female during the rutting season (about June or July), but at other times they live solitary." The smaller Malayan chevrotain, which is very common in the Peninsula, inhabits dense thickets, and produces either one or two fawns at a birth.

THE WATER-CHEVROTAIN.

Genus *Dorcatherium*.

The water-chevrotain (*Dorcatherium aquaticum*) of the West Coast of Africa, is the only surviving representative of a genus which appears to have been widely spread in the Old World during the Pliocene and Miocene epochs of the Tertiary period. Indeed, the genus was originally founded upon the evidence of one of these extinct species, the living form having been subsequently described under the name of *Hyomoschus*, and it is only recently that zoologists have generally recognised the generic identity of the recent and fossil species.

The water-chevrotain is mainly distinguished from the true chevrotains of Asia by the feet being shorter and stouter, with relatively larger lateral toes, and, above all, by the circumstance that the two middle metacarpal bones remain completely separate, as shown in the figure on p. 399. The living species is slightly superior in size to the largest of the Asiatic chevrotains, and resembles the Indian representative of the latter in having the body spotted and striped with white. The general colour of the fur is a rich brown, with a large amount of white on the throat and chest, as well as on the under surface of the tail; the upper part of the body is spotted, while the flanks are marked with longitudinal white stripes, which are larger and more continuous than those of the Indian chevrotain.

As is the case with so many West African animals, we have but scanty information as to the habits of the water-chevrotain in its native state. It is, however,

generally found near the banks of river and lakes, and its mode of life is said to be much like that of pigs.

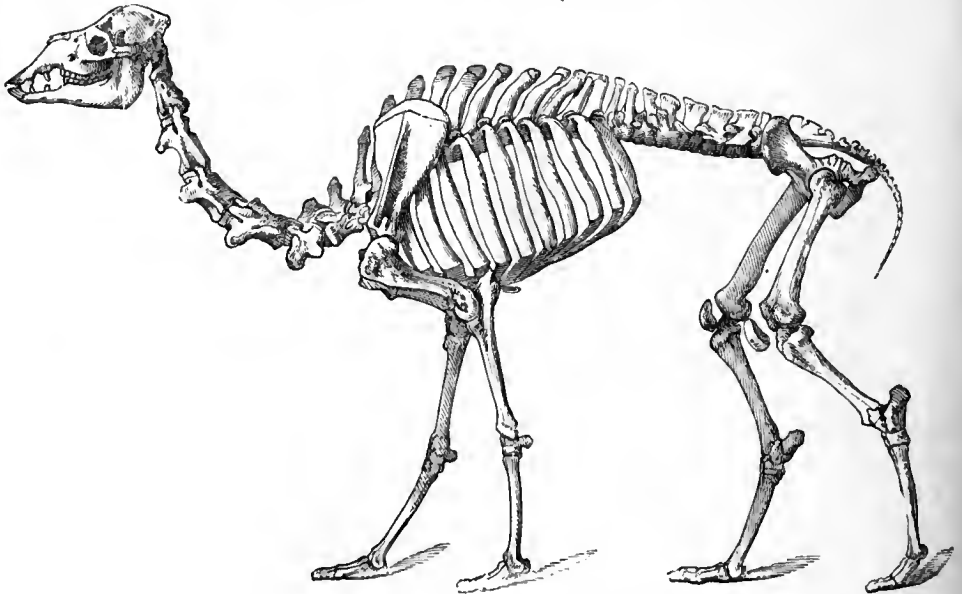
The water-chevrotain has but three premolar teeth in the lower jaw, but in the somewhat larger species found in the Pliocene and Miocene strata of Europe there were four of these teeth. The species occurring in the Pliocene of the Punjab was of still larger dimensions; and affords one more instance of the intimate connection existing between the Tertiary Mammalian fauna of India and that of Africa at the present day.

Extinct Forms. In its separate metacarpal bones, the water-chevrotain makes a decided approach towards the pigs; and in the Tertiary deposits of Europe and North America there occur numerous small Ungulates, which appear to have connected the chevrotains with the deer. Such is *Gelocus*, from the lower Miocene of France, in which the middle metacarpal bones were separate, while the metatarsals were fused into a cannon-bone, which has been regarded as the common ancestor of the two families. *Prodremotherium* of the upper Eocene of France, has cannon-bones in both limbs; while in the American *Hypertragulus* both the metacarpals and metatarsals were separate.

THE CAMELS AND LLAMAS.

Family *Camelidæ*.

The camels of the Old World, and the llamas of the New, form, as already stated, a group of ruminating Ungulates distinguished widely both from the true



SKELETON OF THE ARABIAN CAMEL.

Ruminants and the chevrotains, and which probably have had a totally distinct origin from more primitive even-toed Ungulates.

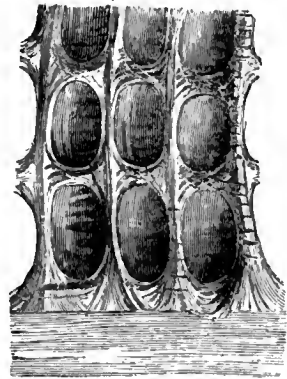
An important point of distinction is that the front of the upper jaw is furnished with incisor teeth; it is true, indeed, that in the adult state there is only a single pair of these teeth remaining, but in young animals there are, as in pigs, three pairs. Then, again, both jaws are furnished with tusks or canine teeth; those of the lower jaw being sharply pointed, and separated by an interval from the incisors, instead of resembling the latter and forming with them a continuous series, as we have seen to be the case in the chevrotains and the true Ruminants. The molar teeth have tall and crescent-shaped crowns, which, however, are not precisely similar to those of the group last-named; and one, or sometimes more, of the premolar teeth generally has a simple pointed crown, like that of a canine, and is not in contact with the other teeth of the check-series. These isolated premolar teeth are seen in the figure of the skeleton of the camel, in the gap between the tusks and the other check-teeth.

The limbs are long, and the thigh is placed nearly vertically, so that the true knee is more detached from the small hind-quarters of the body than is usually the case in Ungulate mammals. The lower portion of the legs is composed of a cannon-bone supporting two toes, without any trace of the lateral toes or their metacarpal bones. The cannon-bone differs, however, from that of the true Ruminants, in that the two pulley-like surfaces at the lower end, instead of being placed side by side and furnished with a distinct ridge in the middle of each, are divergent and perfectly smooth. The bones of the first joint of the toes are also longer and more expanded at their lower ends than in the true Ruminants; the second pair being broad and flattened, while the third form mere nodules, quite unlike the symmetrical ones of the latter group. The feet form broad expanded cushion-like pads (from which the group derives its title of Tylopoda), of which the under surface is undivided, while the front shows a division into two toes, each of which bears a broad nail on the upper surface. The ankle-joint differs from that of the true Ruminants in that the two bones lying immediately below the astragalus, remain distinct, whereas in the former they unite into a compound bone, termed the naviculo-cuboid. A further distinction is to be found in the divided upper lip, like that of a hare; while the elongated neck is characterised by the great length of its component vertebræ. These vertebræ exhibit certain peculiarities of structure into the consideration of which we need not enter here; but it must be observed that they resemble those of the true Ruminants

in that the process in front of the second vertebra, by which it articulates with the first, is spout-shaped. Here, then, we have another instance of a similar structure being independently acquired in two distinct groups. The head is carried high in the air, with the upper part of the neck nearly vertical; and is unprovided



BONES OF THE LEFT FORE-FOOT OF THE CAMEL. (From Dawkins.)



WATER-CELLS IN STOMACH OF CAMEL.

with either horns or antlers. The stomach has but three compartments; the first two of these being provided with a number of cells or pouches which can be closed by the action of muscles, and these contain only fluid. The bones of all the members of the family are remarkable for their extremely solid and ivory-like structure.

The camel family, in proportion to its extent, is more valuable to mankind than any other group of even-toed Ungulates, only one species being unknown in the domesticated condition, while two are now found exclusively in that state. The Old and New World representatives constitute two distinct genera, the former of which we take first.

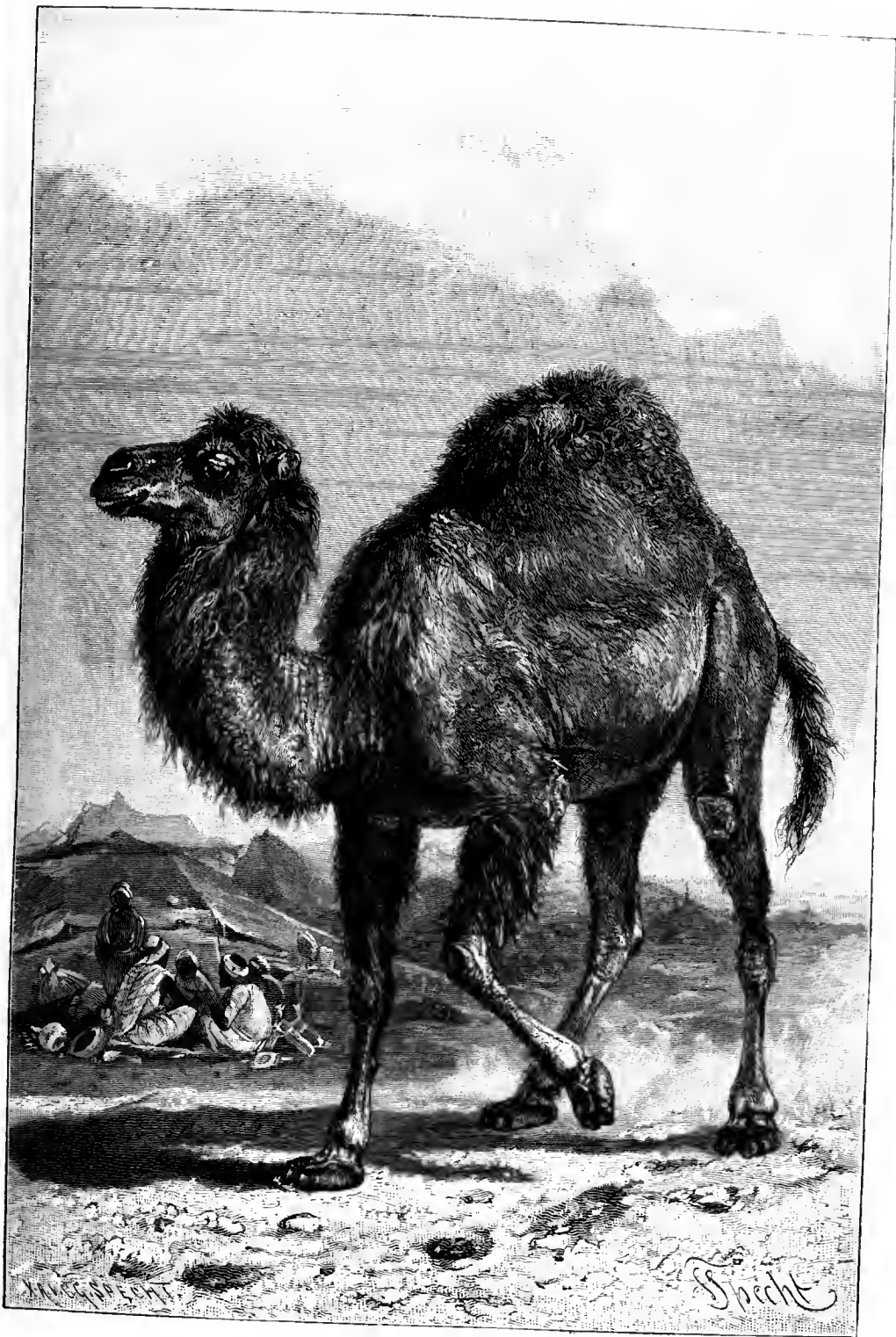
THE CAMELS.

Genus *Camelus*.

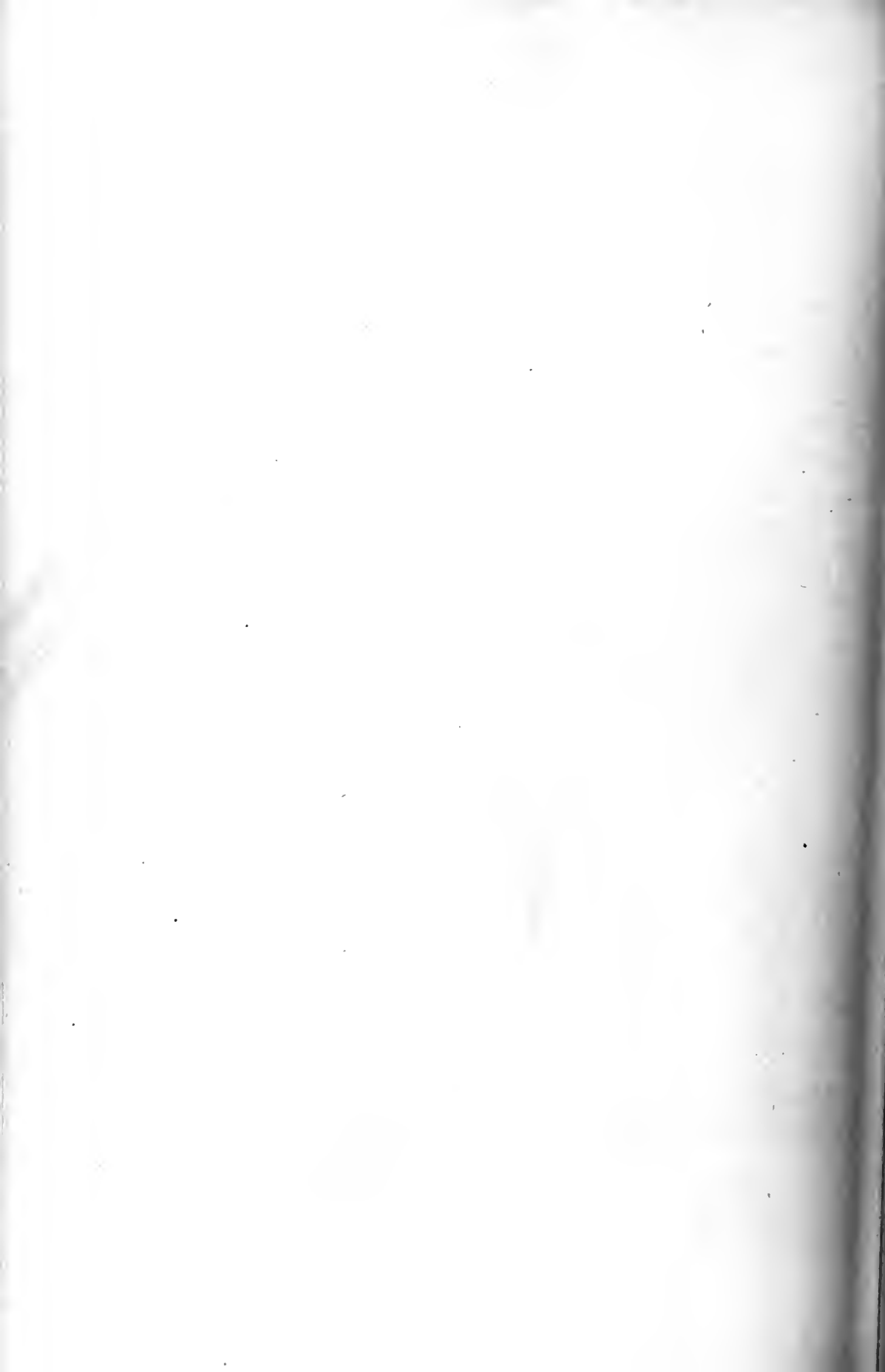
The camels of the Old World, of which there are two distinct species, are characterised by their great bodily size and bulk, and the presence of one or two large fatty humps on the back, as well as by having six upper and five lower cheek-teeth on each side of the jaws, the total number of teeth being thirty-four. Their ears are comparatively short and rounded; and the hair is very irregularly disposed, being in some places very long and shaggy, and in others short and close, although never partaking of the nature of true wool. The feet are broad, with the toes very imperfectly separated; and the tail is comparatively long, reaching nearly to the hocks, and furnished near the end with long hair forming a terminal tuft. Callous pads, on which the animal rests when lying down, and which are present at birth, are found on the chest, the elbows, the wrists (commonly called the knees), and the knees. Needless to say, the whole form of these animals is far from beautiful, while the head is ugly in the extreme; and this want of bodily beauty is accompanied by a viciousness of temper and general stupidity of disposition which can scarcely be paralleled elsewhere among domesticated animals.

The two species of camel are both now unknown in the wild condition, although in some localities there are half-wild herds of which the parents have escaped from captivity. There is also a half-breed between the two species, which is said by the tribes among which it is bred to display better qualities than either of the parent stocks.

The first of these two species is the true or Arabian camel **Arabian Camel.** (*Camelus dromedarius*), which is found both in Africa and Asia, and is characterised by its single hump. It is a long-limbed animal, with a comparatively short coat of hair, and soft feet, adapted for walking on yielding sandy soil, and standing from about 6 feet 8 inches to 7 feet in height. The head is comparatively short, with a long and sloping muzzle, and convex forehead; the eyes are large, with a soft expression; and the small rounded ears are placed far back on the sides of the head. The upper lip overhangs the lower; and the large slit-like nostrils can be closed at will. The long neck is laterally compressed, and thickest in the middle; and the body is massive and rounded. The contour of the back rises from the setting on of the neck to the loins, and then falls rapidly away



ARABIAN CAMEL.



to the tail. The hump, when the animal is in good condition, stands upright, but it alters considerably in shape according to age. The richer the food of the camel, the larger is its hump; while, when the food is poor and dry, the hump decreases in size; and accordingly in the rainy season this appendage attains its maximum development, while in the dry months it proportionately shrinks. In high-conditioned animals, the hump should form a regular pyramid, and occupy at least a quarter of the whole length, but when the animals are half-starved it almost disappears. The hair is soft, and on the hinder part of the head, the neck and throat, the shoulders, the hump, and the upper part of the fore-legs, is longer than elsewhere. The colour of the hair is very variable, although a light sandy is the most common hue; there are, however, white, grey, brown, and even totally black camels; but those of the last-named colour are held by the Arabs to be worthless.

Various Breeds. There are numerous breeds of camels differing more or less from another, and the Arabs recognise no less than twenty distinct strains. Roughly speaking, they may, however, be divided into two classes, namely, baggage-camels and riding-camels, or dromedaries; and Sir Samuel Baker observes that there "is the same difference between a good *hygin*, or dromedary, and a baggage-camel, as between the thoroughbred and the cart-horse; and it appears absurd in the eyes of the Arabs that a man of any position should ride a baggage-camel. Apart from all ideas of etiquette, the motion of the latter animal is quite sufficient warning. Of all species of fatigue, the back-breaking monotonous swing of a heavy camel is the worst." The peculiarly unpleasant motion of even the best camels is due to the circumstance that the two legs of one side are moved simultaneously. The ordinary pace of a baggage-camel is from two and a half to three miles an hour when fully loaded, but a good dromedary will keep up a pace of from eight to ten miles an hour for a long period.

Habitat. Arabian camels are now found in the domesticated condition in all parts of Africa, lying between the Mediterranean and the 12th parallel of north latitude, while in Somaliland they extend as far south as the 5th parallel. They are also widely distributed in South-Eastern Asia, ranging from the lowlands of Afghanistan and Bokhara, where they impinge on the habitat of the two-humped Bactrian camel, through North-Western India, Persia, Asia Minor, Syria, and Arabia. In Asia Minor and Khorasan, there is a race of half-breeds between the Arabian and the Bactrian camel; this breed being known in the last-named country as the Boghdi camel. According to Elphinstone, it has the two humps of the Bactrian species, but the long limbs of the Arabian; and it appears to be generally a product of crossing a male of the former with a female of the latter. Arabian camels have also been introduced into the Canaries, Australia, North America, Italy, the south of Spain, and Zanzibar.

There has been much discussion as to what country was the original home of the Arabian camel; but it has been considered that Arabia has the best title to this honour. This conclusion appears to rest partly on the statements of Diodorus Siculus and Strabo that wild camels existed in Arabia at the commencement of the Christian era, and partly on the circumstance that no representations of camels occur in the ancient Egyptian frescoes. Whatever may be the value of the statements referred to, there can be no question but that the absence of pictures of

these animals from the frescoes of Egypt does not support the conclusion that they were introduced at a comparatively late date into that country. For there is evidence furnished by a papyrus of the 14th century B.C. that camels were at that early period well known in Egypt. Possibly there were some superstitious or other reasons which led to the exclusion of their portraits from the frescoes.

A certain amount of light is thrown on the question by the occurrence of fossilised remains of extinct camels in the Pliocene rocks of the Siwalik Hills, at the foot of the Himalaya, and also in beds belonging to the succeeding Pleistocene period in Algeria. And knowing, as we do, that so many of the African genera of Mammals have taken origin in India, from whence they have migrated to their present home, it would seem highly likely that the same may have been the case with the camels. The Arabian camel, or its immediate parent, may, therefore, have sprung from an Indian ancestor, and thence made its way through Arabia and Syria into Northern Africa.

The Arabian camel is essentially an animal fitted to exist only in dry or desert districts, and consequently all attempts to introduce it into the moist and wooded regions of Southern India and Equatorial Africa have signally failed. Where, however, the climate is at all favourable, its introduction into new regions has generally been attended with success. Camels are reported to have been introduced into Italy in the year 1622, and again in 1738. On a flat plain near Pisa the number in 1810 was forty, and in 1840 forty-one, while later it had increased to upwards of two hundred. Their attempted introduction into Sicily, as beasts of burden in the sulphur mines, was, on account of the climate, a failure; but in Spain they appear to have thriven.

In the year 1856 a drove of seventy-five camels was procured from Smyrna by the United States Government, and distributed over Texas, Arizona, and New Mexico. During the war of secession, the whole of these animals fell into the hands of the Confederates, and were used for carrying the mails, some of them making journeys of upwards of 120 miles in a day. At the conclusion of the war the remnant of these once more came under the Government of the United States, and others were purchased in 1866. These were distributed through Arizona and Texas for breeding purposes; but many died, and the experiment proved unsatisfactory. Consequently, those that survived were turned adrift to shift for themselves; and it appears that some still remain in the wilder districts of California and Arizona, and wander over a considerable area in the course of the year. In Australia, the introduction of camels has been a greater success, and they have proved invaluable in the expeditions which have been undertaken to explore the deserts of the interior.

Habits. The food of the camel in its natural state probably consisted entirely of branches and leaves of trees, and although grain is now largely given, a certain amount of green-food is absolutely essential to the animal's health. No matter how thorny the boughs may be, they are quite acceptable to the camel; and it is perfectly marvellous how the animals manage to eat such food without injury to their mouths. On such a diet, or even on dates, camels will do well; but when compelled to work for days with little or no food, they soon break down, as was disastrously shown in the expedition to Khartum.

For a few days, owing to the peculiar conformation of their stomachs, camels can exist comfortably without water, but their endurance in this respect is often taxed sadly beyond its natural capability.

Although the camel is undoubtedly the most valuable and useful of all animals in dry and desert countries, its disposition and temper are decidedly of the very worst description. In addition to its ordinary surliness and want of attachment to its master, the male camel during the pairing-season is subject to almost uncontrollable outbreaks of rage; and, at the same time, owing to a swelling of the uvula, makes a loud bubbling noise which is most unpleasant to the human occupants of the camp. An instance of the savage disposition of camels is afforded by the habit they have, when passing a mounted man on a narrow path, of turning their heads suddenly round and endeavouring to inflict a bite on the rider's arm or shoulder; a camel's bite being, by the way, exceptionally severe. Writing of the character of the camel, Dr. Robinson observes, that these animals "are commonly represented as patient, but if so, it is the patience of stupidity. They are rather exceedingly impatient, and utter loud cries of indignation when receiving their loads, and not seldom on being made to kneel down. They are also obstinate, and frequently vicious; and the attempt to urge them forwards is often very like trying to drive sheep the way they do not wish to go."

So again, Palgrave writes that the camel "takes no heed of his rider, pays no attention whether he be on his back or not, walks straight on when once set agoing, merely because he is too stupid to turn aside, and then should some tempting thorn or green branch allure him out of the path, continues to walk on in the new direction, simply because he is too dull to turn back into the right road. In a word, he is from first to last an undomesticated and savage animal, rendered serviceable by stupidity alone, without much skill on his master's part, or any co-operation of his own save that of an extreme passiveness."

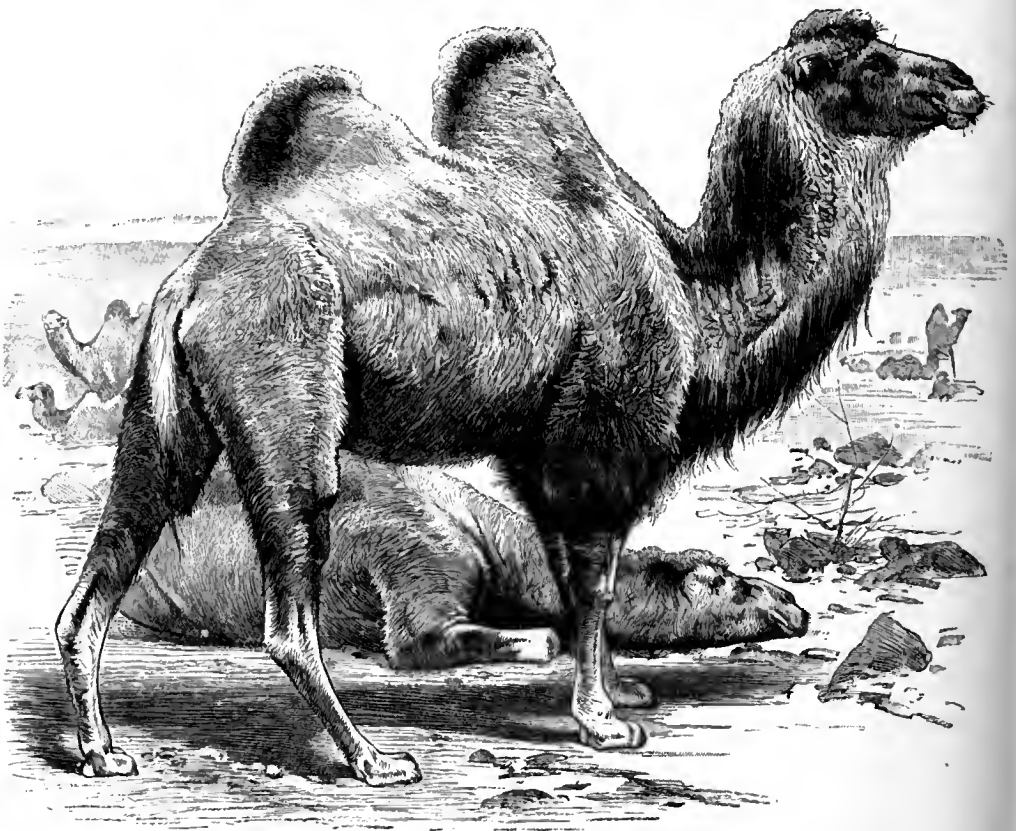
Uses. In addition to its value as a beast of burden, the camel is also esteemed by the natives of many countries on account of its milk and flesh, while its hair is woven into ropes and cloth, and in some parts of India its bones are used in lieu of ivory for inlaying and turning. The milk is extremely thick and rich, but is unsuitable for use with tea or coffee, as it then immediately curdles. From remote antiquity camels have been kept in enormous herds by Eastern nations. In modern times the Arabs of the Sudan possess immense herds, which in the rainy season are driven northwards in thousands; and in some parts of North-Western India the number of camels kept by the natives must be very large. When the young camels are too feeble to undergo the fatigues of a day's march, they are slung in nets on the backs or by the sides of some adult members of the drove. But a single calf is produced at a birth, after a gestation of rather more than eleven months; and the calf is suckled by the dam for at least a twelvemonth.

In the Sudan the price of a riding-camel varies from about £10 to £15, while a good baggage-camel can be purchased for about £4, 10s. Young or weak camels may be bought for as little as 30s.

Aversion to Water. Camels have a great aversion to crossing even the smallest stream, and swim either imperfectly, or not at all, without assistance;

this aversion doubtless indicating that the original home of the animal was in desert lands. On this subject Sir Samuel Baker observes, that "a camel either cannot or will not swim, unless it is supported by inflated skins; thus the passage of the broad river, Atbara (about 300 yards wide), is an affair of great difficulty. Two water-skins are inflated, and attached to the camel by a band passed like a girth beneath the belly. Thus arranged, a man sits upon its back, while one or two swim by the side as guides. The current of the Atbara runs at a rapid rate; and the camel is generally carried at least half a mile down the river before it can gain the opposite bank."

The Bactrian camel (*C. bactrianus*), of Central Asia, is distinguished from the Arabian species, not only by its double hump,



THE BACTRIAN CAMEL ($\frac{1}{2}$ nat. size).

but likewise by its inferior height, stouter and more clumsy build, shorter legs, and harder and shorter feet, as well as by the greater length and abundance of the hair. This animal is, indeed, in all respects, better adapted for a rocky and hilly country than its southern congener; its shorter and stouter limbs rendering it far less liable to accidents in traversing precipitous ascents. The largest development of hair occurs upon the top of the head, the neck and shoulders, the upper part of the fore-limbs, and the humps.

Distribution. The Bactrian camel is found in nearly all the desert-regions of Central Asia lying between Afghanistan and Turkestan, and China and Southern Siberia. In the regions lying to the eastward of Yarkand, there occur droves of these camels now living in a wild condition, which there is every reason to believe are descended from domesticated individuals escaped from captivity. According to Prejevalski, these wild camels differ from the ordinary domestic race by the smaller size of their humps, the more distinct pads on their wrists (front knees), and certain peculiarities in the conformation of the skull. Major C. S. Cumberland states that "the habitat of the wild camel is the Gobi steppe, from Khotan to Lob Nor. Except when snow lies on the ground, these animals may be met with here and there along the old bed of the Yarkand and Tarim Rivers, which they frequent for the pools of brackish water that are to be found here and there. But as soon as the snow falls, they move off into the desert, as if then independent of the water-supply. They prefer the snow, I imagine, as being less salt than the water, although it also is impregnated to a certain extent soon after it falls. The camel is very shy in its habits, and, so far as I could ascertain, has never been caught and domesticated. The natives told me that no horse in the country could catch the camels in the deep sand of the region they frequent. . . . They vary in colour, like the domestic species, from dark brown to lightish dun. Their origin has yet to be traced. I take it that they have sprung from camels which escaped when the district known as Takla Makun was buried in a great sand-storm some two centuries ago. Tradition relates that no human beings survived, but it is likely enough that some of the camels and horses did so, and that this was the origin of the wild camels and ponies which are found in the district."

Food. The Bactrian camel feeds chiefly upon the saline and bitter plants of the steppes which are rejected by almost all other animals; and displays a curious partiality for salt, drinking freely at the brackish water and salt lakes, which are so common throughout its habitat. Instead of confining itself to a strictly vegetable diet, the Bactrian camel, according to the reports of Prejevalski, will, when pressed by hunger, readily devour almost anything that it may come across, including felt-blankets, bones and skins of animals, flesh and fish.

Habits. The pairing-season occurs during February, March, and April; and the young (of which but one is produced at a birth) are not born till thirteen months later, so that the period of gestation is considerably longer than in the Arabian camel. At birth the young are so helpless when the animals are kept in the domesticated state that they have to be attended with the greatest care; but they very soon gain strength, and in about a week are able to eat. They are weaned at an early period for the sake of the milk of the parents, which is largely used by their owners. In their third year they are ridden on short journeys, while in their fifth year they attain their full stature and vigour; and with good management they are said to be serviceable until they attain the age of some five-and-twenty years. In Mongolia and on the Kirghiz steppes the Bactrian camel is fully as important to the nomad inhabitants as is its southern cousin in Arabia.

THE LLAMAS.

Genus *Lama*.

Under the general title of llamas may be conveniently included all the existing South American representatives of the camel family, although that name properly belongs only to a domesticated variety of one of the two wild species.

A DROVE OF VICUNIAS ($\frac{1}{16}$ nat. size).

All the llamas are smaller in size and lighter in build than the camels, and owing to the absence of any hump on the back depart less widely from the ordinary type of Ungulates. Their pointed ears are relatively much longer than in the camels, while their thickly-haired tails are reduced to little more than a stump. The feet, again, are narrower and more pointed than in their Old World relatives, and have

their toes more completely separated, each toe being furnished with a distinct pad on the sole. The whole of the body is covered with a thick coat of long hair partaking of a woolly nature; and there are fewer callosities on the limbs than in the camels. As characters of minor import, it may be added that the head is proportionately longer than in the latter, and has a tapering and sharply-pointed muzzle, while the neck is relatively thinner.

The skull has one tooth on each side of the upper jaw less than in the camels, the missing tooth being the isolated sharp-pointed premolar which is found in the latter in the middle of the gap between the tusk and the main series of cheek-teeth. Consequently the total number of teeth is only thirty-two instead of thirty-four. The premolar tooth in the lower jaw, which is of very small size, not unfrequently, however, falls out in the adult, and thus reduces the number to thirty.

Distribution. Llamas at the present day are entirely confined to the western and southern regions of South America, and can live only where the climate is temperate. Thus on the western side of the continent they are restricted to the higher ranges of the Andes and Cordilleras, but in many parts, Patagonia and Tierra-del-Fuego, they flourish on the plains at the sea-level. In the neighbourhood of the Equator they are generally found at elevations of between twelve thousand and sixteen thousand feet above the sea, and they never descend lower than between six thousand and seven thousand feet. During the rainy part of the year the wild species which inhabit the mountains ascend to the limits of vegetation, but in the hot season they descend to the valleys where alone sustenance is to be found. They live in larger or smaller parties, and sometimes congregate in herds comprising many hundreds of individuals. All the species are characterised by their very objectionable habit of spitting, as many visitors to zoological gardens well know.

Species. There are two wild species of llama now existing, respectively known as the vicunia and the guanaco, and likewise two domesticated races, namely, the llama and the alpaca. For a long period much uncertainty existed as to the relationship of these domesticated races to the wild species, but the researches of Mr. O. Thomas have led to the conclusion that both the former are in all probability derived from the wild guanaco, with which they agree in the proportionately large size of their skulls, and the presence of naked patches on the hind-limbs.

Vicunia. The vicunia (*Lama vicunia*) is the smaller of the two wild species, and is of a uniform light-brown colour, becoming paler on the under-parts and limbs, and with light markings on the face and jaws. The build of the animal is very light and graceful; its head is relatively short, and it has no naked callosities on the hind-legs. In correlation with the shortness of the head, the skull is of proportionately small size. This species has a somewhat restricted range, being confined to the mountains in the district between Southern Ecuador and Central Bolivia, which includes the whole of Peru.

Habits. According to the account of Tschudi, during the wet season of the year the vicunias seek the highest ridges of the Cordillera, where plant-life is but sparse. On account of the softness of their feet, they prefer upland meadows, and avoid the stony, naked peaks, while they still more carefully

shun glaciers and snow-fields. In the hot season, on the other hand, they descend into the higher valleys. The reason of this reversal of the usual plan of migration appears to be that in the Cordillera the vegetation on the higher ridges is completely withered up by the heat of the dry summer season, and that such herbage as remains is only to be found in the valleys, where it is nourished by springs or swamps. Vicunias feed all day, and it is seldom that a flock is seen lying down. During the pairing-season the males fight with great fierceness for the supremacy of the flocks, each of which comprises one male accompanied by from six to fifteen females. The male always remains a few paces behind the flock, and gives notice of any approaching danger by uttering a shrill whistle, at the same time rapidly advancing; the flock then collects, and takes to immediate flight in a swift gallop, the male bringing up the rear, and often stopping to observe the foe.

In the month of February the females give birth to a single fawn, which as soon as it comes into the world is endowed with remarkable speed and endurance. The young males remain with their dams until full grown, when they are expelled from the flock by the united force of females. These young males unite together in separate flocks of from twenty to thirty head; and as such flocks have no special guardian, but all the members are constantly on the alert, they are exceedingly difficult to approach. During the pairing-season incessant fights take place among these male flocks, and the animals then utter a peculiar neighing sort of cry which can be heard at a great distance.

Hunting. The Indians hunt vicunias by forming a circular enclosure of stakes connected by cords, with a diameter of about half a mile, and an entrance of some couple of hundred feet in width. The cords connecting the stakes are hung with bright-coloured pieces of cloth, which flutter in the wind and prevent the animals from trying to break through. When the enclosure is ready, the hunters make a wide circuit on the mountains, and drive in all the flocks of vicunias there may be in the neighbourhood; the animals being despatched by the bolas—a weapon consisting of two large balls connected by a string, which is whirled round the hunter's head and then hurled with unerring aim at his victim. The flesh is divided among the Indians, but the skins belong to the priests. The wool, although small in quantity, is fine and of excellent quality; and in 1826 a law was made that the vicunias should be caught and shorn, instead of killed, but the wildness of the animals rendered this impracticable. In the time of the Incas vicunia-hunts, in which as many as thirty thousand men took part, were organised upon a large scale. An area of some twenty miles would be completely surrounded, and every living thing driven in; and it is said that at times as many as forty thousand head of game, including bears, pumas, foxes, deer, vicunias, and guanacos, would be thus surrounded. Such a hunt would last for a week, during which many hundred head of game would be killed, Tschudi mentioning that in a hunt which he joined, upwards of one hundred and twenty-two vicunias were slaughtered.

Guanaco. The guanaco (*L. guanacus*) is a rather larger and heavier-built animal than the vicunia, with a longer head, larger skull, and distinct naked patches on the knees of the hind-legs. A full-grown male will measure 4 feet in height at the shoulder, and from 7 to 8 feet in length. The thick and woolly hair is of a pale reddish colour, longest and palest on the under-parts. The

geographical range of this species is very wide, extending from the lofty mountains of Ecuador and Peru, where it is found in company with the vicunia, to the plains of Patagonia and the islands of Tierra-del-Fuego.

Habits. In the mountains the habits of the guanaco appear to be very similar to those of the vicunia, but it is not unfrequently seen in larger flocks, which may occasionally reach as many as one hundred or even five hundred head. The pairing-season occurs in August and September, and the young are born ten or eleven months afterwards. Darwin states that these animals are very wild and wary, and that frequently the first evidence of their presence in the neighbourhood of the hunter is their loud, neighing alarm-cry, which makes itself heard at a great distance. If the hunter looks attentively, he will then, writes Darwin, "probably see the herd standing in a line on the side of some distant hill. On approaching nearer, a few more squeals are given, and off they set at an apparently slow but really quick canter, along some narrow beaten track to a neighbouring hill. If, however, by chance he abruptly meets a single animal, or several together, they will generally stand motionless and intently gaze at him, then perhaps move on a few yards, turn round, and look again." The writer then proceeds to give instances of their extreme curiosity, and adds that they are easily domesticated, and in the wild state have no notion of defending themselves. He continues that "guanacos take readily to the water; several times at Port Valdes they were seen swimming from island to island. Byron, in his voyage, says he saw them drinking salt-water. Some of our officers likewise saw a herd apparently drinking the briny fluid from a salina near Cape Blanco. I imagine in several parts of the country if they do not drink salt-water they do not drink at all. In the middle of the day they frequently roll in the dust, in saucer-shaped hollows. The males fight together; two one day passed quite close to me, squealing and trying to bite each other; and several were shot with their hides deeply scored. Herds sometimes appear to set out on exploring parties; at Bahiã Blanca, where, within thirty miles of the coast, these animals are extremely unfrequent, I one day saw the tracks of thirty or forty, which had come in a direct line to a muddy salt-water creek. They then must have perceived that they were approaching the sea, for they had wheeled with the regularity of cavalry, and had returned in as straight a line as they had advanced."

Dying-Places. The most singular circumstance connected with the guanacos is their habit of resorting to certain particular spots when they feel their end approaching. On this point Darwin observes that "on the banks of the Santa Cruz, in certain circumscribed spaces, which were generally bushy and always near the river, the ground was actually white with bones. On one such spot I counted between ten and twenty heads. I particularly examined the bones; they did not appear, as some scattered ones which I had seen, gnawed or broken, as if dragged together by beasts of prey. The animals in most cases must have crawled before dying beneath and amongst the bushes." Although mentioning that wounded guanacos invariably make their way towards the river, Darwin did not attempt any explanation of this strange habit. A later observer, Mr. W. H. Hudson, after stating that this habit is only developed among the guanacos of Southern Patagonia, suggests, however, that it is due to an inherited instinct,

derived from a time when the animals were accustomed during a period of exceptional cold to seek refuge beneath the cover of the bushes growing in the sheltered river-valleys. "Once we accept this explanation as probable," writes Mr. Hudson, "namely, that the guanaco, in withdrawing from the herd to drop down and die in the ancient dying-ground, is in reality only seeking an historically-remembered place of refuge, and not of death—the action of the animal loses much of its mysterious character; we come on to firm ground, and find that we are no longer considering an instinct absolutely unique, with no action or instinct in any other animal leading up to or suggesting any family likeness to it."

Llama. With the true llama (*L. glama*) we come to the first of the two domesticated representatives of the genus, both of which are now considered to have originated from the wild guanaco. The llama attains larger



THE LLAMA ($\frac{1}{2}$ nat. size).

dimensions than the guanaco, and is very variable in colour, although generally white, or white spotted with brown or black, and more rarely completely brown or black. The skull is very similar to that of the guanaco, and the knees have the same naked patches. In general appearance the llama is a long-necked and long-limbed

creature, with comparatively short hair falling but little below the lower line of the body. It was bred by the ancient Peruvians mainly as a beast of burden, or for riding, and was chiefly characteristic of the southern portion of Peru, where, before the Spanish conquest, enormous numbers of these animals were kept. The introduction of horses and mules has, however, gradually led to the displacement of the llama as a beast of burden. When, however, llamas and alpacas were the only domesticated Ungulates in South America, their importance to the Peruvians was fully as great as is that of the reindeer to the modern Laplander, since between them they not only did all the carrying work of the country, but likewise supplied their masters with wool and flesh. The complete distinction between llamas and alpacas from as far back as tradition or records extend, coupled with the extreme antiquity of the Peruvian civilisation, indicates that the domestication of the wild guanaco must in all probability have taken place at a very early period. As showing the security of the country it may be mentioned that, soon after the Spanish conquest, it was not uncommon to meet droves of from three hundred to five hundred or even one thousand llamas, each laden with silver ingots, and the whole in charge of a single native. Such droves slept in the open fields without the slightest danger from loss by robbers. Only the male llamas were used as beasts of burden, while the smaller females were kept for their milk and flesh. In travelling along the roads the droves marched in single file, under the guidance of a leader; and such a line would traverse the highest passes of the Cordillera, and skirt the most stupendous precipices with perfect safety. When not in active use, the herds of llamas were kept on the higher mountain-pastures, where they would often temporarily associate with wild guanacos. The Spanish conquerors of Peru spoke of llama-flesh as being fully equal to the best mutton, and they established in the towns shops for its regular sale. At the period of the conquest it is estimated that upwards of three hundred thousand llamas were employed in the transport of the product of the mines of Potosi alone. Llamas produce only one offspring at a time, so that their rate of increase is not very rapid. Usually the young are suckled by the mother for about four months, but in one race the period is longer; and it is stated that the young of two successive seasons may not unfrequently be seen suckling at the same time.

Alpaca. The alpaca (*L. pacos*) is a considerably smaller animal than the llama, and is bred for the sake of its wool, which is of great fineness and length, reaching in some specimens almost to the ground. The usual colour of the wool is very dark brown or black. In regard to the origin of the alpaca, Mr. Thomas has come to the conclusion that the old view of the vicunia being the parent-stock is untenable, and that we must look to the guanaco as the true ancestor. He observes, for instance, that the size of the alpaca, "although less than that of the llama, is far greater than that of the vicunia. Its skull and teeth wholly agree with those of the former, and the naked patches on the legs, so distinctive of the guanaco as compared with the vicunia, are very often, although not always, present, the exceptions being easily explainable in the case of an animal bred and selected for generations solely with an eye to the thickness and extent of its furry covering. The occasional growth of the fur over the naked patches is not therefore to be wondered at. The probabilities also are much in favour of the

Peruvians having domesticated one wild species only rather than two, and of their having gradually developed two races out of it—the one large, strong, and suitable for the carriage of burdens, and the other smaller in size, but exceptional in its capacity for producing a quantity of useful wool.”

Uses. Alpacas are kept throughout the year in large herds on the high plateaus of Bolivia and Southern Peru, and are only driven down to the villages at the shearing-season. The wool is of two kinds—a longer and coarser, and a finer and shorter; the former being termed by the Peruvians



THE ALPACA ($\frac{1}{4}$ nat. size.)

hanaska, and the latter *kumbi*. The Incas dyed both kinds with bright and lasting colours, and wove them into cloth and blankets; and alpaca wool has been introduced into England, the late Sir Titus Salt having established mills for its manufacture into cloth at Bradford.

Acclimatisation. Attempts have also been made to acclimatise the alpaca in Europe and Australia. A large herd was imported by a late Earl of Derby and established at Knowsley, and it was thought that these animals might be successfully introduced into the highlands of Scotland; but if the attempt was ever made, it had no permanent results. In Australia, after great difficulties in

getting permission from the Peruvian and Bolivian Governments for the export of such a large number, three hundred head were introduced, but in five years these had dwindled down to a dozen, and the experiment does not appear to have been repeated. Probably one of the great difficulties to be contended with in the successful introduction of llamas into other countries would be to find a locality where they could be left almost to themselves, and yet where they would be safe. The climate of Britain is doubtless far too damp for them, and in this respect parts of Australia would be much more suitable.

The alpaca goes with young eleven months, and produces but one at a birth. Its flesh is as excellent as that of the llama.

EXTINCT CAMEL-LIKE UNGULATES.

It has already been mentioned that extinct camels occur in India and Northern Africa, while fossil species of llamas—some as large as camels—are found in eastern South America. In addition to these, the Pliocene and Miocene formations of the United States have, however, yielded the remains of a number of extinct genera of camel-like Ungulates, from which both camels and llamas have probably been derived; and as no such forms have hitherto been discovered in Europe, we may probably regard North America as the original home of the family, from which the modern representatives have migrated southwards across the Isthmus of Darien, and westwards over Behring Strait into Asia. In the older Tertiary formations of Patagonia the group is unknown.

Some of these North American Pliocene types, like *Procamelus*, were not unlike existing members of the family, but had four premolar teeth in each jaw. In the Miocene we come to still more generalised forms, having the typical number of forty-four teeth (that is to say, with three pairs of incisors in each jaw), while one kind (*Poebrotherium*), which was no larger than a fox, had the main metacarpal and metatarsal bones of the feet separate, and also showed traces of the bones of the lateral toes. From this form a transition can be traced to others with four complete toes and bunodont¹ molar teeth; and we thus reach the important conclusion that camels and llamas were derived from pig-like animals quite independently of the true Ruminants.

¹ The meaning of this term is explained in the next chapter.

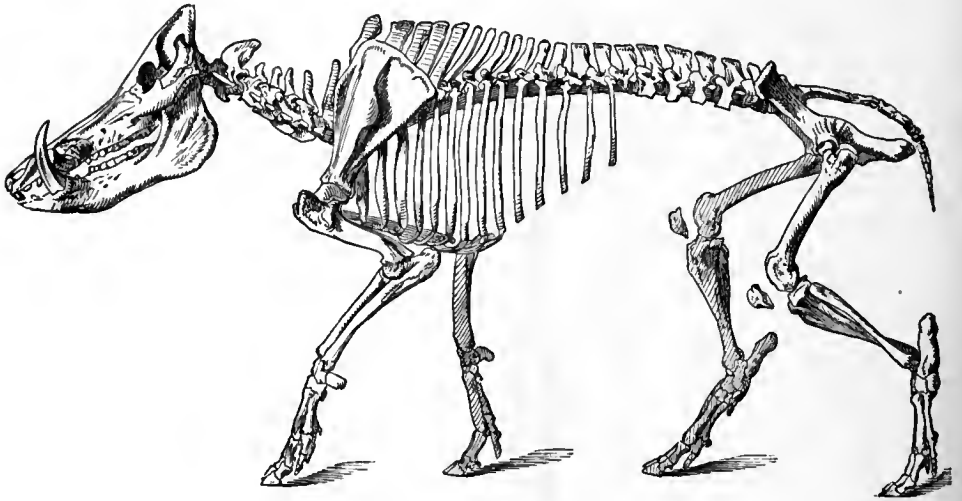
CHAPTER XXV.

UNGULATES,—*continued.*

THE PIG-LIKE UNGULATES.

Family *SUIDÆ*.

THE whole of the even-toed Ungulates described in the five preceding chapters are characterised by their power of ruminating, with which is associated their crescent-like, or selenodont, molar teeth (see figures on p. 155), and, with but one exception, the presence of a cannon-bone in the limbs (see p. 154). We now come to more



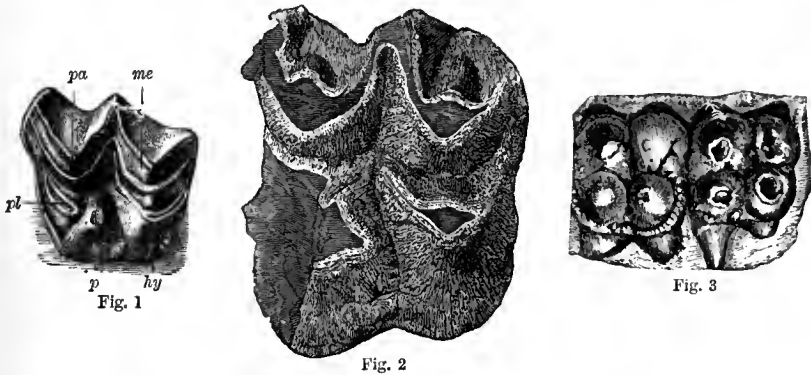
SKELETON OF WILD BOAR.

generalised forms of the same great group of Ungulates, such as pigs and hippopotami, which lack the power of rumination, and in which the structure of the molar teeth and lower portion of the limbs is of different nature.

Extinct Links. At the present day there is a great gap between the types with crescent-like molars and the pig-like animals; a gap so wide that the earlier naturalists failed to recognise the intimate relation that really exists between the two. This gap is, however, almost completely bridged over by a number of extinct Ungulates, and since, in order to have any adequate idea of the relations of the existing groups, some knowledge of the fossil forms is absolutely essential, we must devote a brief space to their consideration.

First, with regard to the molar teeth. On p. 155 there is figured an upper molar of a modern Ruminant, showing that the crown is surmounted by four

crenescentic columns of great height, and separated by deep pocket-like pits, while on the same page there is also represented the corresponding tooth of an extinct Ungulate, in which the same columns, although still crescent-like, are very much lower, and are separated by quite shallow valleys, of which the base is visible from the surface. Now from such a tooth there is but a step to the teeth represented in the woodcuts on the present page, marked 1 and 2. It will be observed, however, that the front inner column of the Ruminant molar is here divided into two moieties (*pl. p*), so that the tooth becomes five-columned. The molar represented in Fig. 1 is that of the anoplothere, a two or three-toed Ungulate from the upper Eocene rocks of Europe, furnished with the full number of forty-four teeth. The one marked 2 belongs to the so-called *Hyopotamus*, which also occurs in the upper Eocene rocks. It will be noticed that the columns of the latter, although very low, still have an imperfect crescentic shape; but in the allied anthracothere



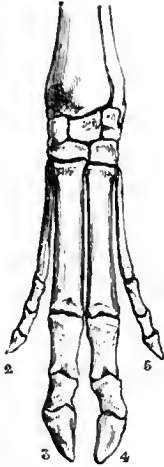
LEFT UPPER MOLAR TEETH OF EXTINCT PIG-LIKE ANIMALS.

1, Anoplothere (after Gaudry); 2, Hyopotamus; 3, Hyothere. (The specimen represented in the second figure is imperfect on the anterior side).

of the same horizon this structure is far less apparent, and the columns assume the form of flattened cones. From such a tooth the transition is easy to the type of the pair marked 3 in our illustration, which belonged to an extinct pig known as the hyothere. In the latter figure it will be seen that each tooth carries four low, conical, hillock-like columns, or tubercles, the column marked *pl* in the molar of the anoplothere having almost completely disappeared. From the hillock-like form of the columns the type of tooth found in the pigs is known as the bunodont (Gr. *bounos*, a hillock) form, in contradistinction to the selenodont (Gr. *selene*, the crescent-moon) form distinctive of all the ruminating Ungulates. This essential distinction in the structure of their molar teeth is the most readily recognised characteristic by which the pig-like Ungulates are distinguished from all those treated in the preceding chapters; but from the transition between one type and the other indicated by extinct forms, it is perfectly clear that the true Ruminants, the chevrotains, and the camels, are all severally descended from bunodont ancestors.

Characters of Pigs. The pigs and their allies are further distinguished from the true Ruminants and camels, by the metacarpal and metatarsal bones of the two main digits of the feet remaining distinct instead of being fused into a cannon-

bone, while in the fore-limb at least the lateral toes are likewise furnished with complete metacarpals, as shown in the accompanying figure. In these respects the pigs are, however, approached by the water-chevrotain (p. 401); and they also resemble all the chevrotains in having a conical process on the front of the second vertebra of the neck for articulation with the first of that series.



THE BONES OF THE LEFT
FORE-FOOT OF THE
FIG. (From Dawkins.)

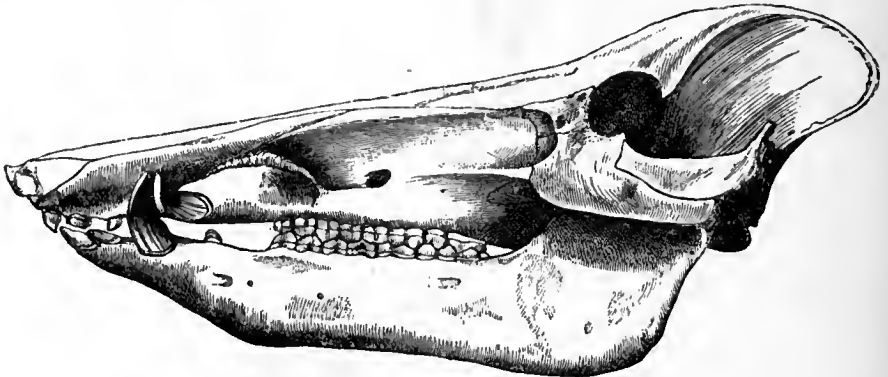
All members of the pig-like group—technically known as the *Suina*—have front or incisor teeth in their upper jaws, and their lower tusks are quite unlike, and distinct from the incisors. Further, in correlation with the absence of the power of rumination, the stomachs of these animals are always less complex than those of the Ruminants, and they may be perfectly simple, and comprise only a single chamber. It is, perhaps, well to add that pig-like animals existed at a date when Ruminants were unknown, as, indeed, must necessarily have been the case if the one group be the ancestor of the other.

With these introductory remarks as to the characteristics of the members of the group, and their relationship through extinct forms with the Ruminants, we may proceed to the consideration of the existing pig-like Ungulates, which are divided into the three families of the Pigs, the Peccaries, and the Hippopotami.

THE PIGS.

Family *SUIDÆ*.

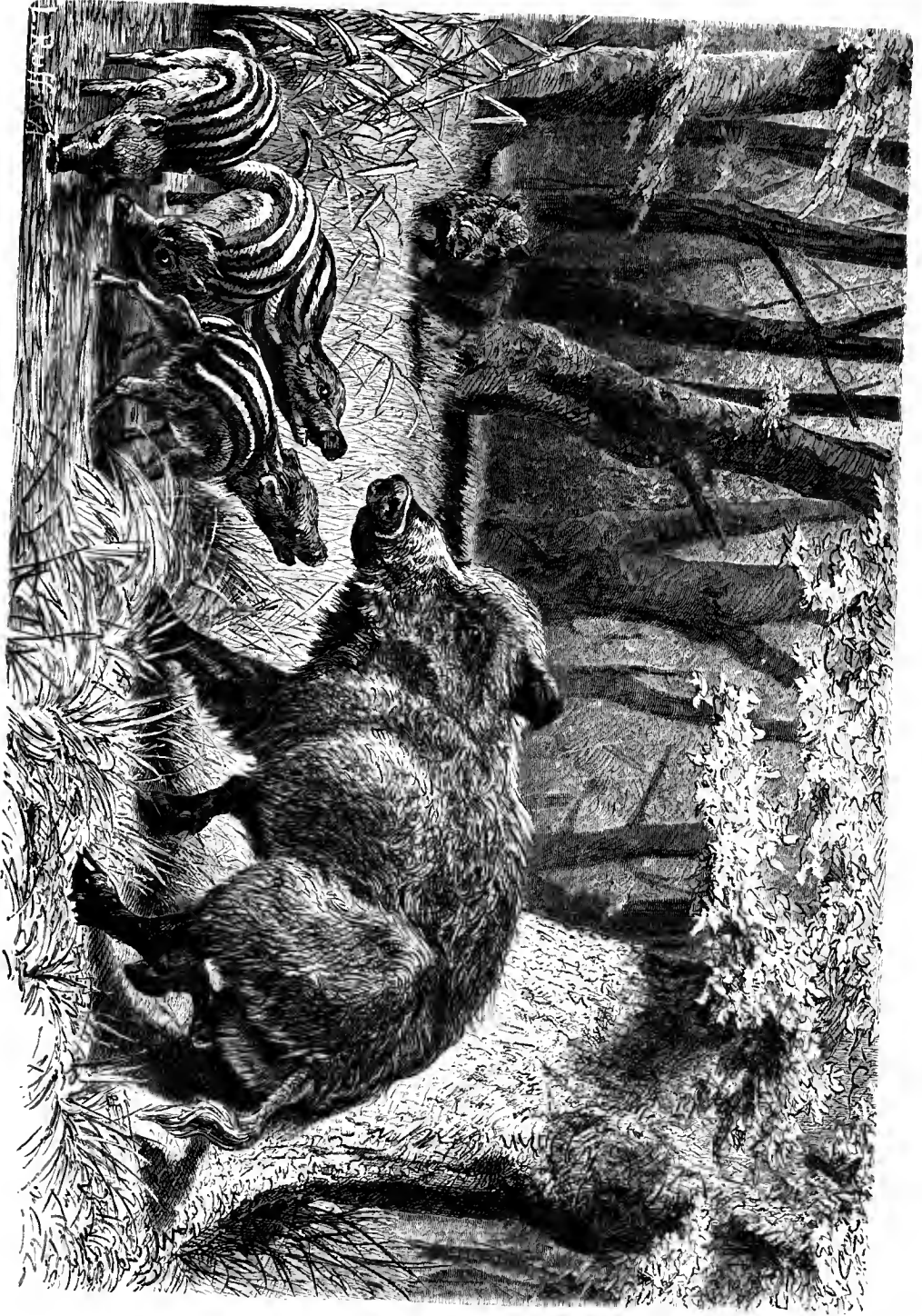
The pigs, or swine, of which there are three existing generic types, are such well-known animals that but little description is necessary. They are, however,



SKULL OF THE BEARDED FIG. (From Nehring.)

distinguished from the other members of the group to which they belong by the following assemblage of characters. The head and skull are greatly elongated, and the muzzle terminates in an abruptly-truncated mobile snout, with a disc-like

A FAMILY OF EUROPEAN WILD SWINE.





naked surface at the extremity, in which are situated the nostrils, the disc being supported by an additional separate bone at the extremity of the skull, as shown in our figure. The feet are narrow, and carry four completely-developed toes, of which the hindmost do not touch the ground in walking, while the inner surfaces of the main pair are flattened. The molar teeth are narrow, the last one in both the upper and lower jaw being more or less elongated; and the large tusks grow continuously throughout life, those of the upper jaw curving upwards, instead of pointing downwards, after the usual fashion. Swine have large flapping ears, and rather long cylindrical tails, with a tuft at the end. Their bodies are more or less sparsely clothed with bristly hairs, and their stomachs are quite simple. Like all unspecialised Ungulates, swine have the neck short and thick, and imperfectly differentiated both from the body and the head, the latter being consequently carried low. The whole of the existing members of the family are restricted to the Old World; and they chiefly frequent damp or swampy districts, and are fond of wallowing in wet mud.



THE LAST RIGHT LOWER MOLAR
TOOTH OF A PIG.

THE TRUE PIGS.

Genus *Sus*.

The typical representatives of the Pig family, such as the European wild boar, are characterised by having forty-four teeth, among which the last molar in each jaw is greatly elongated, while the thick and short upper tusk is turned sharply upwards, and has a large smooth facet worn on the outer side of its upturned extremity by the abrasion of the inner surface of the extremity of the lower tusk. Consequently, if either tusk happens to be broken, the opposing one continues to grow indefinitely, and, from its curved form, generally pierces some portion of the skull with its tip, thus ultimately leading to the death of the animal which has had the misfortune to meet with an accident of this nature. In addition to the bristly hairs, there is generally a more or less developed woolly under-fur. The skull of the pigs, besides the presence of the additional bone in the snout already mentioned, is remarkable for the great length of the nasal bones, and also for the high elevation of the crest of the occiput, which is generally even more developed than in the specimen figured here. In wild pigs the profile of the face is straight, although in most domesticated races it is more or less concave. Pigs are exceedingly prolific animals; and the young of all the wild species (as shown in our illustration) are marked with light longitudinal stripes, although these markings are very rarely observed in those of domesticated breeds.

Distribution. The distributional area of the genus, before curtailed by human agency, was extensive, comprising the greater part of Europe, Southern, and a portion of Central, Asia, Japan, the islands of the Malayan region, and Africa. The two species inhabiting Africa south of the Sahara

and a third from Madagascar, belong, however, to a group distinct from that including the rest. Domesticated pigs have been turned loose in many parts of the world, such as America, the West Indies, and New Zealand, where they have formed feral races tending to revert more or less completely to the wild type, some even producing striped young.

Species. Although some of the species are markedly distinct, the pigs (exclusive of those from Southern Africa) are an exceedingly puzzling group, scarcely any two zoologists being in accord as to the number of existing species. Some of the most important distinctive features are afforded by the cheek-teeth; but as such differences, after all, are but slight, and difficult to recognise, we shall, in the main, confine our attention to some of the better-known species, such as those of Europe and India.

European Wild Boar. The type of the genus is the European wild pig, or wild boar (*Sus scrofa*), ranging over Europe, Northern Africa, and part of Western and Central Asia. In Asia, it is believed by Mr. Blanford to extend into Mesopotamia, Persia, Baluchistan, and Afghanistan, while northwards it ranges to the neighbourhood of Yarkand. It was formerly abundant throughout the British Islands, as is attested not only by historical evidence, but also by the abundance of its remains in the peat-mosses and fens; and boar-hunting was a favourite pursuit of our ancestors. Although the exact date of the extermination of wild boars from the British Islands does not appear to be ascertained, Mr. J. E. Harting has shown that they still existed in Oxfordshire in the year 1339, in Suffolk in 1572, and in Chartley Forest, Staffordshire, as late as 1593; and it is quite probable that in Scotland, and perhaps in Ireland also, they may have lingered on till a still more recent date. In many parts of the Continent, and especially in the Black Forest, wild boars are still abundant.

Indian Wild Boar. The Indian wild boar (*S. cristatus*) is so closely allied to its European cousin that it is frequently regarded as specifically inseparable. It is, however, a somewhat taller animal, with a thinner coat of hair and no under-fur; but it is more especially distinguished by the presence of a crest or mane of long black bristles running from the nape of the neck along the back, and by the more complex structure and larger size of the last molar tooth in each jaw. As regards the latter characteristic, it may be observed that in the European wild boar the hindmost of the three lobes constituting the last lower molar, is not more complex than in the specimen figured on p. 425; but in the Indian species, and more especially in the males, this lobe (the one on the left of the figure) is complicated by the addition of one or more extra tubercles to the hinder extremity, thus making the whole of this tooth considerably longer and more complex. Analogous but less strongly-marked differences may be observed between the corresponding upper teeth of the two species. The usual height of the Indian wild boar varies from 30 to 40 inches at the shoulder, but it is stated that one specimen has been killed standing upwards of 43½ inches; while the weight ranges from 200 to considerably over 300 lbs. When extracted from the jaw, the lower tusk of a fine boar will measure somewhere about 8 or 9 inches in length; but specimens measuring 9½ and 10 inches have been recorded, and one is said to have been obtained

which measured upwards of 12 inches. The Indian wild boar is found in suitable spots throughout India, Ceylon, and Burma, and also in the wooded districts of the outer Himalaya, extending into the interior as far as Kashmir.

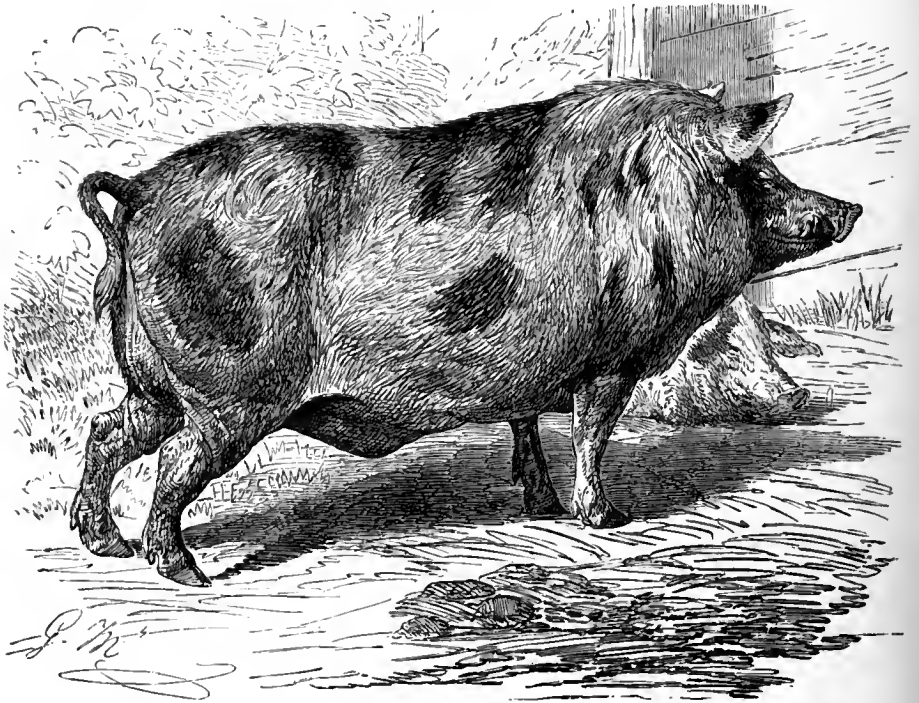
Habits. Since the habits of all swine are very similar, while those of the Indian wild boar are best known to Englishmen, we may give an account of them in this place. As we have said, pigs generally frequent moist or marshy situations, where there is plenty of cover, and their great characteristic is their habit of turning up the ground with their snouts in search of food, leaving marks by which their presence in a district can be instantly recognised. It is this habit which renders these animals so especially obnoxious to the cultivator. During the day the Indian wild boar makes his lair in any convenient cover, sometimes in tall grass, at others in reeds or sugar-cane, and



A "SOUNDER" OF WILD SWINE.

at others in bushes or forest, while not unfrequently standing crops other than sugar-cane afford the necessary shelter. In the mornings and evenings he wanders forth in search of food, in cultivated districts devastating the crops, but away from human haunts he depends chiefly upon roots, those of a kind of sedge being especial favourites. Wild pigs will, however, readily feed on the carcasses of animals and other carrion, while in Assam they are stated to be in the habit of digging out the fish which bury themselves in the mud during the dry season. According to Mr. Blandford, pigs are less nocturnal in their habits in remote districts than in those where they are much disturbed. While the females and young associate in droves or "sounders," usually comprising from ten to a dozen head, and rarely exceeding twenty, the old boars are solitary. The number of young produced at a birth by the European species varies from six to ten, after a gestation of four months; and frequently at least two litters are produced in a year.

The lower tusks of the male wild boar, which project about 3 inches from the jaw, and are kept with edges as sharp as razors by wear against those of the upper jaw, are most formidable weapons, capable of ripping open a horse at a single stroke. Both the European and the Indian species are among the boldest and fiercest of all animals, charging men, horses, or elephants time after time without a moment's hesitation, and in spite of the most desperate wounds. Indeed, the injuries that a wild boar will sustain without loss of life are perfectly marvellous. A correspondent of the *Asian* newspaper relates that he once killed an old boar, in the skull of which the broken extremity of the tusk of another



BERKSHIRE PIG ($\frac{1}{10}$ nat. size).

boar was firmly embedded, with its point penetrating into the brain-cavity a short distance behind the left eye.

Although the speed of a wild pig is considerable, yet it cannot be maintained for any long distance, and accordingly, either a boar or a sow may be easily overtaken by a well-mounted horseman after a comparatively short run. Both as regards speed and inclination to fight there is, however, considerable local variation among the wild pigs of India; the large heavily-built animal found in Bengal being much more disposed to show fight than the lighter pig of the Punjab, which has a greater turn of speed. In spite of its boldness, the Indian wild boar seldom makes unprovoked attacks; but when once roused nothing will stop it. An instance is on record of a boar charging, overthrowing, and ripping open a camel; and there are several well-authenticated cases of boars having attacked and killed or beaten off tigers.

Hunting. In Germany the European wild boar is hunted with boarhounds; and when in the highlands of Ceylon Sir Samuel Baker was in the habit of hunting the Indian pig with a pack of dogs, and despatching his quarry single-handed with a hunting-knife. In all parts of India where riding is possible the wild boar is, however, always speared; and the sport of "pig-sticking," as it is commonly called, is undoubtedly by far the finest and most exciting of all the many kinds of Indian *shikar*. One of the best grounds for pig-sticking is the old valley of the Ganges in the neighbourhood of Mirut, locally known as the *Khadir*. Here "the ground," writes General Kinloch, "consists of level plains covered with grass and intersected with deep *nullas* or ravines, some dry, others full of water; with deep but invisible ditches; holes varying in size, from pits large enough to swallow up horse and rider to others just big enough to admit a horse's leg; hidden stumps, and tangled bushes; and over this one has to gallop at racing pace." Falls are of course frequent, although severe accidents are less common than might have been expected.

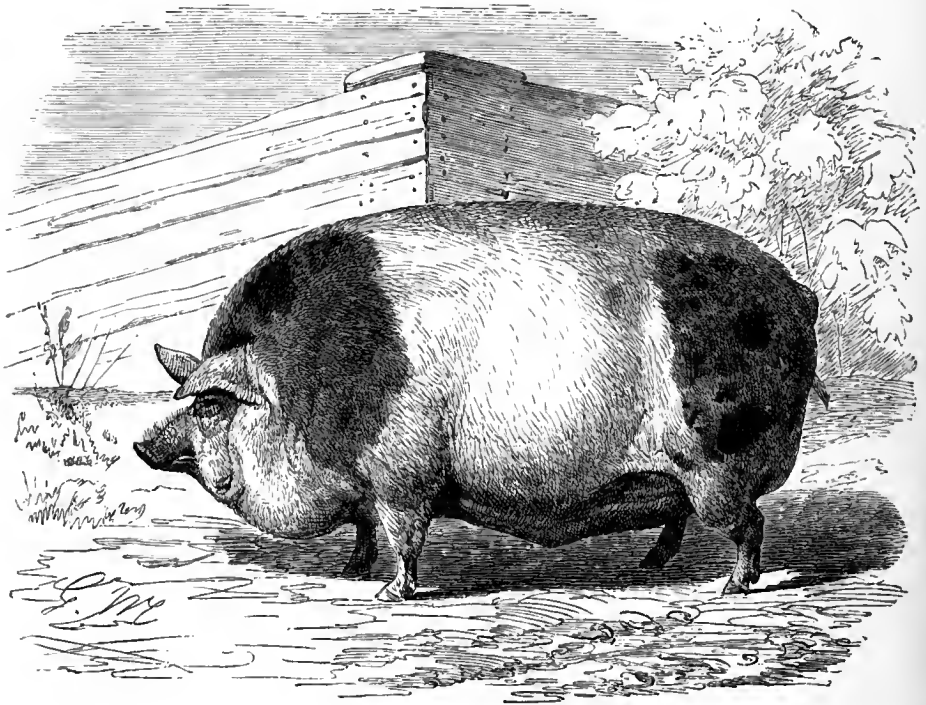
Andaman Pig. A smaller species of pig inhabits the forests of the Andaman Islands in the Bay of Bengal, and stands only some 20 inches in height at the shoulder. In addition to its small stature, the Andaman pig (*S. andamanensis*) is further distinguished by its relatively short tail, the shagginess of the coat, the absence of the crest of long hair on the neck, and, above all, by the relative shortness of the hindmost lobe of the last molar tooth in the lower

Pigmy Hog. jaw. The third Indian representative of the genus is the pigmy hog (*S. salvanius*), of the forests at the foot of the Himalaya in Bhutan, Sikhim, and Nipal. These tiny little pigs are scarcely larger than hares, standing only about 11 inches at the shoulder. They are brown or blackish brown in colour, with small, naked ears, very short tail, and only three pairs of teats in the female instead of the usual six. From the little that is known of the habits of these pigs in the wild state, it appears that they generally live in herds of from five to twenty head in grass-jungle, and that the old boars remain with the sows. Probably the number of young produced at a birth is less than in other pigs.

Malayan Pigs. We have now to consider briefly the wild pigs of the islands of the Malayan region and Japan; and it is among these that the greatest uncertainty prevails among zoologists, as to the real number of species discoverable. These pigs may, however, be divided into three groups, of which the first is nearly related to the Indian pig. The best known representative of the first group is the collared pig (*S. vittatus*) of Java, Sumatra, and Borneo, characterised by the white streak running along the sides of the face to the neck, and by the absence of any crest of hair on the back of the neck, and of warts on the face; the last lower molar tooth being large and complex. The white-whiskered Japan pig (*S. leucomystax*), as well as the Papuan pig (*S. papuensis*), and the Formosan pig (*S. taïwanus*) are nearly allied species. The second group is represented by a well-marked species known as the warty pig (*S. verrucosus*), from Java and Borneo, readily distinguished by the presence of three small warts on each side of the face, the largest of these carrying a number of bristles and being situated just below the eye. The skull in this pig is of ordinary length; while the last lower molar tooth is of medium size and complexity. The Ceram

pig (*S. ceramensis*) and the Celebes pig (*S. celebensis*) belong to this group. Lastly, we have the bearded pig (*S. barbatus*) of Borneo, which is markedly distinct from all the others, having a fringe of long hairs on the cheeks, an extremely elongated skull (shown in the figure on p. 422), and the last molar tooth in the lower jaw relatively short, and of simple structure. The great elongation of the skull is shown by the circumstance that the first cheek-tooth of the upper jaw is separated by a considerable interval from the tusk, whereas in other species the two are placed close together.

Since there is nothing in the habits of these pigs to distinguish them from the Indian wild pig, we may pass on to the consideration of some of the domesticated



HARRISON PIG ($\frac{1}{2}$ nat. size).

breeds of swine. It may, however, be mentioned that with the exception of the European wild boar, which ranges into Algeria and the adjacent districts, the only typical representative of the genus found in Africa is the Senaar pig (*S. senaarensis*) of the north-eastern regions of that continent.

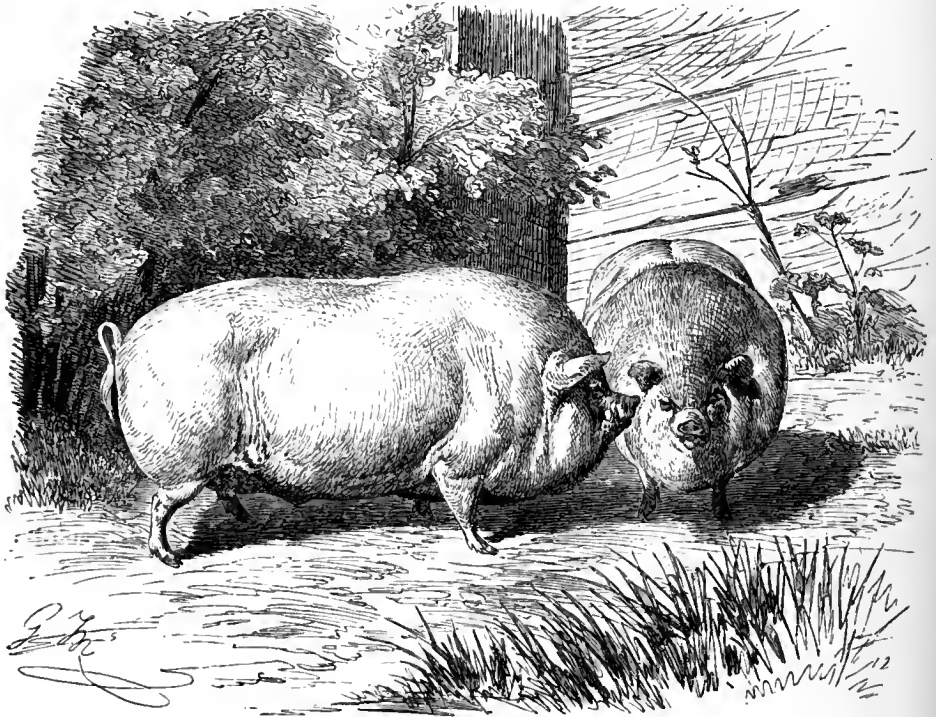
Domestic Swine. Much discussion has taken place as to the origin of the numerous domesticated breeds of swine, and very different views on this subject have been expressed by different writers; some urging that certain of the earlier races found in Europe had an eastern origin, while others regard the whole of them as descended directly from the European wild boar. The earliest evidence of the existence of domesticated swine in Europe is afforded by remains found on the sites of the prehistoric lake-dwellings of Switzerland. These were regarded by Professor Rüttimeyer, of Basle as indicating two distinct breeds—one nearly allied

to the European wild boar, and the other more resembling some of the Asiatic kinds. The late Professor Rolleston failed, however, to detect evidence of Asiatic affinity in any of the prehistoric swine of Europe, and accordingly came to the conclusion that they were all probably derived from the European wild species, although these might possibly have some crossing with an Asiatic stock. It must be confessed that this view is, at first sight, the most probable; and that the original domesticated races of different parts of the world have been derived from the wild species inhabiting the same districts. This is the opinion of Mr. Blanford, who states that the tame pig of India is doubtless derived from the wild *S. cristatus*, with which it probably interbreeds. In modern times, however, there has certainly been a great amount of intercrossing between the various breeds of domestic swine; and many of the races now most esteemed in Europe have a large proportion of Asiatic blood in their veins.

The effects of domestication have been very marked on the swine, although the degree of variation from the wild type depends largely upon the amount of care that has been bestowed upon the breed. We have already mentioned that the European domestic breed differs from all wild species by the concave profile of the face; while as a rule domesticated races have uniformly-coloured young. Indeed, whenever the young of domestic swine are striped, a recent crossing with a wild race may not unreasonably be suspected. When domesticated pigs revert to a wild condition, the striping of the young is, however, frequently resumed. Domestication invariably greatly reduces the size of the tusks of the boars, which in some breeds are very small indeed; and in this respect we have a reversion to extinct species of swine, in the earlier forms of which the tusks were but slightly developed. There are also modifications in the form of the hinder part of the skull, in the number of joints in the backbone, and in the length of the intestines. Equally marked differences obtain in the shape of the ears, which in some of the inferior breeds are large, flapping, and pendent, while in the superior breeds they are small and erect. As regards bodily form, we have but to contrast the long-legged, large-headed, and thin-bodied "greyhound pig" of Ireland, with some of the best modern breeds, like the Harrison swine represented on p. 430, to see how enormous is the difference in this respect. Darwin remarks, however, that the observations of Professor Nathusius tend to show "that the peculiar form of the skull and body in the most highly-cultivated races is not characteristic of any one race, but is common to all when improved up to the same standard. Thus the large-bodied, long-eared English breed with a convex back, and the small-bodied, short-eared, Chinese breeds with a concave back, when bred to the same state of perfection, nearly resemble each other in the form of the head and body. This result, it appears, is partly due to similar causes of change acting on the several races, and partly to man breeding the pig for one sole purpose, namely, for the greatest amount of flesh and fat; so that selection has always tended towards one and the same end. With most domestic animals the result of selection has been divergence of character, here it has been convergence."

Domesticated pigs are now found over the greater part of the habitable world; but while those kept in more northern regions are generally confined more or less closely to the homestead, the races of the warmer parts of the world are allowed to

run more or less fully at liberty. Those kept in confinement are generally larger and fatter, although often more delicate animals, than the breeds which are allowed to roam almost at will; the latter being longer-limbed and thinner than the former, but at the same time bolder and more independent in disposition. In Southern Hungary, Croatia, Bosnia, Servia, Turkey, and Spain, the herds of swine are allowed to run in the woods throughout the year, but in less warm districts they have to be taken in and fed during the winter. In the Sierra Nevada of Spain, these herds ascend to an elevation of some nine thousand feet above the sea, and thus become expert climbers.



DWARF CHINESE PIG ($\frac{1}{2}$ nat. size).

European Breeds. The different breeds of European domestic pigs vary so much that it is almost impossible to classify them, and only a few of the more important ones can even be mentioned in this work. Many of the best breeds have been produced by crossing original stocks with the so-called Siamese breed, which is distributed over a great part of the Malayan region, and has been imported into China. This breed (frequently termed *S. indicus*) is characterised by its small size, cylindrical trunk, hollow back, short limbs, and the approximation of the belly to the ground. The colour is generally black, with the skin externally of a rich copper colour, and the bristles are soft; but there is also a white variety. The ears are small and somewhat erect, and the face is short. According to Mr. D. Low, these pigs "are less hardy and prolific than the native races of Europe, and the females do not yield the same quantity of milk; but they arrive very soon at

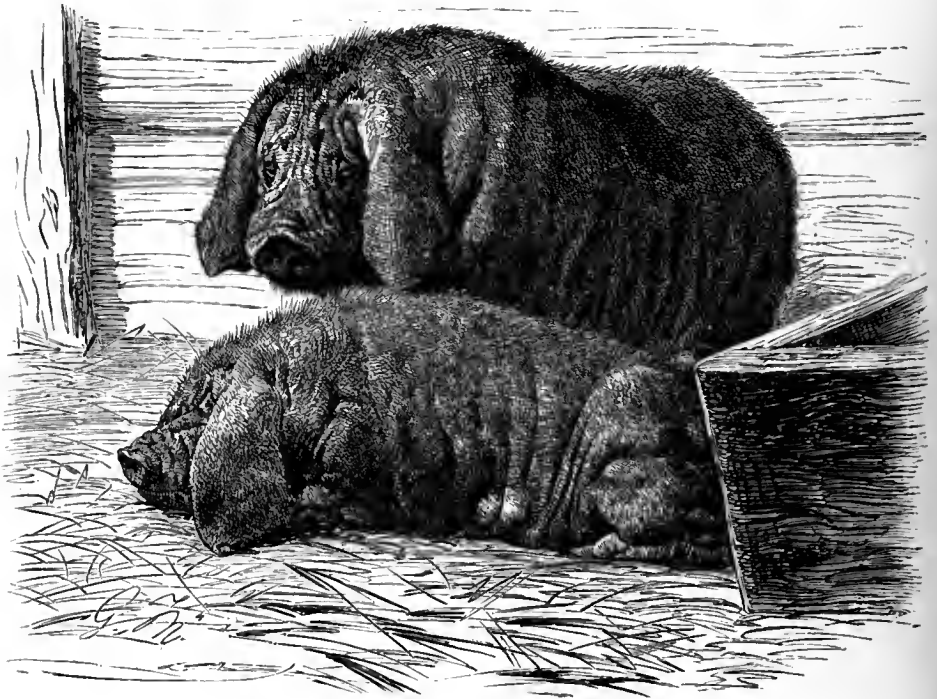
maturity, they fatten on a small quantity of food, and their flesh is white and delicate." The native breeds of Britain, according to the same authority, may be divided into those of small size, with erect or semi-erect ears; and those with larger bodies and long pendent ears. Nearly all these have, however, been more or less largely crossed with the Siamese, or, as it is often called, the Chinese breed; and the general tendency of modern breeding is towards a reduction in size and uniformity in character. Of the smaller kinds, with short erect ears, one of the most distinct is the Highland breed; these pigs being lean, wiry, greyish animals, of great hardihood, roaming over the Scottish moors almost at will, and doing great harm to game and other birds. Near the sea they will feed on molluscs and dead fish, and their flesh, at all times coarse, then acquires a fishy taste. They are also found in the Hebrides and Orkneys.

The larger breeds with pendent flapping ears are chiefly characteristic of the lowlands, but few now remain which have not been crossed with foreign blood. In colour they are mostly white, or white spotted with black. They are long in coming to maturity and fatten slowly, but they attain enormous dimensions, and have the advantage of producing large litters, and being excellent mothers. The Yorkshire and Lincolnshire breeds, as well as those of the Eastern counties, are large white pigs, with pendent ears; the Essex breed (which has now been largely crossed with the Chinese) being remarkable for the fineness of the skin and the softness of the bristles. The Hampshire is also a noted breed; while the largest of all is the Rudgwick. One of the most valuable is, however, the Berkshire breed, which is somewhat inferior in point of size. Originally these pigs, as shown in the illustration on p. 428, were generally of a reddish brown colour, with brown or black spots; but by crossing with the Chinese breed, or derivatives thereof, the size has been reduced, and the colour changed to black, although, when the crossing has been with the white breed, it is more generally black mixed with white. The original Berkshire, writes Mr. Low, "is still regarded as one of the superior breeds of England, combining size with a sufficient aptitude to fatten, and being fitted for pork and bacon, and it is held to be the hardiest of the more improved races." The Harrison pig, figured on p. 430, is intended to exhibit one of the best types of fattening breeds; while the white dwarf Chinese pig, represented in the illustration on p. 432, exhibits the greatest diminution in size, coupled with an almost completely cylindrical form of body.

It may be observed that although the usual mode of life led by pigs in England is not calculated to develop their intellectual faculties, yet they are by no means deficient in intelligence, and display a remarkable acuteness of scent. Indeed, a pig has been trained to stand to game as steadily as the best-bred pointer.

Before taking leave of domesticated swine, we must not omit **Masked Swine.** to mention the curious Japanese masked pig, represented in the figure on p. 434. This pig, writes Darwin, "has an extraordinary appearance, from its short head, broad forehead, and nose, great fleshy ears and deeply-furrowed skin. Not only is the face furrowed, but thick folds of skin, which are harder than the other parts, almost like the plates on the Indian rhinoceros,

hang about the shoulders and rump. It is coloured black, with white feet, and breeds true. That it has long been domesticated, there can be little doubt; and this might have been inferred even from the circumstance that its young are not longitudinally striped." From a study of its skull, Professor Nathusius regards the masked pig as nearly allied to the Chinese breed; but, as Darwin remarks, "if this be really the case, it is a wonderful instance of the amount of modification which can be effected under domestication."

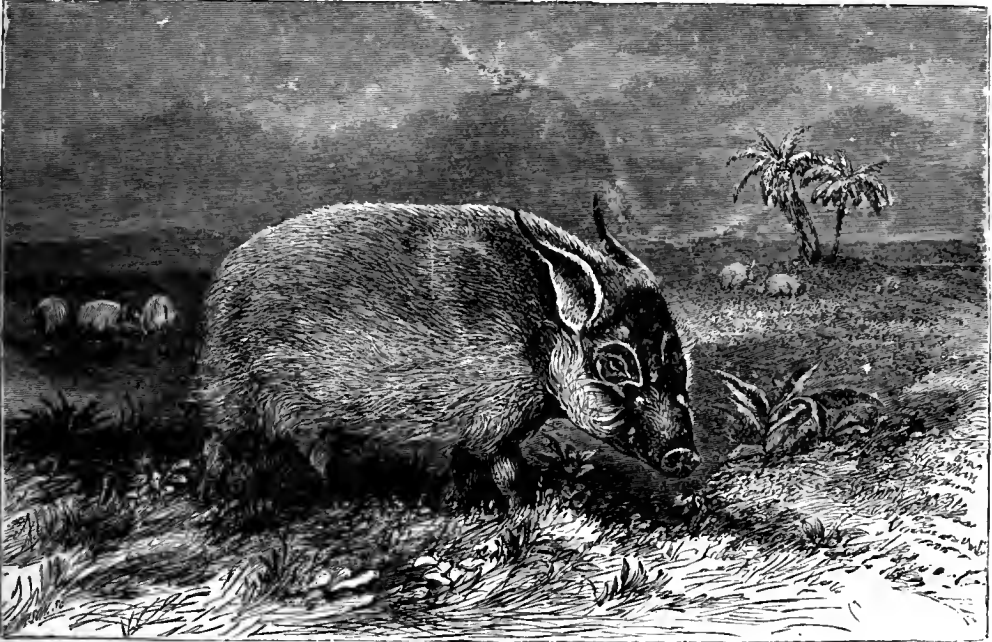


MASKED JAPANESE PIG ($\frac{1}{17}$ nat. size).

Bush-Pigs. The African bush-pigs—the Bosh-Varks of the Cape Boers—differ from the typical members of the genus by always having one pair less of cheek-teeth, owing to the absence of the first premolar on each side of the lower jaw, while frequently the corresponding upper tooth is likewise wanting in the adult. The molar teeth are also distinguished by their simpler structure, the last in the lower jaw having the third lobe much reduced in size. The tusks are scarcely larger than those of domestic pigs, and the snout is unusually elongated. On each side of the face immediately below the eye there is a large swelling, due to the great development of a ridge of bone on the sheath of the upper tusk. The grey bush-pig (*S. africanus*), ranging from South to Central Africa, has the hair of a greyish brown colour, and no pencils of hair on the ears. It generally frequents thick forest, although occasionally found in thorny bush and among reeds in the river valleys. Mr. E. H. Drummond says that "the ingulabi, as it is called by the natives, does an immense amount of damage to their sweet potatoes and fields, and has in

consequence been exterminated in many districts." Its habits appear to be very similar to those of the ordinary swine.

The red bush-pig or river-hog (*S. porcus*) is a rather smaller species than the last, inhabiting West Africa, and distinguished by the long pencils of hairs with which the ears terminate, and also by the brilliant reddish colour of the hair. As in the last species, the bristles of the neck, back, chin, and throat are elongated into a distinct mane, and the tail terminates in a distinct tuft. The prevailing colour is either a shining brownish red with a tinge of yellow, or



THE RED BUSH-PIG.

a dark reddish yellow: the forehead, ears, and limbs are, however, blackish, while the mane on the back, part of the margins of the ears, and the tips of their pencils of hair, the eyebrows, and a streak under the eyes and the margins of the cheeks, are white or whitish. The under-parts are whitish grey, and the snout grey. These brilliant contrasts of colour make the red bush-pig decidedly the handsomest member of the Swine family. These pigs are found in large herds, and frequent moist forests and the banks of rivers, while they are occasionally seen on the mountains. The first living example of this species brought to Europe was exhibited in the London Zoological Gardens, 1852, since which date many specimens have been imported into Europe. A third species (*S. edwardsi*) inhabits Madagascar.

Extinct Pigs. Numerous fossil pigs are found in the Pliocene and Pleistocene Tertiary deposits of the Old World, which may be referred to the genus *Sus*, and several of which differ markedly from all existing species; these fossil pigs occurring in Europe, North Africa, India, and China. One of the most remarkable is the titan pig (*S. titan*) from the Siwalik Hills, at the foot of the

Himalaya. In this monster the length of the skull was 23 inches, against 16 in an average-sized Indian wild pig, so that the height of the animal could not have been much less than that of a fair-sized mule. The same deposits have also yielded remains of an extinct species which did not exceed the living pigmy hog in point of size. Still more noteworthy are Falconer's pig (*S. falconeri*) from the Siwalik Hills, and some allied species from the Pleistocene deposits of Southern India and Algeria, which, in the extreme complexity of the lower teeth, approximated to the under-mentioned wart-hogs. The Auvergne pig (*S. arvernensis*) from the Pliocene of France, is believed, on the other hand, to be related to the African bush-pigs. In most of these extinct species the tusks of the boars, as already mentioned, were relatively small.

THE BABIRUSA.

Genus *Babirusa*.

The extraordinary development of the tusks in the males of the animal to which the Malays have given the name of Babirusa (meaning pig-deer) is so remarkable as to suggest at first sight the idea of a malformation. The babirusa (*Babirusa alfurus*), which is an inhabitant of Celebes and Boru, and is the sole representative of its genus, has, indeed, derived its name from these abnormally-developed tusks, which have led the Malays to liken them to the antlers of the deer. In the boars, as is well exhibited in our figure of the skull, the upper tusks, while curving upwards like those of an ordinary wild pig, instead of protruding from the margins of the jaws, arise close together near the middle line of the face, and thence, after being directed upwards for a short distance, sweep backwards, frequently coming into contact with the surface of the forehead, and are then finally directed forwards at the tip. The lower tusks have the same upwards-and-backwards direction as those of the upper jaw, but are frequently less strongly curved, although in other cases the direction of their sweep is not very different from that of the latter. Both pairs of tusks are quite devoid of enamel, and, as there is no abrasion of the one pair against the other, both grow uninterruptedly; the upper tusks occasionally attaining a length of $14\frac{1}{2}$ inches, we believe, exclusive of the portion buried in the socket. In addition to the peculiar conformation of its tusks, the babirusa differs from ordinary pigs in the diminished number of its teeth, of which the total is only thirty-four; the missing teeth comprising the outermost incisors and the first two premolars on each side of both the upper and lower jaws. The molar teeth are characterised by their simple structure and the small development of the third lobe of the last one in each jaw.

The babirusa has a nearly naked skin of a dark ashy grey colour, sparsely covered with hair along the line of the back, and thrown into numerous wrinkles. The ears are small, the tail is short and devoid of a terminal tuft, and the back is much arched. The female has small tusks, and only a single pair of teats. The height at the middle of the back is about 42 inches. The young, of which there are either one or two at a birth, are devoid of stripes.

The peculiar character of the tusks, the reduction in the number of the teeth, and the uniform coloration of the young, indicate that the babirusa is a more specialised creature than the ordinary pigs. At the same time, the simple structure of the molar teeth indicates that it must be directly descended from one of the extinct genera of pigs in which a similar type of dentition obtains.

Habits. The habits of the babirusa seem to be very similar to those of other wild swine; moist forests, cane-brakes, and the banks of rivers and lakes where abundance of water-plants are to be found, being its favourite resorts. Here these animals collect in larger or smaller herds, sleeping by day and going forth to feed at night. The babirusa is an excellent swimmer, not only entering lakes to feed on water-plants, but likewise traversing small channels of



THE BABIRUSA ($\frac{1}{2}$ nat. size).

the sea separating one island from another. Its gallop is lighter than that of the wild boar. The senses of smell and hearing are very acute in the babirusa, and its grunt is very similar to that of other swine. The young are born in February, and of very small size, and require great attention on the part of the sow.

Babirusa are frequently tamed in Celebes, and may be found in the houses of some of the chiefs. The first living examples brought to Europe were a pair exhibited in Paris in the year 1820.

Use of Tusks. Much discussion has arisen as to the use of the tusks of the male babirusa. It has been suggested that they may be for the purpose of protecting the eyes when the animal is rushing through dense forest; but if this were so, as Mr. Wallace points out, how are we to account for the slight development of these organs in the sows. On the whole, the same observer considers it most probable that the tusks were at one period useful to their owner, and were

then kept of moderate size by mutual attrition, but that, for some reason or other, they have become of no benefit to the animal, and have assumed a monstrous growth like that occurring in the lower tusk of a wild boar when the corresponding upper one has been accidentally broken off.

Hunting.

The natives of Celebes organise carefully-planned hunts for the capture of the babirusa, an account of one of these being given by Dr. Guillemard in the following words:—"The animals being driven into a *curral*, with a V-shaped opening and flanked by netting, we had plenty of time to wait before the sport began, and meanwhile the natives arranged themselves at their posts. One stood at the door of the curral, ready to close it directly any animal rushed in; others took up their places on either side of the wide entrance, while the remainder crouched in front of the long net at intervals of a few yards, each grasping his spear, and hidden from view by a huge *Livistonia* (a kind of palm)



SKULL OF BABIRUSA. (From Guillemard's *Cruise of the Marchesa*.)¹

frond. We had not long been settled before a peculiar barking grunt in the distance announced the arrival of the first victim. Everyone was instantly motionless, and directly afterwards a dark object dashed up at great speed and buried itself in the net a short way down the slope. There was a short struggle, and in less than five minutes the captive, a full-grown female babi-

rusa, was quietly reposing on her back, with her legs tied together with rattan, and we were once more in ambush for the next comer. We were hardly quiet before the same peculiar sound was heard rapidly approaching, and the next moment a magnificent old boar babirusa rushed past within five yards of us, and plunged into the net between our tree and the entrance to the curral. His long tusks became entangled in the meshes, and the natives ran up to spear him. Just at this moment, however, he broke loose, and, turning on his antagonists, scattered them in all directions. It was a most determined charge, and, as we were unable to fire for fear of hitting some of our own men, it might have proved a serious affair for the native he singled out." After some trouble the animal was, however, finally despatched with a spear-thrust; but, "even with four spears buried in his body, the old boar died game, striving to the very last to get at his antagonists."

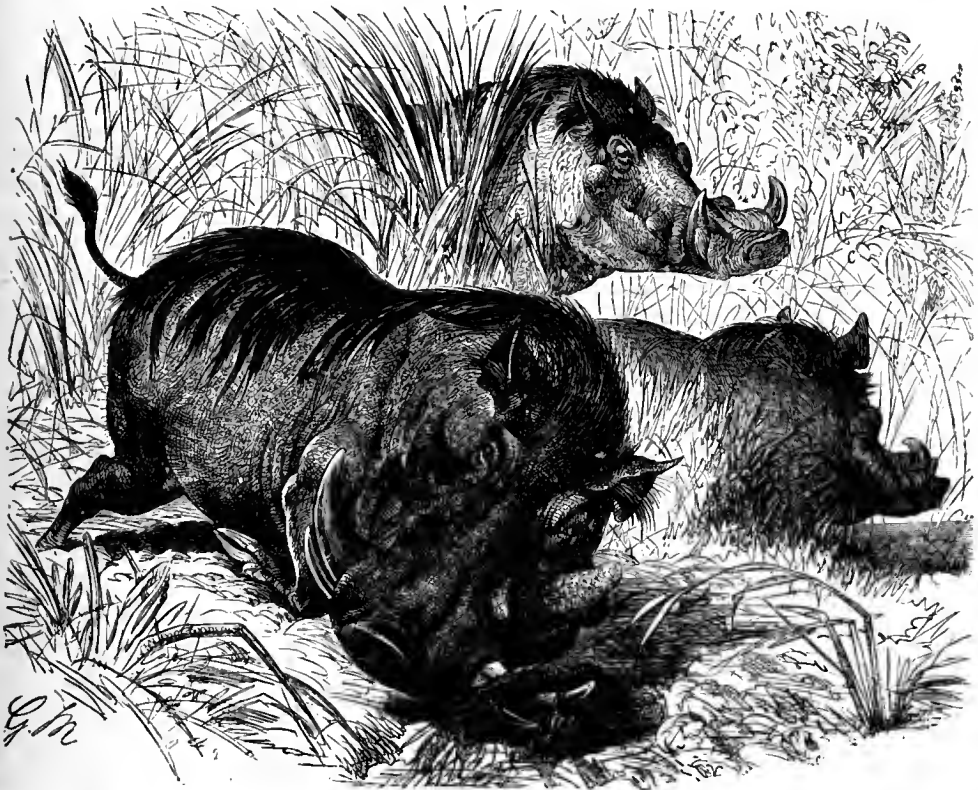
¹ We are indebted to Mr. Murray and the author of the book named for the use of this figure.

THE WART-HOGS.

Genus *Phacochoerus*.

As Africa possesses in the red bush-pig the handsomest representative of the Swine family, so in the wart-hogs it presents us with the most hideous members, not only of that group, but of the whole Ungulate order.

The wart-hogs, of which there are two nearly allied species, are characterised by the enormous size of their heads, in which the lower part of the face is extremely flat and broad, while below each eye is a huge warty protuberance



ELIAN'S WART-HOG ($\frac{1}{2}$ nat. size).

between which and the tusk there are two other of smaller size. The head is likewise distinguished by the great length of the muzzle, and the consequent backward position of the eyes: the hideous physiognomy being completed by the huge tusks with which the jaws of both sexes are armed, those of the upper jaw being considerably longer than those of the lower, or just the reverse of what occurs in the true pigs. This difference in the proportionate length of the upper and lower tusks in the two groups is due to the circumstance that in the wart-hogs the lower pair only bite against the inferior surface of the upper ones, instead of abrading their whole summits. The upper tusks are devoid of enamel except at their tips,

and these small caps are worn away at an early period. They curve in an upward and inward direction, and sometimes project as much as $8\frac{3}{4}$ inches from the jaw, having a basal girth of 5 inches. The shorter and more slender lower tusks have a nearly similar curvature, and are coated throughout with enamel.

The tusks are not, however, the only peculiarity in the dentition of the wart-hogs. In young animals there are thirty-four teeth, namely, one pair of upper and three pairs of lower incisors, a pair of tusks in each jaw, and six cheek-teeth on each side of the upper, and five in the lower jaw. In the adult, the incisors and anterior cheek-teeth tend, however, to disappear, till in some instances the tusks and the last molars alone remain, thus leaving a total of eight teeth. This paucity in the number of cheek-teeth is compensated, however, by the enormous size and complex structure of the single molar remaining in each jaw. The tooth in question is composed of a number of small elongated cylindrical denticules, closely packed together; its total length from back to front, being something over 2 inches, and its height proportionately great, although its width is small. This is, however, only an extreme development of the structure already referred to as occurring in certain extinct species of the genus *Sus*; and in possessing such a single tooth on each side of the jaws in the adult condition, the wart-hogs may be compared to the elephants.

The body in these animals is massive and nearly cylindrical, the ears are small and sharply-pointed, the tail is long and tufted at the tip, and the neck and back are furnished with a mane of long bristly hair, the rest of the body being nearly naked. The young are uniformly coloured.

Of the two species, Ælian's wart-hog (*Phacochoerus africanus*) (figured on p. 439) is distributed over a large part of the eastern side of Africa, ranging as far



HEAD OF PALLAS'S WART-HOG.
(From Sclater, *Proc. Zool. Soc.*, 1869.)

north as Abyssinia. On the other hand, Pallas's wart-hog (*P. pallasi*), of which the head is here figured, is confined to South-Eastern Africa. Both species stand about $27\frac{1}{2}$ inches at the shoulder. The second is distinguished from the first species by its shorter head, which is more convex between the eyes; and it has also the warts below the latter very long and pendent, instead of projecting

outwards, while the tusks are more inclined outwards. The mane is also wider and shorter, and there is a greater development of hair on the top of the head and the ears. It has also been considered that it is only this species in which all the teeth, except the tusks and last molars are habitually shed, but this is doubtful. The colour of Pallas's wart-hog is redder than that of its northern relative.

Habits. Our accounts of the habits of the wart-hogs are not so full as might be desired, and there is some discrepancy between those given by different observers. The statement made by Heuglin that these animals habitually repose on swampy ground, or even in water, is, however, not borne out by later writers. The northern species is found everywhere in Abyssinia, from the level of the sea at Annesley Bay to heights of nine thousand or ten thousand feet in the highlands of the interior. Mr. Blanford writes, that "its habits are very similar to those of ordinary pigs. It lives amongst bushes or in ravines during the day, and comes out to feed in the evening, still keeping much to bush-jungle. The large males are usually solitary; the younger animals and females live in small herds, apparently not exceeding eight or ten in number. I never saw large 'sounders,' such as are so commonly met with in the case of the Indian hog. It feeds much on roots, which it digs up by means of its huge tusks. It also appears to dig large holes, in which it occasionally lies; these are perhaps intended for the young. Despite its formidable appearance, the Abyssinian wart-hog is a comparatively timid animal, far inferior in courage to the Indian wild hog. Several which I wounded showed no inclination to charge under circumstances in which an Indian pig would certainly have shown fight. The flesh is savoury, but dry and hard, even in comparatively young animals."

The foregoing opinion of the courage of these animals is confirmed by Sir Samuel Baker, who states that it is but rarely that they ever charge. One kept in confinement at Khartum on one occasion, however, broke out from its cage and deliberately charged at Sir Samuel Baker's party, when its rush was effectually stopped by having a huge rhinoceros horn hurled at its head. When brought to bay by dogs, wart-hogs make a determined stand, and inflict severe injuries on their assailants. If excited, they carry their long tails stuck straight upright.

In South-Eastern Africa—where they are known to the natives by the name of *Indhlovudawani*—wart-hogs, according to Mr. E. H. Drummond, are found on the plains in light thorn-jungles; and they are abundant in the districts around Mount Kilima-Njaro. In those regions they generally occupy the deserted burrow of an aard-vark, or other animal. Mr. Drummond states that wart-hogs, occupying such burrows, "have a most curious mode of exit when they bolt—a dangerous one if you are not up to it. As they emerge from a hole, they turn a somersault on to the back of it, instead of coming straight out like an ordinary animal, and as that is just the spot where one would naturally stand, more than one man has had his legs ripped open before he learnt the wisdom of experience." The same writer mentions that he has on more than one occasion seen a male wart-hog walk deliberately through a pack of large hounds without taking the slightest notice of them, so long as they refrained from biting. Did, however, one bolder than the rest, venture to come to close quarters, the wart-hog with a sudden jerk would either lay its assailant crippled on the ground, or send it howling away.

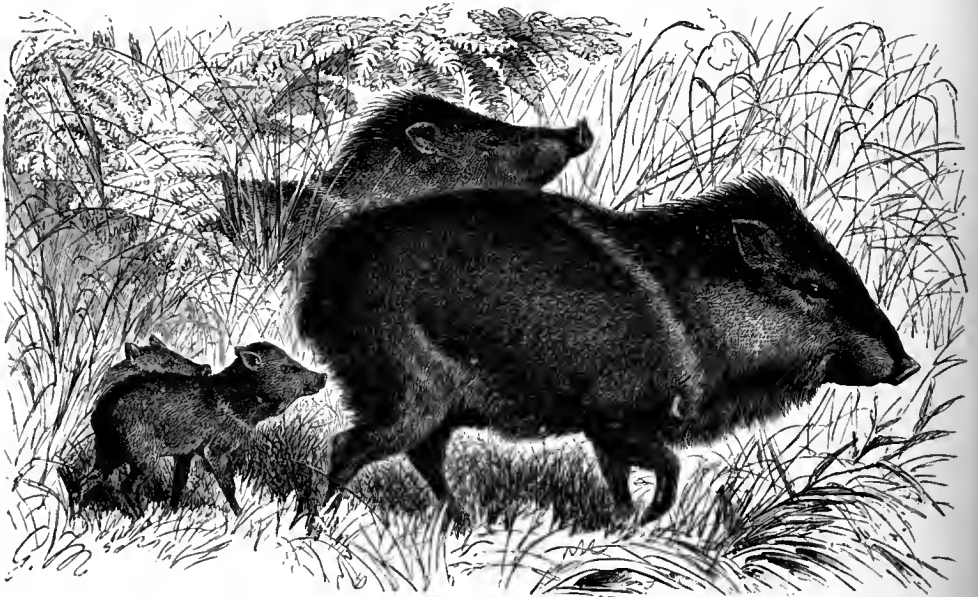
We have no information as to the breeding-habits of the wart-hogs, but from the number of teats in the female being only four, it may be inferred that but few young are produced at a birth. The young are striped.

THE PECCARIES.

Family *DICOTYLIDÆ*.

The peccaries, which are the American representatives of the swine, differ so markedly from the latter that they are regarded as belonging to a separate family, of which there is but a single genus. The most important differences between the two groups are that the upper tusks of the peccaries have their points directed downwards instead of upwards, that their hind-limbs have three instead of four toes, while instead of the simple stomach of the Old World swine, the peccaries have a complex one approaching that of the Ruminants.

Peccaries have a total of thirty-eight teeth, that is to say, they have a pair of



THE COLLARED PECCARY AND YOUNG ($\frac{1}{4}$ nat. size).

incisors in the upper jaw, and a premolar on each side of both jaws less than the wild boar. The downwardly-directed upper tusks, which are at first completely covered with enamel, are of small size, with sharp cutting-edges behind; while those of the lower jaw are directed upwards, outwards, and slightly backwards, and are received in notches in the sides of the opposite jaw just in front of the upper tusks. The last molar tooth in each jaw lacks the hind lobe characteristic of the Old World swine (see fig. on p. 421), and the fourth premolar tooth in the upper jaw resembles the first molar in having four tubercles on its crown, instead of only three. In addition to the difference in the number of toes in the hind-feet, the peccaries are further distinguished by the upper ends of the two larger metacarpal and metatarsal bones being united, so that we have here an approach to the formation of cannon-bones. In this respect, as well as in the complex structure of their stomachs, and the presence of four tubercles on their last upper premolar teeth, the peccaries are clearly one step in advance of their allies of the Old World.

An altogether unique feature in these animals is the presence of a large gland in the middle of the back, from which is secreted in great abundance a most evil-smelling oily substance. In appearance, peccaries are not unlike small hogs but with very slender limbs; they are devoid of any externally visible tails, and their snouts are much elongated and extremely mobile. Their ears are small and pointed; and their bodies are covered with thick bristle-like hairs, elongated into a mane on the neck, and forming a fringe on the throat and hind-quarters. The young are uniformly-coloured, like their parents, and never exceed two in number at a birth.

Species.

Of the two well-defined species, the collared peccary (*Dicotyles tajacu*) is the smaller, and has the most northerly habitat, its range extending from Arkansas and Texas to the Rio Negro in Patagonia. This species stands from about $13\frac{1}{2}$ to $15\frac{1}{2}$ inches in height at the shoulder. The bristly hairs are parti-coloured, and the general hue of the pelage is blackish brown, becoming yellowish brown mingled with white on the flanks. The under-parts are brown, and the upper part of the chest white, while a broad yellowish white stripe runs from the hinder part of the shoulders obliquely downwards to the chest.

The white-lipped peccary (*D. labiatus*) is a rather larger species than the last, its height at the shoulder varying from $15\frac{1}{2}$ to nearly 18 inches. It is further distinguished by the presence of a large white spot on the lower jaw, and the white lips; the general colour of the hair being greyish black. There is also a difference in the mane and fringe on the neck of the two species. The range of the white-lipped peccary is comparatively small, including only the region lying between British Honduras and Paraguay.

Habits.

All peccaries are essentially forest-dwelling animals, but whereas the collared peccary is found only singly or in pairs, or in small parties of from eight to ten individuals, the white-lipped species associates in large herds, of which the members may be numbered by scores. Moreover, there is a marked difference in the disposition of the two species, the former being a harmless and inoffensive creature, whereas the other is comparatively fierce, and not unfrequently inflicts severe wounds with its tusks. Indeed, when a herd of these animals is encountered in the forest, the hunter frequently has to seek protection by climbing a tree. Both species frequent only the densest and most extensive forests, dwelling either in the hollows of trees, in burrows excavated by other animals, or among bushes and grass; and in parts of South America they ascend in the mountains to heights of between 3000 and 4000 feet above the sea. The herds or parties are under the leadership of an old boar. Peccaries wander about both during the day and at night; and when food is scarce they make long migrations in search of it. Their chief food consists of fruits and roots; and their teeth and jaws are of such strength as to enable them to crack with ease the hard seeds of palms. In inhabited districts peccaries inflict much damage on growing crops; and, in addition to roots and fruits, they are by no means averse to varying their diet with carrion, worms, or insects. Their flesh is not much esteemed; and it is essential that immediately the animals are killed, the ill-smelling gland on the back should be removed, as otherwise the flesh will become tainted. As a general rule, but a single young one is produced at a birth, two being comparatively rare.

When taken young, peccaries are easily tamed, although it does not appear that any attempts have been made to establish a domesticated breed. Large numbers of them are destroyed by jaguars and pumas.

Extinct Types. Fossil remains of peccaries, some belonging to living and others to extinct species, occur in the Pleistocene deposits of both North and South America. In addition to these, certain extinct Pliocene and Miocene hog-like animals seem to indicate the parent-stock from which both the peccaries and the true pigs have been derived. Of these *Cherohyus*, from North America, comes closest to the peccaries, while the Old World *Hyotherium*, of which two upper molar teeth are figured on p. 421, is more like the pigs. *Listriodon* is another European type, in which the molars have a pair of transverse ridges instead of four tubercles. Finally *Cheropotamus*, from the upper Eocene of England and France, connects the type of molar tooth characteristic of the pigs with that of the extinct anthracothere referred to on p. 421.

THE HIPPOPOTAMI.

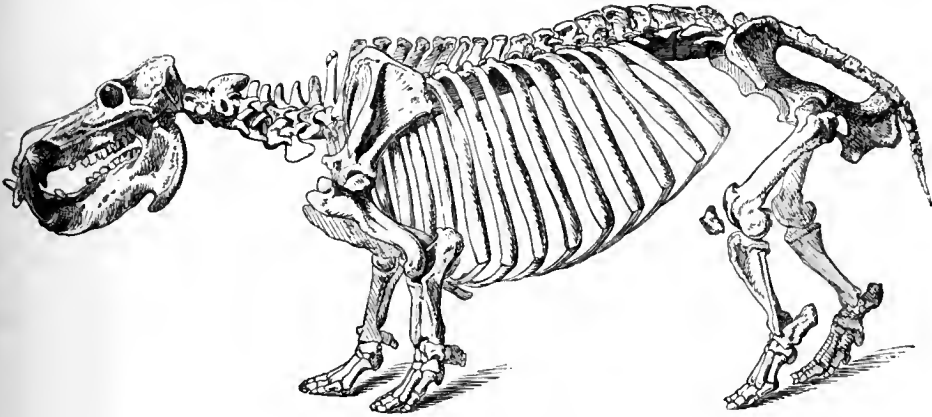
Family *HIPPOTAMIDÆ*.

Although the Greek term hippopotamus, and its English equivalent river-horse, are etymologically decidedly objectionable ones to denote the animals we have now to describe, yet the former at least is so firmly established in European languages that it would be impossible to attempt to change it. The Dutch term *see-kuh*, commonly translated sea-cow, but which we think might equally bear the interpretation lake-cow, and a name used by the Arabs which means water-buffalo, are far less objectionable; but a title equivalent to river-swine, which is said to have been conferred on these animals by the ancient Egyptians, is, from a zoological standpoint, far and away the best of all.

The common hippopotamus, together with a much smaller species from West Africa, constitute a family by themselves, which is also the last group of the even-toed Ungulates. Hippopotami are bulky animals, with round, barrel-like bodies of great length, very short and thick legs, and enormous heads, in which the muzzle is angular and greatly expanded transversely, and has no trace of the terminal disc characteristic of the swine and peccaries. Indeed, the ugly head of a hippopotamus appears as if it were too large and heavy for its owner, since the animal may frequently be seen resting its ungainly muzzle on the ground, as though to relieve the neck from the strain of its weight. The portion of the skull in front of the eyes is very much longer than that behind them; and the sockets of the eyes (as seen in our figure of the skeleton) are completely surrounded by a very prominent bony ring, which has an almost tubular form. In the pigs, on the other hand, the socket of the eye is open behind (compare the figure on p. 422). The prominence of these sockets causes the relatively small eyes of the hippopotamus to project far above the level of the forehead. The ears are small and rounded, and the slit-like nostrils are placed rather close together on the highest point of the broad bristly muzzle; while both ears and nostrils alike can be completely closed at the will of the animal. The neck is extremely short and powerful; and the body is so deep,

that when the animal is walking on soft mud, the under surface comes in contact with the ground. Disproportionately short for the size of the animal, the tail is laterally compressed from side to side. The short and broad feet are furnished with four well-developed short toes, all of which touch the ground when walking; and are encased in rounded black hoofs, of which the middle pair have not their inner surfaces flattened; so that the hippopotamus lacks the cloven hoof of the pigs and the Ruminants. The toes of the feet are partially connected by webs. Although there are a number of bristles on the muzzle, and also a few on the sides of the head and neck, as well as at the extremity of the tail, the skin of the hippopotamus is naked; it is also rather rough and warty, and of enormous thickness.

The gigantic mouth of a hippopotamus, when opened to the widest, is one of the ugliest sights imaginable, looking like a huge red cavern, from the edges of which project the enormous tusks and incisor teeth. The tusks, or canines, are the largest of the teeth in the jaws, and are curved backwards in a bold sweep, with



SKELETON OF HIPPOPOTAMUS.

their extremities obliquely bevelled off by mutual attrition; they grow throughout the life of the animal, and their points are directed downwards. The incisor teeth likewise grow during the whole period of existence, and thereby differ from those of the pigs, which form roots. In the existing species, there are not more than two pairs of these teeth, and whereas those of the upper jaw are directed downwards, the lower ones project forward in advance of the jaw. The sides of the jaws are severally provided with seven cheek-teeth, of which the four premolars have subconical pointed crowns, while the broad molar teeth carry four distinct columns, which, when worn by use, show on their summits well-defined trefoil-shaped surfaces of ivory surrounded by a rim of enamel. A peculiarity in the lower jaw of the hippopotamus is the presence of a hook-like flange at its hinder extremity, as shown in our figure of the skeleton.

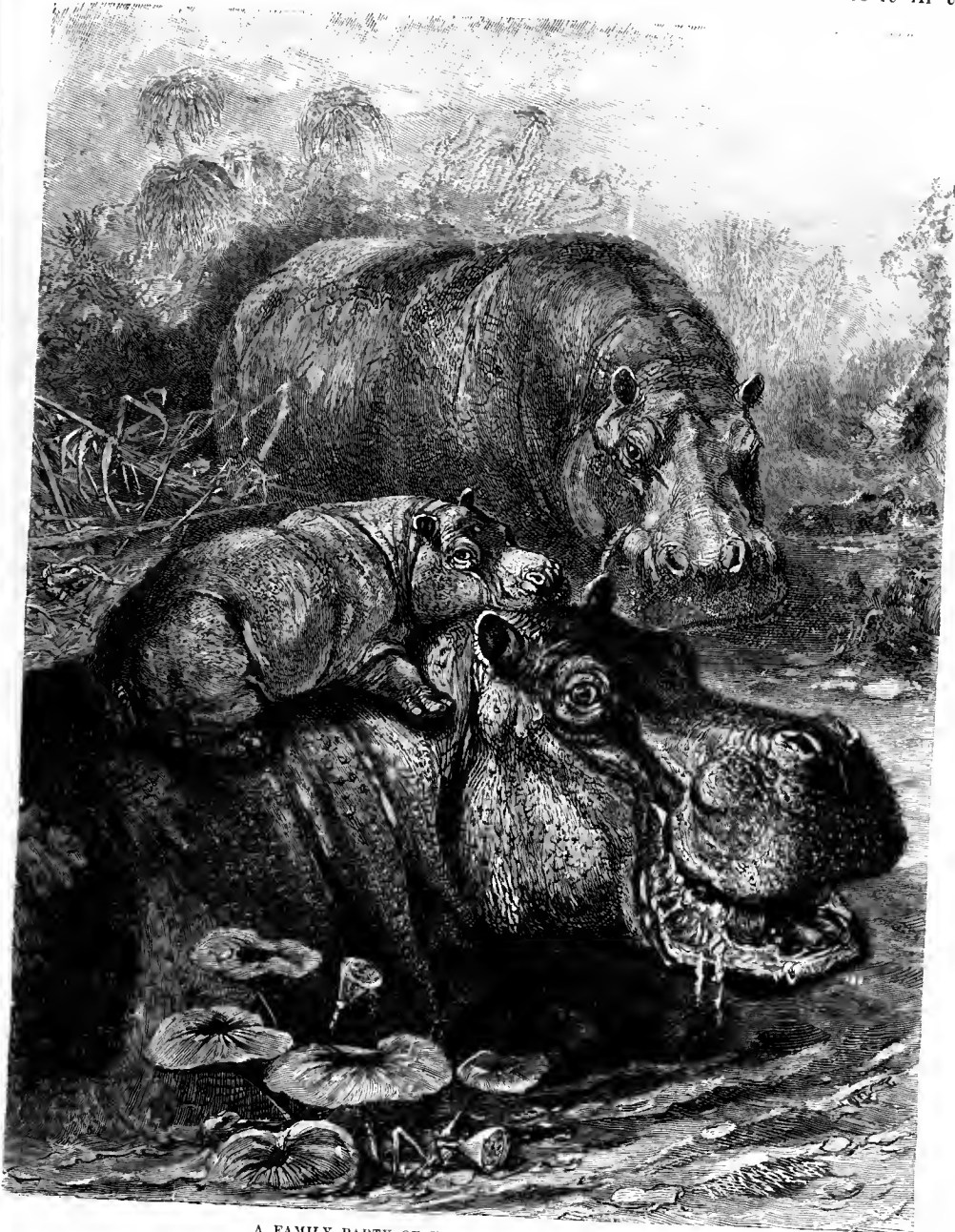
Summarising the result of the foregoing description, it may be observed that the hippopotami are entitled to rank as a distinct family on account of the following differences from the pigs and peccaries, viz. the broad and expanded muzzle, not terminating in a disc; the subequal size of the hoofs, all of which touch the ground, and the absence of flattening in the opposing surfaces of the middle pair; the

continually-growing incisor teeth; the complete ring of bone round the socket of the eye; and the hook-like flange at the hinder extremity of the lower jaw.

Common Hippopotamus. The common hippopotamus (*Hippopotamus amphibius*) is by far the larger of the two living species, and next to the elephant would seem to be the bulkiest of all existing terrestrial Mammals. A male which lived for many years in the London Zoological Society's Gardens measured 12 feet from the tip of the snout to the root of the tail, the length of the latter appendage being 22 inches, and its total weight was about 4 tons. Sir Samuel Baker states that in an old male measured by himself the length was 14 feet 3 inches from the snout to the end of the tail, the latter being about 9 inches. And the same writer estimates the weight of the hide, when freshly removed, at about 5 cwts. The height at the shoulder is some 3 feet 8 inches. This species is further characterised by having two pairs of incisor teeth in each jaw, the middle lower pair being of far larger dimensions than the others. The general colour of the skin is a slaty copper-brown, tending more to blackish brown on the back and purplish brown beneath. There is, however, considerable sexual and individual variation in this respect; and the hue of the skin also varies according to whether the animal has recently emerged from the water, or whether it is thoroughly dry. Dr. Livingstone says that while the males are of a dark colour, the females are of a yellowish brown; and when hippopotami first leave the water the upper-parts appear brownish blue and the under-parts almost flesh-coloured, but when thoroughly dry the colour of the back is blackish brown or slaty. Sir John Kirk observed in East Africa nearly pure white and also spotted individuals, while in others only the feet were white. In certain cases, however, a more or less distinct reddish, purple, or yellow tinge has been noticed. The largest recorded pair of lower tusks of the hippopotamus have a total length of 31½ inches along the curve, and a basal circumference of just over 9 inches.

That the hippopotamus formerly inhabited Lower Egypt is indicated by the occurrence of its remains in the mud of the delta, while this is also confirmed by the frequency with which it is depicted in the ancient frescoes of that country. One of these frescoes preserved in the temple of Edfu shows that the ancient Egyptians were in the habit of harpooning these animals in much the same manner as is now practised on the upper reaches of the Nile. Teeth of the hippopotamus have been dug up at Kalabshi, a short distance above the first cataract; but at the present day the animal is not to be met with north of the neighbourhood of Dongola, in the Sudan, between the second and third cataracts. And even there, according to Sir S. Baker, it is comparatively rare, although a certain number take refuge in the wooded islands between Abou Hamed and Berber. Above Khartum, hippopotami are still to be found in large numbers. Generally, it may be stated that at the present day the hippopotamus inhabits most of the African rivers and lakes lying between the 17th parallel of north and the 25th of south latitude; that is to say, in the south it is found in the upper course of the Limpopo. Formerly, however, its distribution embraced the greater part of the Cape Colony. In East, South, and West Africa the hippopotamus comes much nearer to the coast than in the north, and in many districts it is to be found quite close to, or even in the sea itself. On the other hand, in Abyssinia these animals are found dwelling in Lake

Tzana-Demba, at an elevation of over six thousand feet above the sea-level. The existing species is unknown in Madagascar; but from the reference to it in the



A FAMILY PARTY OF HIPPOPOTAMI ($\frac{1}{2}$ nat. size).

Bible, under the name of Behemoth, it is just possible that it may have inhabited Palestine within the historic period.

In the Pleistocene and upper portion of the Pliocene epoch a large hippopotamus

which appears specifically indistinguishable from the living kind was widely spread over Europe, extending from Italy in the south to England in the north. These fossil hippopotami were, however, of considerably larger dimensions than at least the average of the existing race. In England the range of the animal extended as far north as Yorkshire; and it is a remarkable circumstance that in several English localities remains of the hippopotamus are found lying side by side with those of the reindeer. It has been attempted to explain this association of such southern and northern types by assuming that in the Pleistocene period the summers were very hot and the winters very cold, and that during the summer the hippopotami wandered northwards into regions tenanted in winter by the reindeer. There are, however, difficulties in the way of accepting this explanation, not the least being the circumstance that the living African hippopotamus is not a migratory animal. We may, however, be pretty confident that wherever remains of hippopotami are found, there the rivers must have been free from ice throughout at least the greater part of the year.

Habits.

The hippopotamus is more essentially an aquatic animal than any other Ungulate, the greater portion of its time being spent in the water, where its movements are far more rapid and natural than they are on land. As the carcase of a hippopotamus when freshly killed sinks rapidly to the bottom, the specific gravity of the animal when the lungs are inflated with air cannot be far, if at all, below that of water, and the animal is consequently enabled to stay without difficulty at the bottom of a river or lake, where it can run with ease and speed. Sir S. Baker states that, when undisturbed, the average duration of time during which a hippopotamus remains under water does not exceed five minutes; but in regions where these animals are much hunted the length of the immersion is often much greater, sometimes extending to as much as ten minutes. The same writer also mentions that when on the upper Nile in a steamer that was travelling about ten knots an hour, it was not till the engineer increased the pace by putting on full steam, they were able to overtake a hippopotamus swimming about a hundred yards in advance of the vessel. When a hippopotamus comes to the surface it generally spouts up a column of water by the violent blowing-out of air through the nostrils, accompanied by a loud snorting noise; but, as we shall again notice, these animals learn caution in these respects when much persecuted. A peculiarity of the hippopotamus is that when swimming in the water and about to dive, it gradually subsides by slowly sinking the hind-quarters and afterwards the rest of the body, instead of sinking down head-foremost. When on a high bank and suddenly frightened, it will not, however, hesitate to precipitate itself headlong into the water.

As the giraffe may be regarded as the most characteristic and striking animal in an African desert-landscape, so the hippopotamus forms the most distinctive living feature in a river-scene; and nothing can be more impressive than to come suddenly upon a herd of these gigantic animals on the margin of some unfrequented lake or river. Such a scene is graphically described by Mr. Selous, who writes that on one occasion his companion and himself, after making their way through a thick bush-jungle, suddenly emerged upon a river-bank. "Upon a spit of white sand which jutted into the pool from the opposite bank, stood, high and dry, a herd

of at least twenty hippopotami, their huge, bulky carcasses looking, as they stood all huddled together, like so many black rocks." After mentioning that a water-buck standing on the further shore soon took alarm, Mr. Selous continues that the hippopotami, "though we were in full view and only about two hundred and fifty yards from them, did not seem to notice us, but stood quite motionless and apparently asleep, except that now and then one would move his enormous head slowly to the one side or the other. . . . At length they heard us talking, and commenced, one after the other, to walk into the river. When their bodies were half immersed they let themselves down with a splash, and either swam into deep water with just the tips of their heads out, or dived out of sight at once; I suppose there must have been a ledge beside which the water deepened suddenly. There were some quite small calves amongst them, and these little beasts all ran into the water with a splash, whilst the full-grown animals stepped in slowly and sedately." Similar testimony as to the ease with which hippopotami may be approached in undisturbed districts is afforded by Sir J. Willoughby in East Africa. When stealthily punting on a raft towards a small herd, this writer observes that the hippopotami, "did not seem to mind our approach in the least degree, but continued to enjoy themselves by puffing and snorting and blowing water in jets from their nostrils, and now and again sinking down, to reappear at the end of two or three minutes, and, with their heads half out of the water, to take a look round. When we were within thirty yards, they ceased their gambols to gaze with astonishment at what I suppose was the first attempt to navigate these waters."

On the White Nile Sir S. Baker states, that during the dry season he has seen a bend of the river so crowded with hippopotami, that it seemed impossible that his steamer would be able to make its way without coming into collision with some of the monsters. All, however, managed to steer clear of the path of the vessel, which passed through a perfect crowd of snorting and blowing heads.

Regarding the general habits and haunts of the hippopotamus, Dr. Livingstone states, that on the Chobi and other large rivers, the banks are marked by numerous furrows made by these animals in ascending during the night to graze on the herbage of the adjacent lands; and he adds that as they are guided back to these paths solely by scent, if a heavy rain comes on during their nocturnal excursions they are unable to find their way back to the river, and stand helpless on the land. The males generally remain in company with the females, although a few very aged individuals of the former sex may lead more or less solitary lives. "The still reaches," continues the same observer, "are their favourite haunts, as elsewhere the constant exertion necessary to keep themselves from being carried down the stream disturbs their nap. They remain by day in a drowsy yawning state, taking little notice of things at a distance. The males utter loud, snorting grunts, which may be heard a mile off. The young ones stand on the necks of their dams, and their small heads appear first above the surface as they rise to breathe. The dam, knowing the more urgent need of her calf, rises more frequently when it is in her care. In the rivers of Londa, where they are in danger of being shot, the hippopotami gain wit by experience; for while those in the Zambesi expose their heads, the others keep their noses among the water-plants, and breathe so quickly as to elude all observation."

On the banks of the White Nile, Sir S. Baker states that the favourite haunts of hippopotami are the dense masses of tall reeds fringing the river. There they pass a considerable portion of their time in marshy retreats among the canes; such dens would be impervious to human beings, and would not be observed unless from a vessel upon the river. The tangled mass of vegetation is pierced in numerous places by dark tunnels, which have been bored out by their bulky forms, and these gloomy routes form their channels of retreat, where they retire to sleep. Females, with their calves, are especially fond of these impervious bowers, where they are secure from all chances of molestation by man or beast.

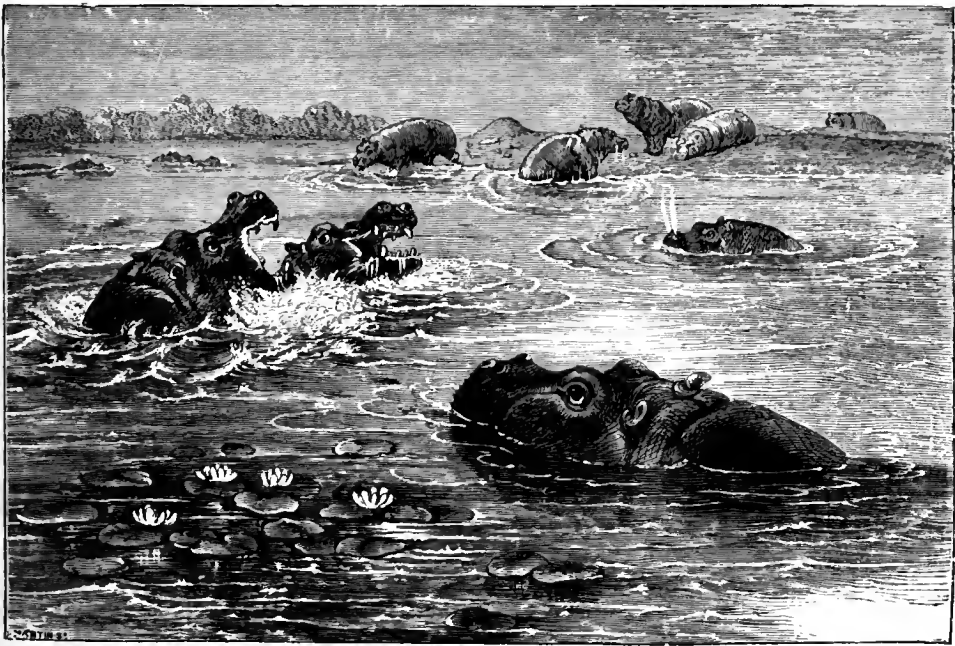
The hippopotamus is a purely herbivorous animal, and from its gigantic bulk consumes an enormous amount of food. The capacious stomach, which, when extended, measures some 11 feet in length, is indeed capable of containing between five and six bushels, which gives some idea of the vast quantity of nutriment the creature requires. In uncultivated districts, grass and various water-plants—more especially the lotus and papyrus—afford the chief food-supply; but where the land adjoining the rivers is under cultivation, the damage done to growing crops of rice, millet, maize, and sugar by hippopotami is incalculable. It is not only the amount they actually eat (although this is large enough), but the quantity damaged in their passage from one part of a field to another. Water-plants are dragged up by the roots from the beds of rivers and lakes, when not too deep, by the hippopotamus in its capacious mouth, and after being brought to the surface, are devoured at leisure. When starting for their nocturnal excursions in the fields, these animals seldom leave the river till about an hour after sunset, and do not return till dawn. On such expeditions they make a prodigious snorting and grunting, which may be heard for long distances.

There is usually but a single offspring produced at a birth, and Sir S. Baker says that he has never seen a female hippopotamus accompanied by more than two calves. The period of gestation is a little short of eight months, and it would seem that the young may be brought forth at any season of the year. The mother, as we have already noticed, is sedulous in her attention to her offspring, but the male is apt to be evilly disposed towards it. Males, according to Sir S. Baker's account, are constantly fighting among themselves at night, and apparently irrespective of any particular pairing-season; and it is also stated by the same observer that a wounded animal may be furiously attacked by a comrade.

The full age attained by the hippopotamus in its wild state has not been ascertained, but, since a calf brought to the London Zoological Society's Gardens in 1850 survived till 1878, the span of life must be considerable.

In disposition the hippopotamus is generally described as comparatively timid, but when a boat passes unexpectedly into the middle of a sleeping herd, or comes close to a solitary individual at night, the results are apt to be serious. Sir S. Baker says that, when travelling by night in an ordinary boat on the Nile, "there is no possibility of escape should a hippopotamus take into his head that your vessel is an enemy. The creature's snort may be heard at a few yards' distance in the darkness, and the next moment you may be overturned by an attack from beneath, where the enemy was unseen." Dr. Livingstone relates how that on the Chobi a solitary male issued from its lair and charged some of his company with

considerable speed, and it was reported to him that another had completely smashed a canoe with a single blow from its hind foot. On another occasion a female hippopotamus, whose young had been speared the previous day, rose suddenly beneath the canoe containing Livingstone and seven natives, and with her head lifted one half of it completely out of the water, so as nearly to overturn it. On the White Nile one of these animals boldly charged one of Sir S. Baker's steamers, and, not content with breaking several floats from one of the paddle-wheels, actually knocked two large holes with its tusks in the bottom of the vessel. The same writer also relates that a hippopotamus once struck the bottom of a "dug-out" canoe measuring twenty-seven feet in length with such force as to lift it partially out of the water. The most extraordinary incident of wanton maliciousness on



HIPPOPOTAMI AT HOME.

the part of these animals is, however, one also recorded by Sir S. Baker. His natives were swimming a herd of about twenty cattle across the Nile, when they were suddenly attacked by a party of hippopotami, some of which seized with open jaws several of the cows and dragged them beneath the water, never to reappear.

Hunting. As already mentioned, the ancient Egyptians were in the habit

of harpooning the hippopotamus, and this custom is still kept up by the Sudanis on the upper Nile. The usual plan when a party of these animals has been observed in the river, is for a couple of hunters, each armed with a harpoon to which a line is attached, to enter the river some distance above, and swim cautiously down on the herd. When within striking distance, both men hurl their weapons at the same time. To each line is attached a wooden float, which marks the position of the animal while below the surface, and the chase is taken up by other hunters on the bank armed with harpoons and lances. By an ingenious

arrangement, the float is at length captured by a rope and the animal dragged to shore, where it is despatched with lances. This, however, Sir S. Baker states, is frequently not accomplished without the death of one or more of the intrepid hunters. In Central Africa, on the other hand, the hippopotamus is harpooned from canoes. In other parts the favourite method is to suspend a weighted spear, frequently tipped with poison, over a branch of a tree near the tracks of the hippopotamus, and to make fast the end of the line, to which it is attached to stakes on either side of the path. When the animal comes along, it strikes against the line, the stakes are loosened, and the heavy spear comes down with a thud on its head or back. Yet another plan is to construct pitfalls in the paths frequented by these animals, and to cover them over carefully on the top with boughs, reeds, or grass.

The most cruel method is, however, one sometimes employed by the Kaffirs of South-Eastern Africa, who, as Mr. Selous relates, are in the habit of starving the unfortunate brutes. They select a pool in a river where the bottom is sandy, and consequently where there is no vegetation; and for choice they prefer a pool with a high bank on one side. Having driven or watched a party of hippopotami into such a pool, the Kaffirs form a hedge round the open sides, and thus render egress impossible. Mr. Selous states that on one occasion he came across such a pool, where, so far as he could ascertain, the animals had been enclosed for about three weeks. When his party reached the scene of operations there were still ten living hippopotami in the pool. "Eight of these seemed to be standing on the bank in the middle of the water, as more than half their bodies were exposed; the poor brutes were all huddled up in a mass, each with his upraised head resting on another's body. Two more were swimming about, each with a very heavily-shafted assegai sticking in his back; these assegais are plunged into them at night when the starving beasts come near the fences seeking for a means of exit from their horrible prison."

Europeans are in the habit of shooting hippopotami with rifles, but most who have tried this sport agree that, when the novelty has worn off, it is not of a very exciting nature. Although when first killed the carcase of a hippopotamus sinks to the bottom immediately after death, it will rise within twenty-four hours, owing to the generation of gases in the stomach, if the depth of water does not exceed some twenty-five feet.

Products. Formerly hippopotamus ivory was valued for the manufacture of artificial teeth, and in the early part of this century it fetched as much as twenty-five shillings per lb. Now, however, the animal is hunted solely for its hide and fat, or for the sake of its flesh as food. The hide is used for whips, and, according to Sir S. Baker, also for facing revolving wheels employed in polishing steel. A good hippopotamus will yield about 200 lbs. of pure fat; and the writer last named states that the flesh of the hippopotamus is always palatable, that of the young calf being delicious; the feet of the latter making an excellent stew, and its skin soup which has been compared to turtle.

In Captivity. Hippopotami thrive well in captivity, and breed not unfrequently. The first specimen exhibited in the London Zoological Society's Gardens was captured on the upper Nile in 1849, and brought to England in

the following year, where, as already mentioned, it lived till 1878. This was a male, and although a consort was obtained for it in 1853, no young were produced till 1871. The calf born in that year did not, however, long survive, and the same untimely fate also befell a second calf produced in the spring of the following year. A third calf was born in the autumn of 1872, and is still living (1894).

Pigmy Hippopotamus. The Liberian or pigmy hippopotamus (*H. liberiensis*) from Western Africa is a much smaller animal, not exceeding a pig in dimensions, and weighing only about 400 lbs. This species differs structurally from the common one in having only a single pair of incisor teeth in the lower jaw, although a small representative of the second pair may sometimes occur on one side. The colour of the back is slaty black, while that of the under-parts is dirty greyish white, and the sides greenish slaty grey. The height at the shoulder is about 2 feet 6 inches, and the total length 6 feet, of which 7 inches are occupied by the tail.

Habits. This diminutive species appears to be confined to Upper Guinea, and according to Herr Büttikofer is found only in swamps and damp forests, and not in rivers. Its habits are said, indeed, to be more like those of wild swine than those of its gigantic cousin, and, instead of traversing well-beaten paths, it wanders great distances in the woods. The author quoted is uncertain whether the Liberian hippopotamus is nocturnal or diurnal in its habits, although he is inclined to believe that it is the latter. It is, however, certain that it lives either solitary or in pairs, and that it never associates in troops like the larger species.

Extinct Hippopotami. Among extinct species of the genus, the Maltese hippopotamus (*H. minutus*), of which the remains are found in such enormous quantities in the caverns of Malta and Sicily, appears to have been no larger than the Liberian species, though it resembled the ordinary living African one in the number of its lower incisor teeth. Intermediate in size between the Maltese and the common hippopotamus was Pentland's hippopotamus (*H. pentlandi*), found in the same deposits as the former. The vast quantities in which the remains of these two extinct species are found in the Sicilian caves presents a puzzle, since hippopotami are not the sort of animals which one would expect to frequent such habitations. Some years ago many shiploads of teeth and bones of these species were imported into England from Palermo for the manufacture of charecoal.

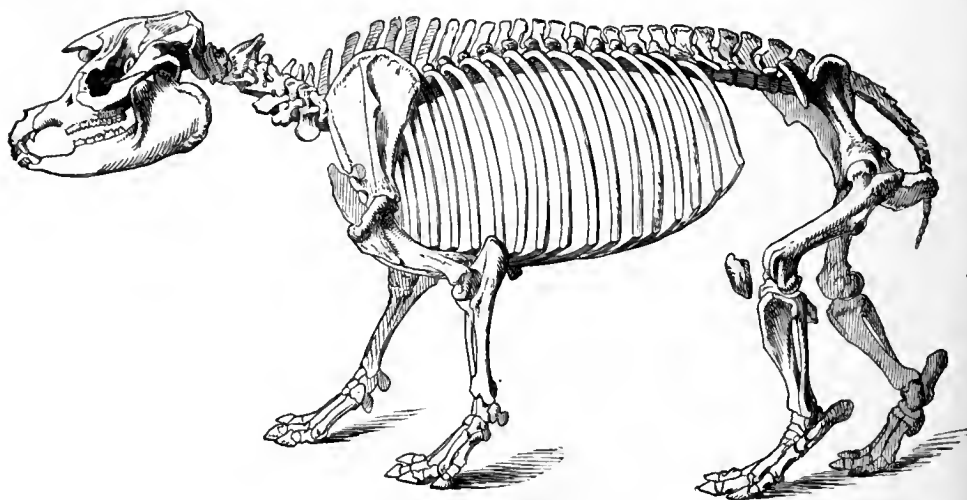
Although hippopotami are now quite unknown in India, during the Pleistocene and Pliocene epochs they were abundant in that country. In the Pleistocene of the Narbada Valley in Central India remains of two species of the genus are met with; one of these (*H. palaindicus*) being characterised by the presence on each side of the lower jaw of a small incisor tooth between the two larger ones, corresponding to those of the common African hippopotamus; while in the second Narbada species (*H. namadicus*) both upper and lower jaws were provided with three nearly equal-sized pairs of incisor teeth. The same condition also obtains in the Siwalik hippopotamus (*H. sivalensis*) from the Pliocene rocks at the foot of the Himalaya, and likewise in the Pliocene Burmese hippopotamus (*H. iravadicus*) and the Algerian hippopotamus (*H. bonariensis*), which was likewise of Pliocene age. An extinct hippopotamus (*H. lemerlei*) has also been discovered in the superficial deposits of Madagascar.

CHAPTER XXVI.

UNGULATES,—*continued.*

TAPIRS, RHINOCEROSSES, AND HORSES.

WITH the three groups of animals known as tapirs, rhinoceroses, and horses, we come to an assemblage of Ungulates differing in many important respects from all those described in the preceding chapters, and collectively constituting a distinct primary division of the order to which they belong. The most obvious external



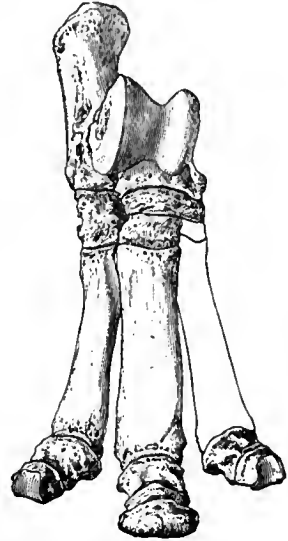
SKELETON OF MALAYAN TAPIR.

characteristics of this assemblage of animals are displayed by their feet, in which, as we have already had occasion to mention (p. 153), the toe corresponding to the third or middle finger of the human hand, or to the middle toe of the human foot, is always larger than either of the others, and is symmetrical in itself. This peculiarity of foot-structure is exhibited in the accompanying figure, and likewise in the smaller figures on p. 455; and how essentially different it is from the type of foot obtaining in the even-toed Ungulates will be apparent by contrasting these figures with the illustration of the foot of the pig given on p. 422. In all the Even-toed Ungulates, we may once again remind our readers, instead of the third toe being symmetrical in itself and larger than either of the others, it is symmetrical to a line drawn between itself and the fourth toe, and is equal in size to the latter, with which it forms a pair.

Although in the members of the present group the number of toes in the foot is frequently three, it may be increased to four or diminished to one; yet in all

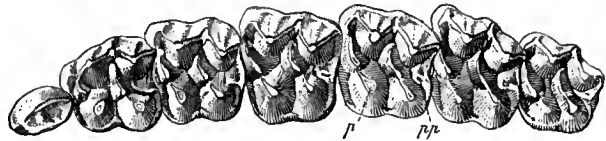
these variations the symmetry of the third digit is preserved. And it is on account of the prominence of this same digit that the group has received the designation of the Odd-toed, or Perissodactyle Ungulates.

Another distinctive feature of this group is to be found in the conformation of the astragalus of the ankle-joint of the hind-foot. This bone, which forms the upper right-hand corner of the accompanying figure of the hind-foot of a rhinoceros, is characterised by its deeply-grooved pulley-like superior surface, while inferiorly it is abruptly truncated; and, unlike that of the Even-toed group, it has not a facet for articulation with the fibula, or smaller bone of the leg. The astragalus of an Even-toed Ungulate is, on the other hand, a more elongated bone, with its lower surface highly convex, and divided into two distinct moieties. A third very important characteristic of the limbs of the Odd-toed Ungulates is that the femur, or bone of the upper segment of the hind-leg, is furnished with a projecting crest on the upper part of its hinder surface known as the third trochanter; this trochanter (of which the position is clearly shown in the left hind-limb of the figure of the skeleton of the tapir) being quite unknown among the Even-toed Ungulates.



BONES OF THE RIGHT HIND-FOOT OF AN EXTINCT RHINOCEROS. (From Osborn.)

The foregoing characteristics of the feet are alone sufficient to distinguish the Odd-toed Ungulates from the even-toed group, but there are also certain other features—especially some connected with the teeth—which it is advisable to notice. As regards the cheek-teeth, it may be observed that in the upper jaw the premolars (as shown in the accompanying figure) are generally as complex as the molars, whereas in most members of the Even-toed group they are simpler. Then, again, all the upper cheek-teeth, with the exception of the first, in most



THE LEFT UPPER CHEEK-TEETH OF THE ANCHITHERE. (From Osborn.)

of the earlier and more primitive representatives of the group are characterised by carrying six columns or cusps on their crowns, of which the two innermost pairs tend to unite more or less completely, and thus form a pair of oblique transverse ridges, extending across the crown to the two outer columns; the two latter also uniting to form a longitudinal outer wall to the tooth. From this primitive type of tooth all the more specialised developments may be derived, and, as we shall have occasion to notice later on, while the earlier forms have low-crowned molar teeth, like those represented in the figure, some of the later types have the crowns greatly elongated in the vertical direction. In this respect, therefore, the Odd-toed Ungulates have developed in a manner exactly paralleled among the Even-toed group, a similar parallelism being also noticeable in respect to the reduction of the number of toes on the feet. Moreover, as we find in the Even-toed Ungulates

an increased length in the metacarpal and metatarsal bones of those forms in which but two functional bones remain, so in the present group there is a similar elongation of the single metacarpal and metatarsal (cannon) bones in its one-toed representatives, namely, the horses. It is only of late years that the great importance played by parallelism in the development of allied groups of animals has been fully recognised, and fresh instances of it are being constantly discovered. In no group are there better examples of this phenomenon than among the Ungulates, where it is displayed among several groups, and affects totally different parts of the skeleton.

The lower cheek-teeth of the Odd-toed Ungulates very generally differ from those of the other main group in that the last of the series resembles those in advance of it in having two lobes, this feature being distinctive of the whole of the existing members of the group. On the other hand, in all the living representatives of the even-toed group, with the single exception of one small antelope (*Neotragus*, p. 309), the corresponding tooth has three distinct lobes. Generally, the lower cheek-teeth of the present group carry either two transverse ridges or a pair of crescents, one in front of the other, on their crowns. It may be added that all the Odd-toed Ungulates have simple stomachs, and that in all cases the liver is not provided with a gall-bladder.

The whole of the living Odd-toed Ungulates may be divided into three well-marked family groups, which are commonly designated as tapirs, rhinoceroses, and horses (the latter term including zebras, asses, etc.); and according to the classification adopted in this work, each of these three families is now represented only by a single genus. With the exception of the tapirs, which are common to the Malayan region and Central and South America, all the existing Odd-toed Ungulates are Old World animals. Moreover, all the three groups are represented by a comparatively small number of species, while, with the exception of the horses, these species are far inferior in the number of individuals by which they are represented to the majority of the Even-toed Ungulates. All these circumstances point to the conclusion that, as a whole, the Odd-toed Ungulates are a waning group; and this conclusion is fully supported by the discoveries of palæontology. Thus, in the first place, both rhinoceroses and horses were abundantly represented during former epochs in the New World; while, in the second place, the rocks of both hemispheres have yielded fossil remains of an enormous number of extinct generic, and even family, types of Odd-toed Ungulates, several of which serve to connect very closely together the three living groups. What may have been the reason of this gradual waning of the Odd-toed Ungulates, and the enormous development of the Even-toed group during the later geological epochs, it is not easy to divine. Perhaps, however, it may be that the former group is one of a lower and less adaptive nature than the latter. The horses are, however, an exception to the other members of the present group, both as regards the number of species and individuals (irrespective of those bred by man), and belong to a specialised branch which has been raised to a platform of evolution as high as that occupied by the Ox family in the other group. Even here, however, it is hard to understand why horses (until reintroduced by the Spaniards) became extinct throughout the New World, unless indeed Mr. W. H. Hudson's suggestion that they were exterminated by pumas should prove to be well founded.

THE TAPIRS.

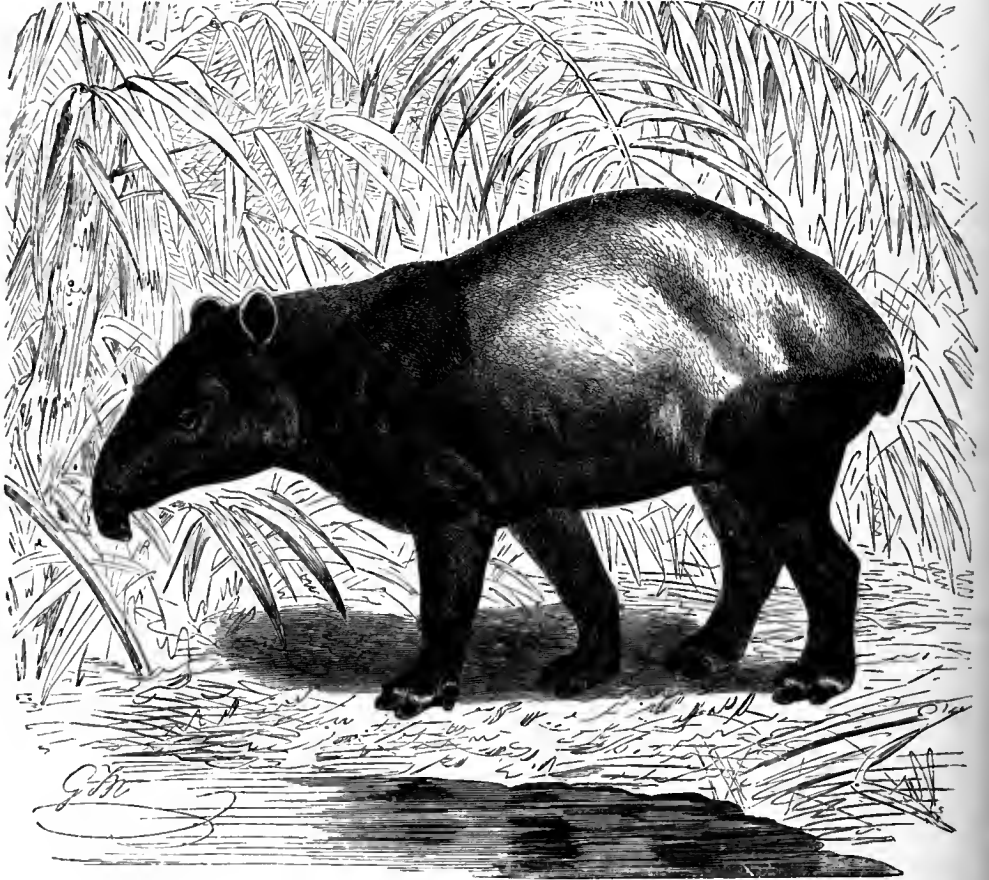
Family *TAPIRIDÆ*.

The tapirs are the least specialised of all the existing Odd-toed Ungulates, and their peculiarly antediluvian appearance would indeed suggest this even to the unscientific observer. Their generalised character is indicated by the circumstance that they differ from all other living members of the same great group by having four toes to their fore-feet, although their hind-feet resemble those of the rhinoceroses in being tridactyle. In the fore-feet the three main toes correspond to the three middle fingers of the human hand, while the small external one represents the fifth, or little finger. The tapirs are further characterised by the production of the extremity of the muzzle into a short cylindrical proboscis or trunk, at the extremity of which are situated the nostrils. The general form of the body is heavy and ungainly, the limbs being relatively short and stout, and the tail scarcely more than a rudiment. The eyes are small in proportion to the size of the head, and the erect and oval ears of moderate size. The thick skin is smooth and covered with a rather scanty coat of short hair, which is usually of uniform colour.

The skull, as seen in the figure of the skeleton on p. 454, is rather short, narrow, and high, its most distinctive features being the enormous size of the aperture of the nose, and the absence of any bony bar dividing the socket of the eye from the great channel on the side of the brain-case. The teeth are forty-two in number, or two less than the full typical number, the missing ones being the first premolar on each side of the lower jaw. The short-crowned cheek-teeth are separated from those in the front of the jaws by a long gap, and the tusks, or canines, are small, those of the upper jaw being inferior in dimensions to the outermost pair of incisors. The upper cheek-teeth have two transverse ridges and an outer longitudinal wall, while those of the lower jaw carry a pair of transverse ridges alone. In the limbs all the bones are fully developed and quite distinct from one another. It may be added that the toes are encased in long and rather oval hoofs, while inferiorly the foot is furnished with a large callous pad, which takes a share in supporting the weight of the body. Except when the soil is soft and yielding, the small outermost toe of the fore-foot scarcely touches the ground.

Distribution. The existing tapirs, all of which may be included in the one genus *Tapirus*, have a most remarkable geographical distribution, a solitary species being found in the Malayan region, while the whole of the other four are restricted to Central and South America. Still more remarkable is the circumstance that, instead of all the American species being closely allied, two of them are nearly related to the Malayan tapir, while the other two form a totally distinct group. A flood of light on this remarkable instance of what is known as discontinuous distribution is, however, thrown by palæontology, remains of extinct tapirs having been discovered in the middle and upper Tertiary rocks of Europe (including those of England) and China, while nearly-allied or identical forms occur in those of the United States. Such remains are also found in the cavern-deposits of Brazil, which belong to the later Pleistocene epoch. Since these extinct forms

belong to the existing genus, tapirs may be regarded as among the oldest of living Mammals. It was considered by Mr. Wallace that the Old World was the original home of the group, from whence they migrated to North America; but subsequent discoveries have rendered this doubtful. Probably, however, they are but comparatively recent immigrants into Central and South America. And it is interesting to notice, as Mr. Wallace observes, that while in the Old World, where they were once so abundant, they have dwindled down to a single species, existing in small numbers in the Malay Peninsula, Sumatra, and Borneo only, in the western



THE MALAYAN TAPIR ($\frac{1}{3}$ nat. size).

continent they occupy a much larger area, and are represented by several distinct species. With regard to the probable ancestors of the tapirs, we shall have some remarks to make at the conclusion of this chapter.

Save for the circumstance that the Malayan species differs from all the rest in coloration, the various kinds of tapirs are remarkably alike, both in respect of bodily form and habits. Whereas, however, four of the species are found at or near the sea-level, the fifth inhabits comparatively high elevations in the Cordilleras.

Habits. Speaking of tapirs in general, Sir W. H. Flower remarks that "they are solitary, nocturnal, shy, and inoffensive, chiefly frequenting

the depths of shady forests and the neighbourhood of water, to which they frequently resort for the purpose of bathing, and in which they often take refuge when pursued. They feed on various vegetable substances, as shoots of trees and bushes, buds and leaves."

Malayan Tapir. The Malayan tapir (*T. indicus*) is the largest of the whole group, and differs from all the others in its parti-coloured skin. In height this animal stands from 3 to 3½ feet at the withers, and about 4 inches more at the rump, its length along the curves from the tip of the snout to the root of the tail being about 8 feet. In the adult the colour of the head and front of the body, as well as the limbs, is dark brown or black, while the body from behind the shoulders to the rump and the upper part of the thighs is greyish white, as are also the ears. On the other hand, the newly-born young are brownish or velvety black, marked with spots and longitudinal streaks of brownish yellow on the sides, and of white beneath; the change from the young to the adult coloration taking place, according to Mr. Blanford, between four and six months after birth.

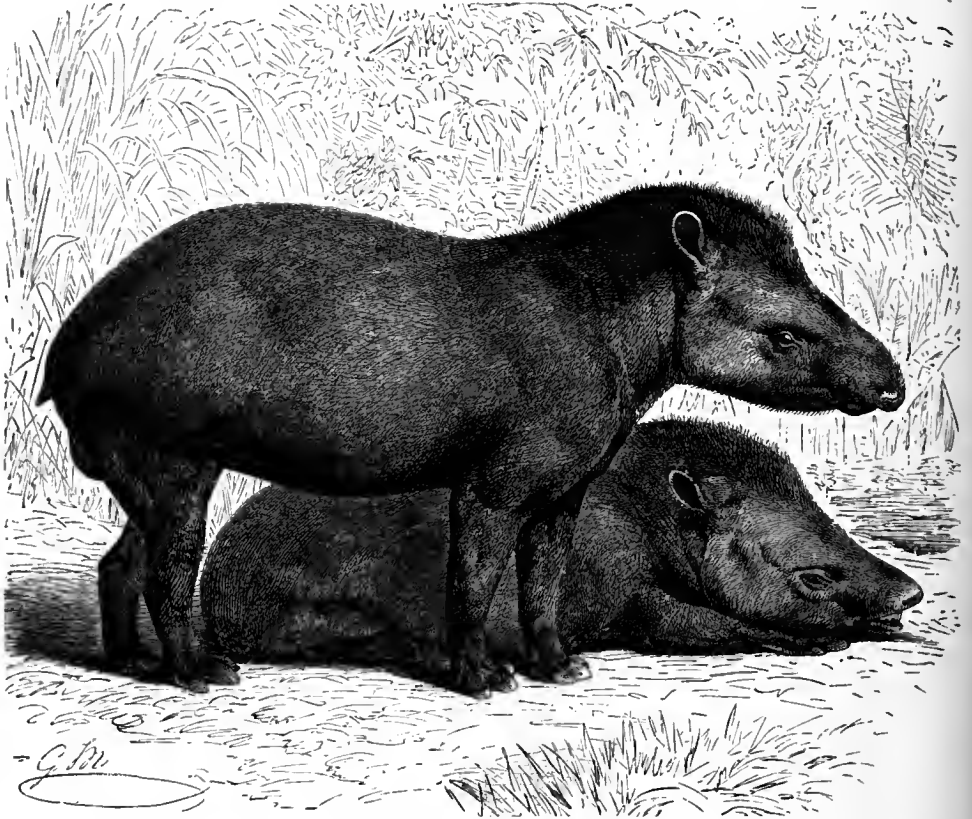
The Malayan tapir is found in the peninsula from which it takes its name, extending northwards to Tenasserim, and it also occurs in the island of Sumatra, and perhaps in Borneo. Although one of its skulls had been sent to the Asiatic Society of Bengal in Calcutta as far back as the year 1806, it was not till Diard in 1817 sent to Cuvier a portrait and description of a specimen then living in the viceroy's menagerie in Barrakpur, near Calcutta, that it was recognised in Europe as a distinct species. Apart from a notice by Wahlfeldt in 1772, Sir Stamford Raffles had, however, knowledge of the creature's existence in 1805, and in 1816 Major Farquhar sent a description of the animal to the Asiatic Society of Bengal.

Owing to its retiring nature, the Malayan tapir is but seldom seen in its native haunts, and our information as to its habits is consequently meagre in the extreme. Indeed, nothing is known as to its breeding-habits, although it seems to be ascertained that but one young is produced at a birth. Mr. Mason writes that, "though seen so rarely, the tapir is by no means uncommon in the interior of the Tavoy and Mergui provinces. I have frequently come upon its recent footmarks, but it avoids the inhabited parts of the country." When taking to the water, it is reported to plunge in and walk along the bottom, instead of swimming. In spite of its shy and retiring habits, this tapir, if captured at a sufficiently early period, can be readily tamed, and is said to exhibit considerable attachment to its master.

American Tapirs. Of the New World tapirs the best known species is the common South American tapir (*T. americanus*), originally described by Linnæus as a terrestrial species of hippopotamus. In common with the other American kinds, the adult is of a uniform dark brown or blackish colour, although the young are striped and spotted after the manner of the Asiatic species. The snout is shorter than in the latter, the hinder part of the head more elevated, and the crown of the head and neck furnished with a short, stiff, upright mane. The margins of the ears are white. This species inhabits the forest-districts of Brazil, Paraguay, and the northern part of Argentina. The second member of this group is Ronlin's tapir (*T. roulini*), which is a mountain species inhabiting the Cordilleras of Ecuador and Colombia at an elevation of from seven thousand to eight thousand feet above the sea, and locally known as the pinchaque. It has a less vaulted skull and a rounder

neck, without distinct crest, than the lowland species, from which it is further distinguished by the presence of a long white spot on the chin.

The two remaining species are Baird's tapir (*T. bairdi*), ranging from Mexico to Panama, and Dow's tapir (*T. dowi*), restricted to Guatemala, Nicaragua, and Costa Rica, which constitute a second group of the genus distinguished by the characters of the skull. In all the three species of the first group, as seen in the figure of the skeleton given on p. 454, the nasal cavity is perfectly open in advance of the roofing bones of the skull; but in those of the second group this cavity is



THE AMERICAN TAPIR ($\frac{1}{12}$ nat. size).

divided by a vertical partition in the middle line, similar to one shown later on in the figure of the skull of an extinct rhinoceros.

Habits. The following notes on the habits of the American tapirs refer mainly or exclusively to the common species. These tapirs confine themselves exclusively to the thickest parts of the forests, carefully avoiding all open spaces, and forming regular pathways along which they travel in search of food and water. In the forest itself it is generally difficult to come across them, but Humboldt and others state that, when travelling on the rivers by boat, tapirs may be often seen in the early morning, when they come to the bank for the purpose of drinking. Although mainly nocturnal, it is stated that in the densest and darkest portions of the forest tapirs may be encountered abroad during the

daytime. They are fond of gamboling in the water and rolling in soft mud, their hides being often thickly plastered with the latter, probably as a protection against the bites of insects. Indeed, in many respects their mode of life is very similar to that of swine, although in their more solitary habits they present a closer resemblance to their cousins the rhinoceroses. Thus the males, except during the pairing-season, are said to be completely solitary, and even family parties are but rarely met with; and, except when several have been temporarily collected by the attraction of unusually good pasture, it is but very seldom that more than three individuals are seen in company. Tapirs commence to feed in the evening, and probably continue throughout the greater part of the night.

These animals are slow and deliberate in their movements, usually walking with their snouts close to the ground, and by the aid of scent or sound detecting the presence of foes with extreme acuteness. When frightened, however, they rush blindly forwards, crashing through bushes or splashing through water in precipitate flight. The American tapir is an excellent swimmer, crossing the largest rivers with facility, and even diving beneath the surface of the water, although with what object is not ascertained. Not improbably it may also walk along the beds of shallow rivers and lakes, as was observed to be the habit of a specimen of the Malayan species kept in captivity at Barrakpur.

The chief sound uttered by the American tapir is a peculiar shrill whistle, which, according to Azara, has but little volume in comparison with the size of the animal by which it is emitted. This whistle is uttered at all seasons, and is not, as has been supposed, restricted to the pairing-season; the Malayan species is reported to give vent to a very similar sound. When suddenly disturbed, the American tapir utters a loud snort.

Although in general perfectly harmless animals, fleeing precipitately before the smallest dog, tapirs will sometimes attack their enemies fiercely, this being more especially the case with females that have been deprived of their young. In such instances they rush violently at their foes—human or otherwise—and after knocking them down will trample upon and bite them after the manner of wild swine.

In Brazil, the food of the tapir is largely composed of palm-leaves in districts remote from cultivation, but at certain seasons of the year these animals subsist almost exclusively on fallen fruits, while in other districts swamp-grasses and water-plants form their chief nutriment. In the neighbourhood of plantations they frequently do much harm to the crops of sugar-cane, melons, etc., and they are especially dreaded by the proprietors of cacao-plantations for the amount of damage they inflict on the young plants. Salt seems especially grateful to their palate, and in order to obtain it they will eat the saline earth found in many parts of South America. In captivity they are fond of any sweet substances, and it is also said that in this condition they frequently become almost as omnivorous as swine. The American species can be as easily tamed as their Asiatic cousin, and tame individuals may sometimes be seen at large in the streets of some of the South American towns.

Hunting.

Although on account of their affording no trophies in the shape of horns, antlers, or tusks, tapirs offer no attraction to European

sportsmen, yet they are much sought after by the native South-American hunters for the sake of their flesh and hide. The flesh is said to be juicy and well-flavoured, and both in appearance and taste resembles beef. The skin, which is of great thickness and strength, is cut into long thongs, which, after being rounded and treated with fat, are used for reins and bridles. It is, however, unsuited for shoe-leather, as it becomes very hard and unyielding when dry, and very soft and spongy when wetted. The hairs, hoofs, and certain other parts are used by the natives as medicine; the hoofs being sometimes hung round the neck as charms, and in other cases ground to powder and taken internally.

In South America tapirs are generally hunted with the aid of dogs, which chase the animals through the forest until they enter the water. Here they are attacked by the hunters, who have lain concealed among the reeds on the river bank, and by them they are pursued as they dive and swim in the water. When the area of water is not too large, the chase is frequently of no great duration, and the animal is before long despatched either with a club or a hunting-knife. Sometimes, however, the hunt is more protracted, the tapir leaving the water and breaking away from the dogs among the dense reeds or bushes, until again brought to bay in another pool or river. The traveller Schomburgk gives a graphic account of a tapir hunt he once witnessed when in South America. As his vessel rounded a headland on the river, a female tapir with her young came into view standing on a sandbank. Scarcely, however, had his Indians time to utter the word "Maipuri" (the native name of the common species), than the two animals caught sight of the party, and dashed into the thick cover on the bank. This cover was in the form of giant reeds and grass, with sharp-cutting edges, some seven feet in height, which offered a formidable obstacle to the progress of Europeans. The Indians, however, wriggled their way between the stems like snakes; and soon two shots in quick succession, followed by a shout of triumph, told that they had come up with their quarry. When Schomburgk reached the scene, he passed the female tapir lying dead with a bullet through the lungs. The dogs then took up the trail of the young one, which was concealed among the reeds. As soon as the creature perceived that it was discovered by the dogs, it uttered the peculiar whistling cry, mentioned above, by which the hunters were guided to its place of concealment. Eventually the young tapir, which was about the size of an ordinary full-grown pig, broke cover, and after an exciting although short chase was despatched.

In some parts the South American Indians track the tapir to its lair, and shoot it as it lies. In Paraguay, when the hunters capture a young tapir of too large a size to be carried on a horse in front of the rider, they bore a hole in one side of the snout through which they pass a thong, and the animal will then follow readily enough when led.

Next to man, the worst foes of the tapir are the larger cats; the **Foes.** jaguar preying largely on the American species (as depicted in the coloured Plate in the first volume), and the tiger attacking its Malayan cousin. It is said that when an American tapir is attacked by a jaguar, it immediately rushes into the thickest cover in the hope of dislodging its assailant, which from the thickness of the animal's hide is unable to obtain a firm hold on its back.

It is further reported that the tapir is not unfrequently successful; and, in any case, many of these animals are killed with the marks of jaguar's claws on their backs.

Succession of Teeth. Before leaving these animals, it may be mentioned that the whole of the four premolar teeth on each side of the upper jaw are preceded by milk-teeth, whereas in the pig and other Even-toed Ungulates the first of these teeth never has a deciduous predecessor, as, indeed, is the case with other groups of Mammals. Some rhinoceroses, however, resemble the tapirs in having the first premolar preceded by a milk-tooth, although this seems to be merely an individual, and not a specific peculiarity.

THE RHINOCEROSES.

Family RHINOCEROTIDÆ.

Although inferior in length of body, and probably also in weight, to the hippopotamus, the larger species of rhinoceros exceed it in height, and, therefore, vie with it in claiming the position of being the Mammals next in point of size to the elephants. Unlike the tapirs, the various species of rhinoceros, all of which are now confined to the Old World, differ very markedly from one another in structure—so much so, indeed, that by many writers they are divided into several genera; and there is also considerable disparity in point of size. In spite, however, of these minor differences, all these animals are so much alike in general appearance, that it seems preferable to include the whole of them in the single genus *Rhinoceros*. All the existing rhinoceroses differ from tapirs in having but three toes on both fore and hind-feet, but since there are some extinct species with four toes to the front limbs, this point of distinction cannot be regarded as a very important one. The presence of one or two horns in the middle line of the front of the head might at first sight be regarded as a more valuable diagnostic character, but since these appendages are always or frequently absent in the female of one of the living Indian rhinoceroses, and are invariably wanting in certain extinct kinds, it will be obvious that other features must be sought that will distinguish these animals from the tapirs.

Teeth. Such characteristics are to be found in the cheek-teeth, of which two from the upper jaws of certain extinct species are represented in the figures on next page. In the molar teeth of the upper jaw the two outer columns have completely coalesced so as to form a continuous external wall to the crown; this wall being sinuous, and in some cases (as in the upper figure) forming a prominent buttress at the front outer angle of the crown. From this outer wall proceed two continuous oblique transverse ridges, separated from one another by a deep valley, interrupted by projecting processes from one or both ridges, and sometimes also from the outer wall. This middle valley is usually quite free from cement; and its form, as likewise the relative height of the whole crown, varies considerably in the different species. Instead of having the simple transverse ridges found in those of the tapirs, the lower cheek-teeth of the rhinoceroses have a pair of crescents, placed one in front of the other. On each

side of both the upper and lower jaw there are seven cheek-teeth; but the last molar in the upper jaw differs from the rest in having its hinder ridge more or less aborted, so that the form of the crown is generally triangular.



LEFT UPPER MOLAR TEETH OF TWO EXTINCT SPECIES
OF RHINOCEROS.

Both considerably worn by use.

growing from the skin, and having no connection with the bones of the skull, although there are prominences on the latter beneath each horn. The skull, as shown in the figure of that of an extinct species given in the sequel, is characterised by its elevated occipital region, long curved profile, the absence of

As regards their front teeth, the different species of rhinoceros present a considerable amount of variation, some of them having such teeth in both jaws, while in others they are totally absent; but there are never any canine teeth or tusks in the upper jaw, and the number of upper incisor teeth never exceeds two pairs. In the lower jaw there may be a pair of large pointed and nearly horizontal tusks, and between them a small pair of incisor teeth.

Form. All the living rhinoceroses are animals of large size and heavy build, with the legs comparatively short and stout, although less so than in the hippopotamus. Each of the toes is furnished with a relatively small, but broad and well-defined hoof-like nail. The head is large and elongated, with a concave profile; and the erect oval ears placed very far back. The eyes are very small in proportion to the size of the head; and the upper lip is generally, although not invariably, prehensile, and prolonged beyond the extremity of the lower one. The thick skin is either naked, or but sparsely clad with hair, and may be thrown in certain parts of the body into a series of deep folds. The tail is thin and of moderate length.

Horns. The horns, which form the characteristic feature of the physiognomy of the living species, are composed of a closely-packed mass of horny fibres,

INDIAN RHINOCEROS.





any bony bar at the hinder part of the socket of the eye, and the large size of the nasal bones, which are completely fused together. In those species with but one horn this is carried upon the nasal bones, and the front horn of those with two of these appendages has a similar situation; but the second horn, when present, is placed on the frontal bones.

Habits. Rhinoceroses are stupid and somewhat timorous beasts, generally striving to escape from man, although when brought to bay exceedingly fierce, and consequently from their great size very dangerous. Although the African species are entirely dependent on their enormous horns, as weapons of offence and defence, the Asiatic kinds, in which the horns are smaller, seem to rely chiefly upon their sharply-pointed lower tusks, which are capable of inflicting terrific gashes. All are mainly nocturnal; and while some resemble the tapirs in frequenting tall grass-jungles and swampy districts, others seem to prefer more or less open plains. Their food is entirely vegetable; but whereas some species subsist almost exclusively on grass, the food of others consists mainly of twigs and small boughs of trees; this difference in diet being correlated with a difference in the structure of the molar teeth. At the present day these animals are restricted to South-Eastern Asia and Africa; and they may be divided into two main groups according to their geographical distribution, the Asiatic group being again subdivided into two minor groups.

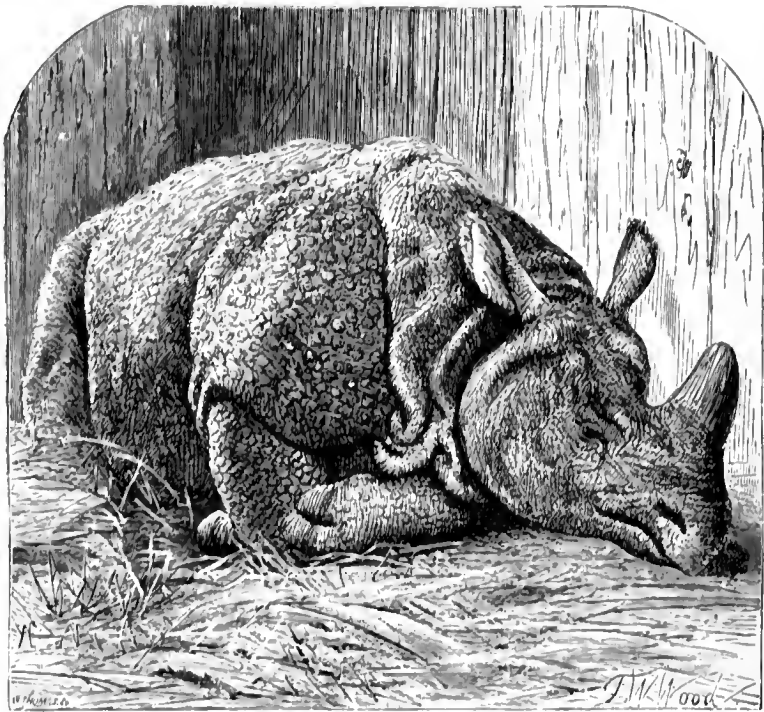
THE ASIATIC RHINOCEROSSES.

The whole of the three species of rhinoceroses inhabiting Asia are characterised by the skin being thrown in places into thick folds, and by the presence of teeth in the front of the jaws; the horns being either one or two in number.

Indian Rhinoceros. By far the largest of these three is the great one-horned Indian rhinoceros (*R. unicornis*), which may be conveniently designated as the Indian rhinoceros *par excellence*, and is the one which has been longest known in Europe from living examples, a specimen having been sent to Portugal as long ago as the year 1513. In this species there is but a single nasal horn; and the skin, with the exception of that of the tail and ears, is naked, and on the sides of the body studded with a number of large convex tubercles, reminding one of the rivets in an iron boiler, which are largest on the fore and hind-quarters, where they may be as much as an inch in diameter. The skin of the body is divided into a number of shield-like pieces by the aforesaid folds. Thus there is a fold before and behind each shoulder, marking off a large triangular shield covering the shoulder; and another in front of each thigh dividing the large saddle-shaped body-shield from the one on the hind-quarters. The folds behind the shoulder and in front of the hind-quarters continue completely across the back, but the one in front of the shoulder inclines backwards and dies out close to the second great fold. Other folds form great rolls of skin on the neck, while there are others below the shields on the fore and hind-quarters and one situated behind the buttocks which forms a groove for the reception of the tail. The head is very large in proportion to the body, with the occipital region of the skull very much elevated; and the ears are large, with their tips fringed with hairs. The horns are large in

both sexes; and the colour of the skin is a uniform blackish grey. In height the Indian rhinoceros stands from 5 feet to 5½ feet at the shoulder. In a male standing 5 feet 9 inches at the shoulder, measured by General Kinloch, the length from the tip of the snout to the root of the tail was 10 feet 6 inches, the length of the tail 2 feet 5 inches, and the girth of the body 9 feet 8 inches. The length of the horn is seldom more than a foot, although Jerdon says that there are instances on record of horns of 2 feet in length, and one in the British Museum measures 19 inches.

Teeth. The Indian rhinoceros is further characterised by its teeth. As a rule, there is but a single pair of broad incisors in the upper jaw, although in some cases there may be a smaller pair behind them. In the lower



GREAT INDIAN RHINOCEROS IN THE ZOOLOGICAL GARDENS.

jaw there is one pair of long, triangular, pointed tusks, and between them a pair of small cylindrical incisors which can be of no functional importance. The upper molar teeth have tall crowns, and in the absence of a buttress at their front outer angle, and the flat plane formed by their worn surface, resemble the one represented in the lower figure on p. 464. They are, however, distinguished from the latter by the presence of a small vertical plate, projecting from the outer wall into the extremity of the middle valley. It will be obvious that this flat plane of wear of the cheek-teeth implies that the jaws have a backwards-and-forwards grinding motion, and not a champing action; such a mode of mastication being similar to that existing in horses and cattle.

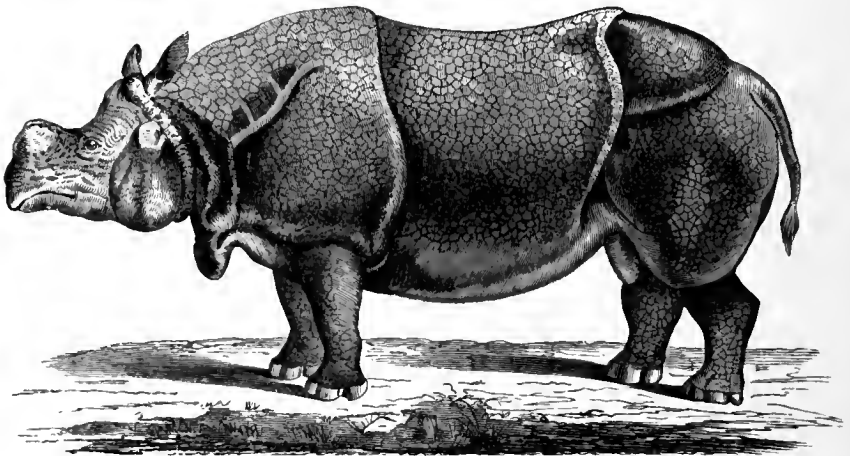
Distribution. This rhinoceros is exclusively confined to India, and at the present day, according to Mr. Blanford, is almost restricted to the Assam plain, being rarely, if ever, found to the westward of the Tista River. Twenty or thirty years ago, it was, however, still common in the so-called terai country at the foot of the Sikhim Himalaya, while some years earlier it frequented the sub-Himalayan districts of Nipal, and ranged as far west as Rohilund; while the writer last quoted believes that, about the year 1850, it also occurred in the grass-jungles of the Ganges valley at the north end of the Rahmahal Hills in Bengal. In the early part of the sixteenth century it ranged over the Punjab as far westwards as Peshawur; and since its fossilised remains are found in the North-West Provinces, the Nerbada valley, and Madras, it may be inferred that the Indian rhinoceros formerly ranged over the greater part of Peninsular India, in localities suited to its habits.

Habits. The Indian rhinoceros is a denizen of the great grass-jungles that cover such a large portion of the plains of India, and from this circumstance, coupled with the general resemblance of its molar teeth to those of the African Burchell's rhinoceros, which is known to be a grass-eater, it may be assumed that its food is chiefly grass. Regarding the density and height of these jungles, General Kinloch writes that, "year after year, in the short space of two or three months, these giant grasses shoot up to a height of from twenty to thirty feet, forming, with the wild cardamum, various other broad-leaved plants, and numerous creepers, a tangled cover which shelters the elephant, the rhinoceros, and the buffalo, as effectually as a field of standing corn affords concealment to the partridge or the quail. I have seen a line of about fifteen elephants beating a strip of reeds not more than two hundred yards in width, and I could hardly see the grass shake. There was not as much commotion or indication of what was going on, as would be caused by a pack of beagles drawing a gorse-cover. Runs or tunnels among the high reeds, like magnified 'meuses' of hares and rabbits, show that the same paths through the thick jungle are generally made use of."

The rhinoceros chiefly frequents such portions of these grass-jungles as are on swampy ground; and although it is in general a solitary animal, the writer just quoted states that he has known half a dozen individuals roused from a belt of not more than half a mile in length by three hundred or four hundred yards in width. Like tapirs, the Indian rhinoceros is fond of a mud-bath. Although there are many stories extant as to its ferocity, and more especially its enmity to the elephant, it appears that this animal is generally quiet and harmless. Even when wounded, according to Mr. Blanford, it is but seldom that it charges home; but when it does attack, the sharp lower tusks are used much after the same manner as those of a wild boar. The only sound that this rhinoceros utters is a peculiar grunt, which is repeated at frequent intervals during excitement. The usual gait of this rhinoceros is a long swinging trot, but when disturbed, it can break into an awkward but very rapid gallop. Only a single calf is produced at a birth, but there is some uncertainty as to the length of the period of gestation, an old writer stating that it is nine months, while a more recent authority affirms that it is nearly or quite double as long. Since rhinoceroses, so far as we are aware, have

not bred in captivity in Europe, the point is one not likely to be soon cleared up. The Indian rhinoceros thrives well in confinement, and frequently lives in that state for a long period. One specimen acquired by the London Zoological Gardens in 1834 lived till 1849, while a second, purchased in 1850, died in 1874, and a third presented in 1864 is still (1894) flourishing. Mr. Blanford states that he has heard of captive specimens living fifty or sixty years, and Mr. Brian Hodgson was of opinion that the natural term of this animal's life is upwards of a century.

From the immense thickness and apparent toughness of its enormous folds, it was long considered that the hide of the Indian rhinoceros was bullet-proof, and that the only places where the animal was vulnerable were the joints of the armour. General Kinloch relates an amusing story of a soldier in India, who had heard of this legend, firing point-blank at a tame rhinoceros which had been captured by his regiment during the Mutiny, in order to obtain ocular proof of its



GREAT INDIAN RHINOCEROS.

truth. Needless to say, as the shot was well aimed, the unfortunate animal fell dead, which meant a considerable loss to the regimental prize-fund. And we may mention here that the Indian rhinoceros, like all its kindred, when shot sinks down in its tracks, and lies as if asleep, instead of falling over on its side like most other mammals.

As a matter of fact, the skin of the living animal is quite soft, and can readily be penetrated in any place by a bullet, or easily pierced by a hunting-knife. When dried it becomes, however, exceedingly hard; and it was formerly employed by the Indian princes in the manufacture of shields for their soldiery. General Kinloch states that if polished the hide "is very handsome and semi-transparent, and when held up to the light looks exactly like tortoise-shell, the tubercles giving it a beautiful mottled appearance."

The horn is used by the Hindus (to whom in common with the natives of most parts of India, the animal is known by the name of *gairda*) in some of their religious ceremonies; when manufactured into cups it is considered by the Chinese to possess the property of indicating the presence of poison.

Hunting. There are two modes, according to General Kinloch, of hunting the Indian rhinoceros—"one by quietly tracking up the animal on a single elephant until he is at last found in his lair, or perhaps standing quite unconscious of danger; the other, by beating him out of jungle with a line of elephants, the guns being stationed at the points where he is most likely to break cover. In the latter case it is necessary to have reliable men with the beaters, who can exercise authority and keep them in order, for both mahouts and elephants have the greatest dread of the huge brute, who appears to be much more formidable than he really is."

The same writer gives his experience of rhinoceros-hunting as follows. On a certain occasion the General and his party "had tracked a wounded buffalo into a large and very thick cover, into which it was useless to follow him with any chance of getting a shot. The three guns, therefore, went on ahead, and took up their positions at the other end of the cover, while the pad-elephants were ordered to form line and beat steadily through the jungle. After waiting a long time at my post I heard some large animal crashing through the reeds, and as the line of beaters advanced the waving of the grass betrayed its movements. It came on very slowly, occasionally stopping for some time to listen, and again making a cautious advance. I remained still as death, but I was in a great state of anxiety lest my elephant should become uneasy and give the alarm. Fortunately, he remained silent, and at length the rhinoceros, anticipating no danger ahead, and pressed by the steadily advancing line of elephants behind him, poked his ugly head out of the reeds within twenty yards of me. I could only see his snout and his horn, and aimed above the latter for his forehead. I either took a bad aim, or my elephant moved slightly as I fired, for, as I afterwards found, my bullet merely grazed the snout, cutting a deep furrow along the base of the horn. As the rhinoceros wheeled round, I gave him another bullet in the centre of his ribs, and he rushed back into the reeds and through the beaters with an angry grunt." On search being made in the jungle, it was found that the second bullet had done its work, the huge animal lying dead with its legs folded beneath the body in the usual recumbent posture.

Javan Rhinoceros. The Javan, or lesser one-horned rhinoceros (*R. sondaicus*), is an altogether smaller animal than the preceding, with the head relatively less large in proportion to the body, although its height at the shoulder is scarcely, if at all, inferior. The skin, which is nearly or quite naked, lacks the large tubercles of the Indian rhinoceros; while the fold in front of the shoulder, instead of inclining backwards, is continued right across the body like the other two main folds. Superficially, the skin is divided by a network of cracks into a number of small mosaic-like discs. The great folds of skin which are so conspicuous in the neck of the Indian rhinoceros are in this species much less strongly developed. The general colour is a uniform dusky grey. The skull is less elevated than in the larger species in the occipital region; but there are the same number of front teeth. In structure the upper molar teeth are, however, simpler, resembling the lower of the two figured on p. 464; and their crowns are not so tall. Measurements of wild individuals appear to be very few; but in a large female the height at the shoulder was $5\frac{1}{2}$ feet. The female is generally or invariably hornless.

Distribution. This species has a much more extensive distribution than its larger cousin. There is no evidence that it ever occurred in Peninsular India, but it is found in the Bengal sundarbans and portions of Eastern Bengal, while it has been met with in the Sikhim "terai." From the valley of Assam it ranges eastwards through Burma and the Malay Peninsula to Sumatra, Java, and Borneo; its partially fossilised remains occurring in the latter island.

Habits. Mr. Blanford observes that this species "is more an inhabitant of the forest than of grass, and although it is found in the alluvial swamps of the sundarbans, its usual habitat appears to be in hilly countries. It has been observed at considerable elevations both in Burma and Java." Indeed, there is evidence that it probably ascends occasionally to as much as seven thousand feet above the sea-level. This species being a forest-dwelling one, while its molar teeth are of the same pattern as those of the leaf and branch-eating common African rhinoceros, it is pretty certain that its food must be of the same general nature as that of the latter. In disposition the Javan rhinoceros is said to be more gentle than the large Indian species, and it is not unfrequently tamed by the Malays. The horns are never large, and afford but poor trophies to the sportsman.

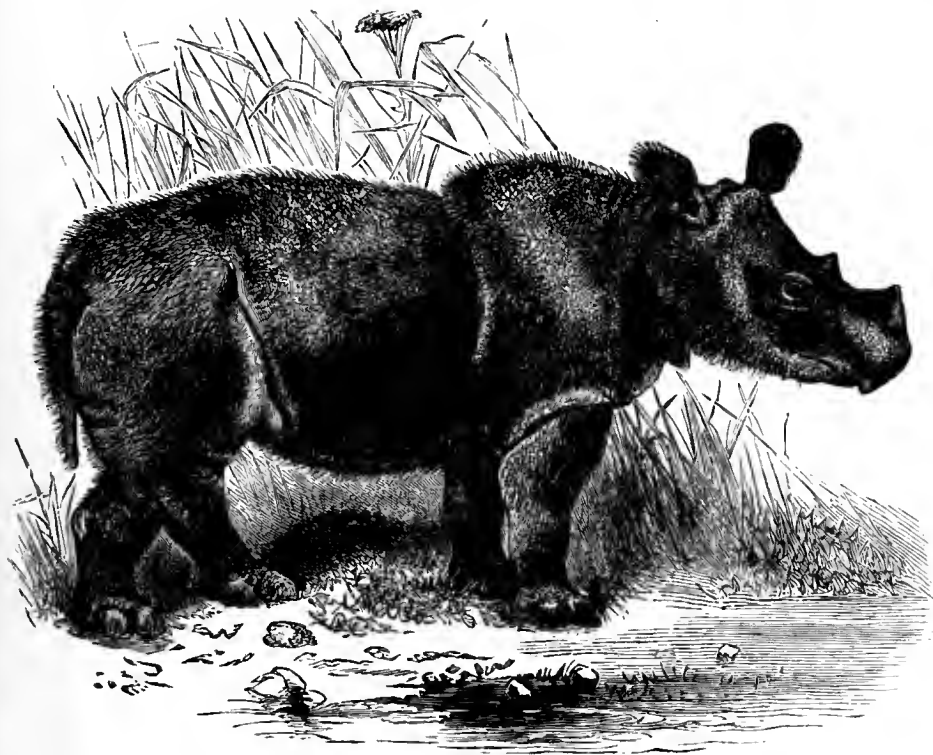
Allied Siwalik Rhinoceroses. In the Pliocene rocks of the Siwalik Hills at the foot of the Himalaya there occur remains of a single-horned rhinoceros (*R. sivalensis*), which appears to have been closely allied to the Javan species, of which the original home may accordingly have been India. More remarkable, however, is the occurrence of a fossil rhinoceros in the interior of the Himalaya, at an elevation of about sixteen thousand feet above the sea-level, which likewise seems to have been related to the same species. It may be added that another fossil Indian rhinoceros (*R. palwindicus*), of which an upper molar teeth is represented in the lower figure on p. 464, appears to have been the forerunner of the living great Indian rhinoceros; its molar teeth approximating to those of the latter, although of a rather less complex structure.

Sumatran Rhinoceros. Reverting to the living Asiatic species, the last of all is the Sumatran rhinoceros (*R. sumatrensis*), which is mainly characteristic of the countries to the eastward of the Bay of Bengal, occurring but rarely in Assam, although a single example has been obtained from Bhutan. From Assam it ranges through Burma and the Malay Peninsula to Siam, Sumatra, and Borneo; but it is quite unknown in Java.

Characters. This is the smallest of all the living species of rhinoceros, and differs from the preceding kinds in carrying two horns. It is further distinguished by its hairiness, although there is a certain amount of individual variation in this respect. As a rule, the greater part of the body is thinly covered with brown or black hair of considerable length, while there are larger or smaller fringes of hair on the ears and tail. The skin, which is rough and granular, and varies in colour from earthy brown almost to black, has the folds much less developed than in the single-horned species, and only the one behind the shoulders is continuing right across the back. The two horns are placed some distance apart, and when fully developed are thick and massive at the base, but very slender above, the front and longer one sweeping backwards in a graceful curve. In

many specimens the horns are, however, very short, and in examples kept in confinement like the one from which our figure is taken, they become worn down to mere stumps. The Sumatran rhinoceros differs from its two Asiatic cousins in having lost the pair of small incisor teeth in the lower jaw, in the front of which only the tusks remain, and even these are sometimes shed in old age. In these respects, therefore, this species, concomitantly with the presence of two horns, shows an indication of approximating to the African rhinoceroses.

In addition to the variation in the degrees of development of the hair, this species



THE SUMATRAN RHINOCEROS.¹

The horns, as in most captive specimens, are abnormally short.

shows considerable individual differences in colour, and also in the relative breadth of the skull. A specimen purchased in 1872 by the Zoological Society of London for over a £1000, and exhibited in their gardens, differed from the ordinary form by its superior size, paler and browner colour, smoother skin, shorter and more thickly-tufted tail, and the longer, finer, and more reddish-coloured hair; the latter forming a long fringe on the ears, of which the insides were naked. This animal had also a much wider head than ordinary. It was accordingly regarded as a distinct species, under the name of the hairy-eared rhinoceros (*R. lasiotis*); but there is little doubt that it cannot be considered as anything more than a well-marked variety of the Sumatran species.

There is considerable variation in regard to the dimensions of this species, but

¹ Messrs. Macmillan & Co. have favoured the Editor with this figure.

Mr. Blanford considers that from 4 feet to $4\frac{1}{2}$ feet will represent about the average height at the shoulder. In the above-mentioned specimen the height at the shoulder was 4 feet 4 inches, and the length from the tip of the snout to the root of the tail 8 feet; the weight of the animal being about 2000 lbs. On the other hand, in an adult female from the Malay Peninsula, the shoulder-height was only 3 feet 8 inches. There is also great variation in regard to the length of the horns, the hinder one being in some cases reduced to an almost invisible knob. Mr. E. Bartlett gives the following particulars of Bornean specimens. In one example the front horn was $4\frac{1}{2}$ and the second 2 inches in length; in a second, while the front horn measured 5 inches, the hind one was a mere knob; and in a third, the front horn had a length of 19 inches with a girth of 16 inches, the second horn being fairly developed, although not more than about 3 inches in height. A single specimen of a front horn had a length of 11 inches, with a basal girth of $11\frac{1}{2}$ inches; but the maximum recorded length is upwards of 32 inches along the curve.

Habits.

The molar teeth of this species are almost indistinguishable from those of the Javan rhinoceros, and as its habits appear to be very much the same as those of the latter, the diet of the two is probably also similar. The Sumatran rhinoceros inhabits hilly forest-districts, and it has been observed in Tenasserim at an elevation of four thousand feet above the sea. It is a good swimmer, and is reported to have been seen swimming in the sea in the Mergui Archipelago. Although shy and timid in the wild state, in captivity it soon becomes tame.

Mr. E. Bartlett states that in Borneo the dyaks are very partial to the flesh of this species as an article of diet. And he adds that the kyans—a race very distinct from the dyaks—procure the horns for barter, for which they receive a high price from the Chinese, who import them to China for medicine. The horns are ground into powder for some diseases, while others are cut into minute fragments to carry about the person. The same writer further states that this rhinoceros is becoming extremely rare in the province of Sarawak, on account of the value set upon its horns, but in Central and North Borneo in the very old jungle it is more plentiful.

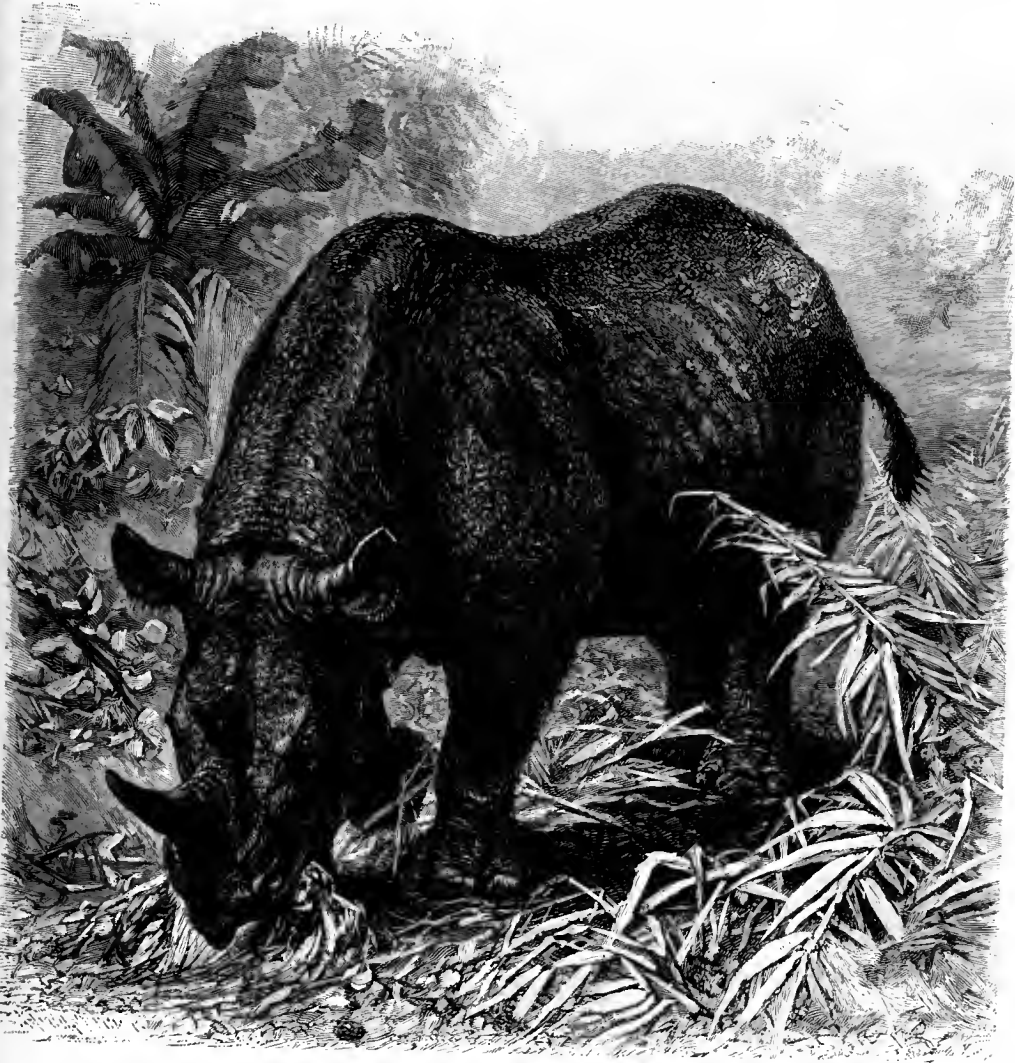
In 1872 a Sumatran rhinoceros, recently imported into London, gave birth to a calf; and this event afforded Mr. A. D. Bartlett data for considering that the period of gestation was a little over seven months. This however, as Mr. Blanford points out, seems a very short period for such a large animal, and contrasts very markedly with the length of time assigned by Hodgson to the great Indian rhinoceros.

**Allied Extinct
Species.**

No fossil species allied to the Sumatran rhinoceros has hitherto been obtained from the Tertiary deposits of India, whence we may conclude that the latter is probably a comparatively recent immigrant into North-Eastern India. Schleiermacher's rhinoceros (*R. schleiermacheri*) of the Miocene and lower Pliocene deposits of France and Germany appears, however, to have been very closely allied to the Sumatran species; and thus affords, in common with some other fossil mammals, evidence of an eastward migration of types formerly inhabiting Western Europe.

AFRICAN RHINOCEROSSES.

Although it is commonly reported by hunters, who in many cases derive their information from native sources, that there are several kinds of rhinoceros inhabiting Africa, we have at present definite acquaintance with only two species, namely, the common African rhinoceros, frequently spoken of as the black



THE COMMON AFRICAN RHINOCEROS ($\frac{1}{25}$ nat. size).

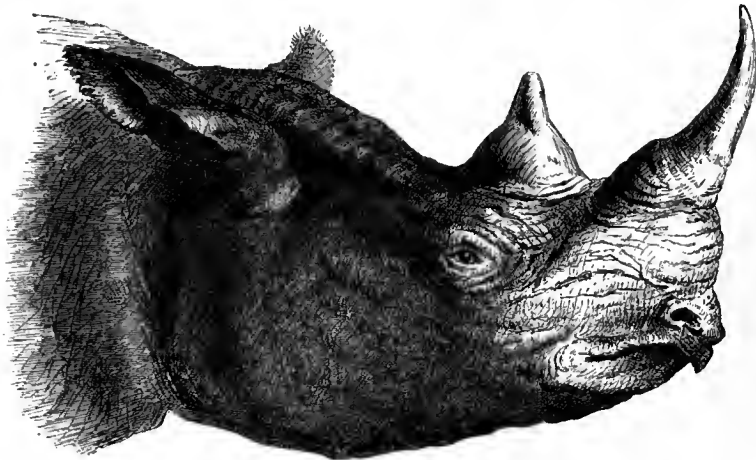
rhinoceros, and the square-mouthed, or Burchell's rhinoceros, commonly termed the white rhinoceros. Since there is but little, if any, marked difference in the colour of the two animals, the names founded on this character are best discarded. It is possible, however, that a third species may inhabit East Africa.

Characters.

Both species are furnished with two horns, which attain a greater development than in either of their Asiatic relatives. From

all the latter the African rhinoceroses are distinguished by the absence of any permanent folds in the skin, and also by the want of both incisor teeth and tusks in the adult state; such teeth if they occur even in the young being rudimentary and functionless. In consequence of this want of front teeth, the extremities of both the upper and lower jaws are much shorter than in the Asiatic species. Moreover, whereas in the latter the nasal bones are narrow and terminate in a point, in the African rhinoceroses they are rounded and truncated in front. In both kinds the skin of the body is almost entirely naked and comparatively smooth; but there is generally a little fringe or tuft of hairs on the ears and tail.

Common African Rhinoceros. The common African rhinoceros (*R. bicornis*) is the smaller of the two species, and is also the one which has by far the wider distribution, extending, in suitable districts, through Eastern and Central Africa, from Abyssinia in the north to the Cape Colony in the south. From the character



HEAD OF THE COMMON AFRICAN RHINOCEROS.

of the upper lip this species is sometimes spoken of as the prehensile-lipped rhinoceros, while in Southern and Eastern Africa it is variously termed the boreli or upetyani, the keitloa, and the kulumani; these different native names, as we shall notice later,

referring to differences in the relative proportions of the two horns. This species is best characterised by the pointed and slightly prehensile upper lip, the small and rounded nostrils, and the position of the eyes being a little behind the continuation of the axis of the second horn. The ears are of moderate length, and furnished with a fringe of hair along the upper edge, while in some cases they are rounded above, although in others more pointed. There is a considerable amount of individual variation as to the length and amount of the fringe of hairs on the margins of the ears. The molar teeth of this rhinoceros are of the type of the uppermost of the two represented on p. 464. That is to say, they have comparatively low crowns, a well-marked buttress at their front outer angle, the middle valley not divided into two moieties by a cross-partition, and the surface of the crown when worn raised into two distinct ridges. The latter feature shows that the jaws have a somewhat champing, instead of a completely grinding action; and since we know that this species feeds almost exclusively on twigs and leaves, it may be assumed that molar teeth of this pattern always indicate a similar diet for their owners. The horns are well developed in both sexes.

As regards dimensions, in an adult female from Abyssinia described by Mr.

Blanford, the length of the tip of the snout to the end of the tail measured along the curves was 6 feet 9 inches, of which 1 foot 9½ inches was occupied by the tail, and the height at the shoulder 4 feet 8½ inches. These dimensions are, however, exceeded by males, which, according to Sir S. Baker, may stand from 5 feet 6 inches to 5 feet 8 inches at the shoulder.

The proportions of the two horns to one another vary greatly, the front one being in some cases much longer than the hinder, while in others the two are nearly or quite equal, and, more rarely, the second horn may be the longer of the two. The native name boreli is applied to those individuals in which the second horn is the shorter, while keitloa is restricted to such as have horns of equal length, or the second longer than the first. Mr. Selous has shown that there is a complete transition from the one to the other type, and consequently that such differences cannot have any specific value.

Size of Horns. In regard to the length attained by the horns of this species, it appears that in Abyssinia and other parts of North-East Africa, from Sir S. Baker's experience, the front horn rarely or never exceeds 23 or 24 inches, but much larger dimensions are recorded in South and East African specimens. Thus examples of the front horn are described as measuring 44, 43, 41, 40, and 38½ inches in length; but with the exception of the last, in which its length is 21 inches, in none of these examples are the dimensions of the second horn recorded. In one specimen the length of the first and second horns were respectively 31 and 19½ inches, in another 28¾ and 15¼, in a third 28¼ and 8¾, in a fourth 27 and 16½, in a fifth 21½ and 18¾, and in a sixth 14⅝ and 14¾ inches. The front horn is generally nearly circular in section and slightly curved backwards, while the second is nearly straight, much compressed, and with its hinder edge often sharper than the front one. Sir J. Willoughby killed in East Africa an example of this rhinoceros having a small rudimental third horn behind the normal pair.

Habits. In Abyssinia Mr. Blanford states that this rhinoceros is confined to the lower elevations, not ascending above some five thousand feet. In the valley of the Anseba he writes that it "inhabits the dense thickets on the bank of the stream, which are intersected in all directions by the paths made by these animals. In the densest parts, where roots and stems render the jungle almost impervious, there are places known by the inhabitants as rhinoceros-houses. The stems and branches have generally been broken away or pushed back, so as to leave a clear space, about fifteen or twenty feet in diameter, at the bottom of which the ground has been worn into a hollow by the trampling and rolling of the animal in wet weather. These houses are used as retreats during the heat of the day. On two or three occasions we disturbed a rhinoceros from one of these, and he rushed off with much noise and loud snorts through the bushes. So far as we could learn from our observations, these animals enter the thick jungle early in the morning and rest until one or two o'clock in the day, then they leave their thickets and go out to feed, usually remaining, however, amongst high bushes. At the time of year in which we visited the country, rain generally set in in the afternoon, and, even if it did not rain, the sky was overcast. In the clear weather the rhinoceroses are said never to appear before evening. They are great browsers, feeding chiefly on the young shoots and branches of acacia and other trees, or on fruits: so far as I

could see, they do not generally eat grass. Their movements are very quick, their usual pace being a smart trot, and the numerous tracks show that they move about a good deal." After expressing his doubts as to the statements of the natives that a man on horse cannot escape from one of these animals, Mr. Blanford adds that "they are easily eluded by turning, as they are not quick of sight, and, like most mammals, they never look for enemies in trees; consequently, a man two or three feet from the ground will remain unnoticed by them if he keeps quiet. They are said to be extremely savage, and unquestionably the first one killed by us charged most viciously. . . . I cannot help thinking, however, that their savage disposition has been somewhat exaggerated." Most of these animals seen by the members of the Abyssinian Expedition were in pairs,—an old female with a nearly full-grown calf,—but on one occasion four were observed. Mr. Blanford compares the snort of alarm or rage uttered by these animals when disturbed to the noise of a locomotive rather than to the sound of any other animal.

The foregoing account is confirmed in all essential particulars by the observations of Mr. Selous in South-Eastern Africa, who writes that this species of rhinoceros "lives exclusively upon bush and roots, eating not only the young leaves as they sprout from the end of a twig, but also chewing up a good deal of the twig itself. It is owing to the fact that this species lives upon bush that its range is very much more extended than that of the square-mouthed rhinoceros; for there are many large districts of country in the neighbourhood of the Zambesi to the eastward of the Victoria Falls covered almost entirely with an endless succession of rugged hills, almost devoid of grass, though well wooded, in all of which districts the prehensile-lipped rhinoceros is numerous, as it thrives well upon the scrubby bush with which the hillsides and valleys are covered; whereas the square-mouthed species, though common in the forest-clad sand-belts and broad grassy valleys which always skirt the hills, is seldom or never found among the hills themselves, which is doubtless because the pasturage is too scanty to enable it to exist."

The same writer also tells us that this rhinoceros, like the larger African species, exhibits extraordinary activity in getting over hilly and rocky ground, and that it can traverse places which at first sight appear utterly impracticable for an animal of its bulky and apparently clumsy build. We also learn from the same observer that while the present species of rhinoceros always walks with its nose carried high in the air, the other kind walks with its muzzle close to the ground. Again, whereas in the common species the calf invariably follows its mother, the offspring of Burchell's rhinoceros as constantly precedes its parent.

Mr. Selous agrees with Mr. Blanford that the ferocity of the prehensile-lipped rhinoceros has been much exaggerated, and he is, indeed, inclined to regard it as an animal of a rather cowardly, if not exactly peaceable, disposition. It must, however, be borne in mind that those sportsmen who have attributed a ferocious disposition to this species, always make a distinction in this respect between the boreli and the keitloa, and give to the latter a much better character than they assign to the former. Whether any difference in this respect is really associated with the variations to which these names refer, we are not prepared to say (although it seems most unlikely); but it is important to notice that even those who attribute extreme ferocity of disposition to some individuals of this species have never

asserted that this applies to all. Mr. Selous states that he was only once charged by a common rhinoceros, and this after strong provocation, and even then the animal did not charge home; and he considers that vicious individuals are comparatively few and far between. "These animals," writes the same observer, "are very quick and restless in their movements, and either very inquisitive or mistrustful of their eyesight, for usually, when disturbed by anyone approaching from below the wind, they will jump up with a snort, gaze fixedly at the intruder, then, with another snort, trot quickly a few steps nearer, stand again, move their heads with a quick motion, first to one side then to the other, advance again perhaps, and finally, when shouted at, whisk quickly round and trot away in grand style, with tail screwed up over their backs." Recounting his experiences in Mashonaland, where he sometimes met with five, six, or even eight in a day, Mr. Selous says that whenever these animals met his wind, they invariably made off at once, but when they only saw him, they acted in the manner above described. On occasions of the latter kind the Kaffirs would take refuge up the nearest tree, and would urge their master to do likewise. He, however, always stood his ground, and found that although the rhinoceroses would sometimes advance in his direction from about forty to twenty yards' distance, yet, that if he threw stones or assegais at them, or even simply shouted, they always eventually turned tail and fled. If, however, a rhinoceros is fired upon when thus facing a man, it will, after dropping upon its knees, very often spring up and rush straight forwards; but Mr. Selous attributes such action not to any intention of making a charge, but merely to the animal being maddened by the shock and rushing blindly ahead; and he considers that it is thus that many of the accounts of its fierceness and aggressiveness have originated. He adds, however, that one of these animals when in full career, and either wounded or tired, will not hesitate to charge any obstacle that may be in its path, even a waggon and a team of oxen. Finally, Mr. Selous states that he believes the pursuit of the common African rhinoceros to be attended with less danger than that of either the lion, elephant, or buffalo; and he supports this opinion by observing that both Kaffirs and Hottentots, who but seldom care to molest a lion, never have the slightest hesitation in attacking a rhinoceros. The foregoing account is confirmed in all essential particulars by Sir John Willoughby, who suggests, however, that the rhinoceros is apt to be dangerous at certain seasons.

In South-Eastern Africa Mr. Drummond states that both species of rhinoceros generally leave their lairs about four o'clock in the afternoon, or, in districts where there are many human beings, somewhat later. They commence feeding in the direction of their drinking-places, to which they travel by regular beaten paths, and arrive at the same somewhere about dark. If the drinking-place is a mud-hole they frequently refresh themselves with a roll, after drinking their fill. They then start for their favourite thorn feeding-grounds, where they remain till day-break, when they generally again drink. At an earlier or later hour after this, the time being to some extent dependent on the freedom of the district from human intrusion, they retire to their sleeping-places, which they reach at any rate before the heat of the day. The lair is always in an extremely sheltered and deeply-shaded spot, and so heavily do they slumber that a practised stalker could almost touch them with the muzzle of a gun, unless they are awakened by the birds which

accompany them in search of the ticks with which they are infested. Mr. Hunter states, however, that in the Kilima-Njaro district rhinoceroses lie out in the open plain during the day.

The common rhinoceros is met with in Southern Africa generally either solitary or in family-parties of two or three. In the latter case it is usually a female accompanied by her calf; but Sir J. Willoughby met a male, female, and half-grown calf together, and as in this instance the horns of the male were much shorter than those of the female, it may be that the longer horns generally belong to the latter sex. Occasionally several full-grown individuals are seen together, Mr. Drummond stating that on one occasion he met with a party of six or seven. Sir J. Willoughby relates that once he shot one of a pair of these rhinoceroses, which was immediately fiercely attacked and rolled over by its companion. When a cow rhinoceros is killed, the calf generally remains by the dead body of its parent, from which it can with difficulty be dragged away.

Hunting. Like most other large African animals, the common rhinoceros is rapidly decreasing in numbers from the incessant pursuit to which it is subjected in the southern and eastern portion of the continent. Writing in 1881, Mr. Selous said that it was still fairly common in South-Eastern Africa, although it had been nearly exterminated in the regions to the westward. Only a few then remained on the Chobi, while between that river and the Zambesi there were none, and the natives said that there never had been any in that district. Northwards of the Zambesi they were, however, again met with, and from thence they doubtless extend through the whole of Central Africa to Abyssinia and the Sudan. In the Kilima-Njaro district Sir J. Willoughby's party found these rhinoceroses very plentiful in 1886, having on one occasion seen as many as sixteen head during a single day's march.

In Southern Africa the common rhinoceros is hunted either by being followed up when out feeding on the plains, or by the hunter lying in wait at its drinking-places. In the Sudan the Hamram Arabs are, however, in the habit of chasing the rhinoceros on horseback, and of hamstringing it by a dexterous stroke of a long two-handed sword. This sport, according to Sir S. Baker, tries the speed of the best horses, and that writer's account of the chase of a couple of these animals, which, after running more than two miles, defied further pursuit by escaping into thick cover, is probably known to many of our readers. An Arab hunter explained to Sir S. Baker, "that at all times the rhinoceros was the most difficult animal to sabre, on account of his extraordinary swiftness, and, although he had killed many with the sword, it was always after a long and fatiguing hunt, at the close of which the animal becoming tired generally turned to bay, in which case one hunter occupied his attention, while another galloped up behind and severed the hamstring. The rhinoceros, unlike the elephant, can go very well upon three legs, which enhances the danger, as one cut will not disable him." A less sporting method adopted by the Arabs of the same regions is to dig a hole about two feet deep by fifteen inches in diameter in the animal's run, and to place in the centre a rather elaborately-constructed snare, to which is attached a rope with a heavy log of wood at the other end. When the rhinoceros steps on the pit, one of its feet is caught in the running noose. When caught, the first effort of the rhinoceros is to

escape, and he forthwith pulls the log from the trench in which it was buried. This log, writes Sir S. Baker, "acts as a drag, and, by catching in the jungle and the protruding roots of trees, it quickly fatigues him. On the following morning the hunters discover the rhinoceros by the track of the log that has ploughed along the ground, and the animal is killed by lances or by the sword."

The same writer adds that the hide of a rhinoceros will produce seven shields; these being worth about two dollars each, as simple hide before manufacture. The horn is sold in Abyssinia for about two dollars per pound, for the manufacture of sword-hilts, which are much esteemed if of this material. In South Africa the flesh of the common rhinoceros is much appreciated by the natives as food; but as the animal never has any fat, the meat is somewhat dry.

Like other members of the genus, this rhinoceros appears to be long-lived even in captivity, a specimen from Nubia, acquired by the Zoological Society of London in 1868, having lived in the menagerie till 1891.

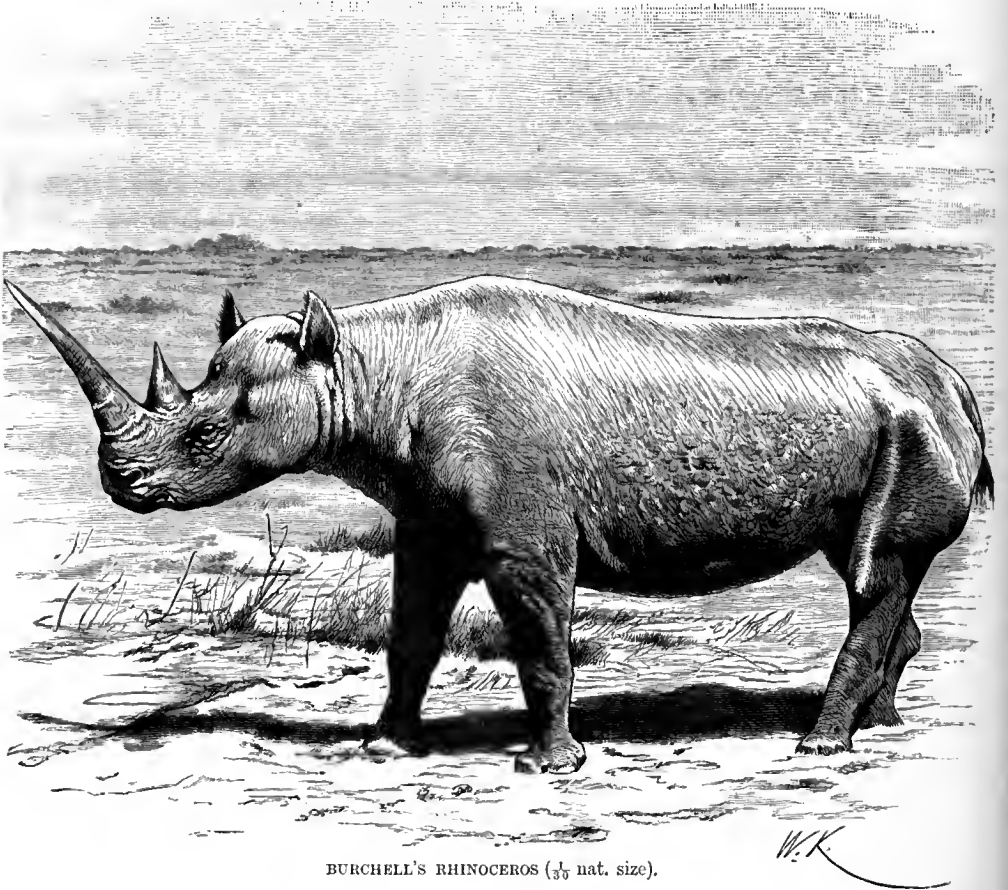
Extinct Ally. The immediate ancestor of this species appears to have been the extinct thick-jawed rhinoceros (*R. pachygnathus*), of which a series of finely-preserved remains have been obtained from the well-known fresh-water deposits of Pikermi, near Attica, belonging to the Pliocene period.

Burchell's Rhinoceros. The largest of the group is the square-mouthed, or Burchell's, rhinoceros (*R. simus*), commonly known as the white rhinoceros, which is now, alas, practically exterminated. In addition to its great size, this species is characterised by its bluntly-truncated muzzle and the absence of a prehensile extremity to the upper lip, as well as by the great proportionate length of the head, which in large specimens is more than a foot longer than in the common species. Moreover, the nostrils form long narrow slits; the eye is placed entirely behind the line of the second horn; and the ear is very long, sharply pointed at the extremity, where it has but a very small tuft of hairs, and has its lower portion completely closed for some distance, so as to form a tube. The front horn attains a greater length than in the common species. In the skull the extremity of the lower jaw forms a much wider and shallower channel than in the *R. bicornis*, and the structure of the upper cheek-teeth is different. These teeth resemble in general structure those of the great Indian rhinoceros, having very tall crowns, with flat grinding surfaces, no distinct buttress at the front outer angle, and the outer portion of the middle valley cut off by a partition. They are, however, quite peculiar among existing species, in having a large amount of cement investing the interior and filling up the valleys of the crown. Moreover, the third molar in the upper jaw, instead of being triangular in shape, closely resembles the tooth in front of it; a peculiarity found elsewhere only among certain extinct hornless species. In colour Burchell's rhinoceros differs but little from the common species, the general hue of both being a slaty grey.

Dimensions. In height this rhinoceros is known to reach $6\frac{1}{2}$ feet at the shoulder, and it is said that specimens were formerly obtained which slightly exceeded these dimensions. As regards length, our information is far from satisfactory. It has been stated that the length may be something between 18 and 19 feet; but this seems quite incredible, more especially as the proportions of our figure indicate that the length was rather more than double the height, which

would make it about 14 feet. One of the specimens referred to below has a length of 12 feet 1 inch, and a height at the shoulder of 6 feet 2 inches.

There is fully as much variation in the relative length of the horns as in the common species, the second horn being sometimes a mere stump, and at others attaining a length of 2 feet, while in some instances both are comparatively short. The front horn is, moreover, liable to considerable variation in shape. Thus, in the typical form of the species, it curves backwards in a more or less bold sweep, as shown in our figure of the head, the individuals exhibiting this form being



BURCHELL'S RHINOCEROS ($\frac{1}{30}$ nat. size).

known to the Bechuanas by the name of mohohu. In other cases, as shown in our illustration of the entire animal, the front horn is nearly straight, with a forward inclination, specimens with this type of horn being designated by the natives as the kabaoba. When the anterior horn is straight and attains the length of about a yard, the point touches the ground as the animal walks along when feeding, and such horns consequently always show a flat surface on the front of the tip produced by friction. It was at one time considered that the mohohu and the kabaoba were distinct species, but Mr. Selous has shown not only that they consort together, but that there is a complete transition from the one type of horn to the other. As a rule, the horns of females are longer and more slender than those of males.

The longest known horn is one of the kabaoba type in the British Museum, of which the total length is $56\frac{1}{2}$ inches. The history of this specimen is unknown, but it has been in the collection for a very long period. Next to this is an example of the mohohu type recorded by Mr. Selous, of which the length is given as 54 inches. Other fine specimens of the front horn measure 44, $42\frac{3}{4}$, 40, and $38\frac{1}{2}$ inches. In examples where both horns have been preserved, the length of the front one in one case is $37\frac{3}{8}$ and that of the hinder $17\frac{7}{8}$ inches, while in another these dimensions are 33 and 13 inches. At the time when these rhinoceroses were abundant it was the ambition of every South African chief to possess a long staff, or *kerrie*, made from a front horn; and it is, therefore, as Mr. H. A. Bryden suggests, highly probable that the largest dimensions recorded above may have been considerably exceeded.

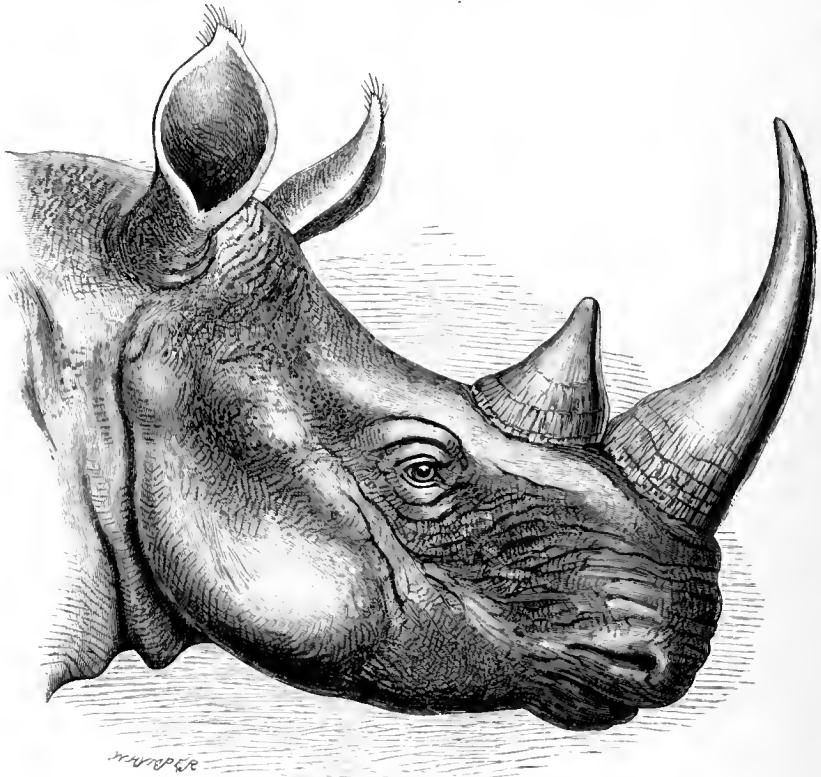
Distribution. The range of this rhinoceros was always limited, and apparently never extended north of the Zambesi; this restricted distribution being, as already mentioned, largely due to the creature's grass-eating habits. For the last seventy or eighty years it has been unknown to the south of the Orange River, but, according to Mr. Bryden, there is a tradition that it formerly roamed over the greater part of the Cape Colony. About the middle of the present century, when Gordon Cumming, and afterwards Andersson, made their well-known hunting-tours, Burchell's rhinoceros was comparatively common in parts of the Kalahari Desert, Ngamiland, and various districts between the Orange and Zambesi Rivers. Indeed, Gordon Cumming states that on one occasion he saw upwards of twelve of these magnificent animals together in long grass, while Andersson and Chapman speak of having shot as many as eight in a single night, while they were drinking at a water-hole during the dry season. Mr. Selous remarks, however, that the numbers thus met with were probably drawn together from over a large tract of country, as at such times drinking-places are few and far between. In 1874 Mr. Selous met with a considerable number of these rhinoceroses on the Chobi, but on again visiting the same district in 1877 he only came across traces of two, while in 1879 they had completely disappeared. In North Mashonaland there were, however, still a considerable number between 1878 and 1880, while others were to be met with in a small tract on the Sabi River in South-East Africa. About ten years ago Mr. Selous was, however, only able to find a single specimen in Mashonaland, and it was then thought that this animal, which fell to his rifle, was actually the last of its race. In a remote corner of Mashonaland this indefatigable hunter found, however, some half-dozen individuals still living in 1892, two of which were subsequently shot by Mr. R. T. Coryndon. In the north Kalahari Desert the species had been completely exterminated some years previously to 1890.

The extirpation of this rhinoceros is the more to be regretted since our museums are very badly off for specimens. It is, however, fortunate that Mr. Coryndon has succeeded in bringing home the skeletons and skins of two adult examples, which are preserved in the British Museum and the Rothschild Museum at Tring; while there is also a stuffed specimen in the Museum at Leyden. In addition to a magnificent skull, with horns, the British Museum likewise possesses a fine series of detached horns.

Habits.

In treating of the common African rhinoceros, we have already had occasion to refer to the exclusively grass-eating habits of this

species, and the consequent restriction of its habitat to open grassy plains. We have also alluded to its habit of walking with its head carried close to the ground; and likewise to the circumstance that the calf always precedes its mother when walking. It may be added that the mother appears to direct the course of her offspring with her long front horn. As regards its time of feeding and taking repose, the animals of this species closely resemble those of the ordinary kind. Mr. Selous states that "their sight is very bad, but they are quick of hearing and their scent is very keen; they are, too, often accompanied by rhinoceros-birds, which, by running about their heads, flapping their wings, and screeching at the



HEAD OF BURCHELL'S RHINOCEROS.—After Sclater.

same time, frequently give them notice of the approach of danger. When disturbed, they go off at a swift trot, which soon leaves all pursuit from a man on foot far behind; but if chased by a horseman they break into a gallop, which they can keep up for some distance. However, although they run very swiftly, when their size and heavy build are considered, they are no match for an average good horse. They are, as a rule, very easy to shoot on horseback, as, if one gallops a little in front of and on one side of them, they will hold their course, and come sailing past, offering a magnificent broadside shot, while under similar circumstances a prehensile-lipped rhinoceros will usually swerve away in such a manner as only to present his hind-quarters for a shot."

These animals were generally found in pairs or in parties of three, although,

as already mentioned, sometimes considerably more were seen together. Although, as we have seen, there is some difference of opinion as to the temper and disposition of the other species, all sportsmen agree that Burchell's rhinoceros was generally a harmless and inoffensive creature. Still, sometimes it would when wounded make a charge; and from the enormous size of the animal such a charge was a serious matter for those against whom it was directed. On one occasion Mr. Oswell caught sight of one of these rhinoceroses, and, putting spurs to his horse, soon came up alongside. He fired with good effect, but the animal, instead of attempting to escape, eyed its adversary for a moment, and then deliberately advancing, made a sudden rush at his horse, thrusting the long front horn completely through the animal's body, so that the point of the weapon struck the rider's leg through the flap of the saddle on the other side. Fortunately, Mr. Oswell was so little injured, that he was enabled to disengage himself from the body of his dead horse, and kill his formidable opponent.

When shot through the heart or both lungs this rhinoceros, like the other species, Mr. Selous tells us, is quickly killed. If, however, the bullet penetrates but one lung, they will go on for miles, although blood may be streaming from their mouth and nose. Similarly, they will hold on their course, at first at a gallop and then at a trot, with a broken shoulder, for more than a mile; but a broken hind-leg brings them immediately to a stop. The latter circumstance is somewhat at variance with Sir S. Baker's account of hunting the common rhinoceros in the Sudan, referred to on p. 478.

Burchell's rhinoceros differed from the other African species in that during the autumn and winter months, that is to say from March till August, it accumulated an enormous quantity of fat; and at such times its flesh is stated to have been of excellent quality, somewhat resembling beef, but with a peculiar and characteristic flavour of its own. The favourite dish was the hump on the withers, which was cut out and cooked with the skin on in a hole in the ground. The flesh of the calf was excellent at any season, and has been compared to very tender veal.

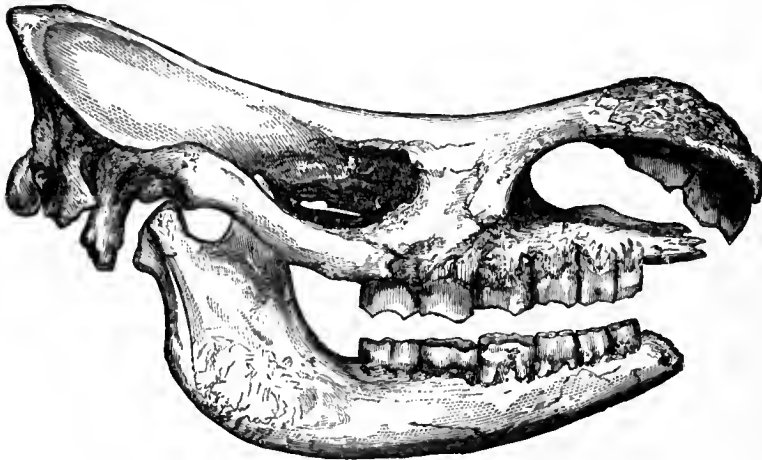
Holmwood's Rhinoceros. Certain very remarkable front horns of a rhinoceros obtained from traders at Zanzibar, and doubtless belonging to an East African form, may possibly indicate a third species, which may be known as Holmwood's rhinoceros. These horns, one of which measures 42 inches, are characterised by their great length and slenderness, coupled with the small size of the base. It has been suggested that they are abnormal horns of the female of the common species, but it is quite probable that they belong to a totally different animal, which may be more nearly allied to Burchell's rhinoceros.

EXTINCT RHINOCEROSSES.

In the course of the preceding paragraphs, some reference has been made to certain extinct species of rhinoceroses which approximate closely to some of the existing members of the group. Besides these, there are, however, a multitude of extinct species, which ranged not only over Europe and Asia, but likewise North America. It has, indeed, been suggested that America was the original home of

these animals, from whence they migrated to Asia and Europe; but it appears to us that the evidence is equally in favour of the migration having been in the opposite direction. These rhinoceroses occur throughout the Tertiary period as far down as the upper Eocene division; and even at that low horizon many of the species may be referred to the living genus, although in most cases they were unprovided with horns, while some of them had four toes to each fore-foot. Rhinoceroses are, therefore, even more ancient animals than tapirs.

Mention has already been made of a rhinoceros from Greece, which was closely allied to the common living African species; but there were also several other extinct Old World kinds resembling the existing African rhinoceroses in the presence of two horns and in the absence of front teeth, while in some cases there is evidence to prove that their skins were of the smooth type. One of the most remarkable of these species is the broad-nosed rhinoceros (*R. platyrhinus*) from the Siwalik Hills at the foot of the Himalaya, which was an



SKULL OF EXTINCT RHINOCEROS FROM THE BRICK-EARTH OF ESSEX.

enormous animal, with upper molar teeth resembling in structure those of Burchell's rhinoceros, although the last one was of the ordinary triangular shape. The other species, with molar teeth of similar type, is the woolly rhinoceros (*R. antiquitatis*), so called from the

thick coat of woolly hair with which its body was covered. Skeletons, bones, and teeth of this species have been found in the cavern and other superficial deposits of the greater part of Europe, including England, while entire carcases occur frozen in the ice of the Siberian "tundra." From these frozen specimens it has been ascertained not only that the skin was covered with woolly hair, but likewise that it was devoid of the permanent folds characterising the Asiatic species. The horns of the woolly rhinoceros appear to have rivalled in size those of the living African Burchell's rhinoceros. From the structure of their upper molar teeth it may be inferred that both the broad-nosed and the woolly rhinoceros were grass-eaters. In Siberia, however, portions of needles of conifers and of twigs of other trees have been found in the interstices of the molar teeth of the latter; from which it has been assumed that the animal was a branch-eater. It is, however, quite probable that while in Siberia it may have been compelled from lack of its proper food to take to feeding upon leaves and twigs, yet that in the more southern portion of its range it resembled its allies in being entirely a grass-eater.

During the Pleistocene period there were three other species of two-horned

rhinoceroses without front teeth, inhabiting England and other parts of Europe, which had upper molar teeth of the general type of those of the common African species, although their skulls were very different. Of these, the Leptorhine rhinoceros (*R. leptorhinus*) and the Megarhine rhinoceros (*R. megarhinus*) are found in the brick-earths of the Thames valley and other superficial deposits; while the Etruscan rhinoceros (*R. etruscus*) occurs in the somewhat older "forest-bed" of the Norfolk coast, and likewise in the upper Pliocene beds of Italy and France. The Leptorhine and Megarhine species have tall-crowned cheek-teeth, and (as shown in the accompanying figure) are characterised by the presence of a vertical bony partition in the skull dividing the two chambers of the cavity of the nose. In this respect they resemble the woolly rhinoceros; a rudiment of the same feature also occurring in the living Javan rhinoceros. The Etruscan rhinoceros, on the other hand, has shorter-crowned cheek-teeth, and no such bony septum in the nasal cavity. That all these three species browsed on leaves and twigs may be pretty confidently asserted from the structure of their upper molar teeth; while a carcase found embedded in the ice of Siberia belonging to either the Leptorhine or the Megarhine species, shows that these had smooth skins like the living rhinoceroses of Africa. The Deccan rhinoceros (*R. deccanensis*) and the Karnul rhinoceros (*R. karnuliensis*), from the superficial deposits of Southern India, indicate that smaller representatives of the two-horned branch-eating group likewise inhabited that country.

Reference has already been made to the occurrence in the Miocene deposits of Europe of an extinct two-horned rhinoceros provided with upper and lower front teeth, which was allied to the living Sumatran species. Throughout the middle Tertiary rocks of Europe, as well as in the Pliocene and Miocene of India, there are found, however, a number of rhinoceroses differing from any living species in the total absence of horns, while in those cases where their limbs are known the fore-feet were provided with four toes. Some of these animals were of very large size, and all of them had molar teeth of the type of that represented in the upper figure on p. 464 (which belongs to one of the Indian species), and their jaws were furnished with large front teeth. Moreover, in one of the Indian representatives of this hornless group, the last molar tooth was of nearly the same form as that in front of it, instead of being triangular. That all these species subsisted on leaves and boughs, may be inferred from the structure of their short-crowned molar teeth; and it may be observed here that all the older Ungulates had short-crowned cheek-teeth, adopted for champing twigs and leaves rather than for masticating grass; whence it may be concluded that grassy plains are probably a comparatively recent feature in the history of our globe. Hornless rhinoceroses also occur in the Tertiary deposits of North America, but at least the majority of these resembled existing types in having but three toes on each fore-foot; while their limbs were relatively shorter than in their Old World allies, and their bodies more elongated. Finally, there were certain other small rhinoceroses from the lower Miocene of both Europe and the United States, in which the front of the skull carried a very small pair of horns placed transversely instead of longitudinally.

The above are all the forms which can be included in the genus *Rhinoceros*.

There are, however, a number of allied extinct animals which connect the true rhinoceroses with more generalised extinct types of Odd-toed Ungulates. Such for instance is the *Amynodon*, from the Miocene Tertiary of North America, which was a rhinoceros-like animal with no horn, and the full typical number of forty-four teeth. That is to say, there were three incisors, a tusk, and seven cheek-teeth on each side of both jaws; the front teeth being like those of ordinary mammals, and not having the peculiarly modified form presented by those of the true rhinoceroses. Moreover, the whole of the three upper molar teeth were alike; and none of them had the processes projecting into the middle valley which are found in those of all true rhinoceroses. Probably the *Amynodon* also occurred in the lower Miocene and upper Eocene rocks of France. There were other allied types, but the above example is sufficient to show that the earlier rhinoceroses were far less different from tapirs and some extinct generalised forms to be noticed later on than are their modern representatives.

We must not, however, take leave of the rhinoceros family without referring to a most remarkable creature known as the elasmothere, which flourished during the Pleistocene period in Siberia. This creature was probably as large as Burchell's rhinoceros, and like that species had no teeth in the front of the jaws. The skull had a bony partition in the cavity of the nose, and carried on the forehead an enormous protuberance which, during life, doubtless supported a horn of very large size. The most remarkable feature about the elasmothere is, however, to be found in the structure of its cheek-teeth, which while formed on the type of those of the rhinoceroses, are greatly elongated, and have their enamel so much folded as to present some resemblance to those of the horse. Indeed, the elasmothere may be regarded as a highly-specialised grass-eating creature, presenting a relationship to an ordinary rhinoceros somewhat similar to that which the horse exhibits to certain extinct Ungulates noticed in the sequel.

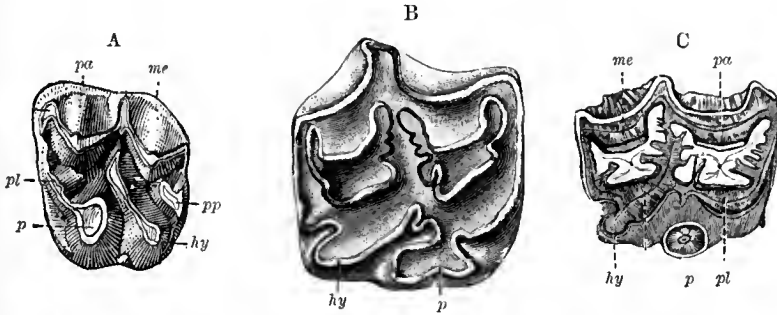
THE HORSE TRIBE.

Family *EQUIDÆ*.

Under the general title of horses, zoologists include not only the animals to which that name is restricted in ordinary language, but likewise the asses, zebras, and quaggas, together with certain nearly-allied extinct animals. All these are characterised by having very high-crowned cheek-teeth, in which the enamel is thrown into a series of complicated foldings, and the deep valleys between the component columns completely filled up with cement. In the upper cheek-teeth, as shown in B and C of the accompanying figure, the outer columns (*pa, me*) of each tooth are flattened, and the premolars somewhat exceed the molars in size; while in the lower jaw the ridges are crescent-like, although much complicated by the foldings of the enamel. So different, indeed, are the molars of the horses from those of other Odd-toed Ungulates, that it is at first sight somewhat difficult to realise their fundamental unity of structure. A comparison of the three figures in the accompanying illustration will, however, clearly indicate how the structure of the tall-crowned molar of the horse is essentially the same as that of the low-

crowned molar of the extinct anchithere, while that of the latter does not differ very widely from the molars of the rhinoceros represented on p. 481. Remembering that the figured molar of the anchithere belongs to the opposite side of the jaws to those of the horses, it will be apparent that it would only require a heightening of its columns and ridges, accompanied by the formation of a series of foldings in their investing enamel, and the filling up of the deepened intervening valleys with cement, to produce a very similar type of tooth. It is almost superfluous to add that the tall-crowned molars of the horse, with their completely filled valleys, and their alternating ridges of harder and softer constituents, are far more efficient instruments of mastication than the low-crowned teeth of the anchithere, with their perfectly open valleys. Indeed, while the horse's are adapted for a grinding action, and have nearly flat surfaces, the anchithere's molars are suited to a champing motion, and have ridged surfaces.

Incisors. Another peculiarity in the dentition of the horses is that the incisor or front teeth in both jaws have an infolding of the enamel at the summit of their crowns, as shown in the figures A, B, C, on p. 490.



UPPER MOLAR TEETH OF THE ANCHITHERE (A), THE HORSE (B), AND THE HIPPARION (C).

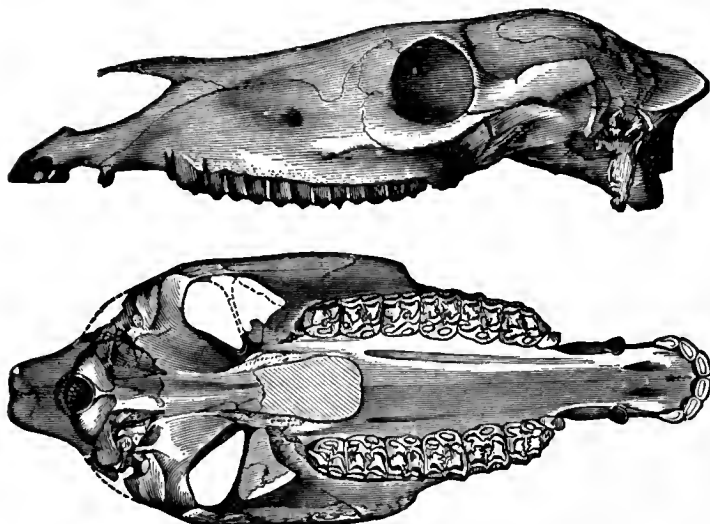
A is from the left, and B and C from the right side of the jaw.

This peculiar structure, of which we shall have more to say in the sequel, may be imitated by taking the finger of a glove and pushing in the top, and afterwards filling the whole of the inside with wax.

Other Characters. The skull of the horses differs from that of all other living Odd-toed Ungulates in having the socket of the eye completely surrounded by bone. In all existing horses the number of toes on each foot is reduced to one, which is enclosed in a large solid hoof. This toe, which corresponds in the fore-limb to the human middle finger, is supported by a single long cannon-bone. On the sides of this cannon-bone there are, however, small splints representing the remnants of the second and fourth toes; and in certain extinct forms (as shown in the figures on p. 153) these lateral toes were complete and furnished with hoofs, although they were much inferior in size to the middle toe, and could have been of little, if any, functional importance. In defining the horse family, it must accordingly be stated that although the toes may vary from one to three in number, it is only the middle one that is functionally important. Another distinctive feature of the family is that in the fore-limb the ulna is represented only by its upper extremity, which becomes united with the radius;

while in the hind-limb the remnant of the fibula becomes similarly fused with the tibia.

Specialisation. So far as their extremely specialised organisation is concerned the horses hold a position among the Odd-toed Ungulates precisely analogous to that occupied by the true Ruminants, or Pecora, in the Even-toed division of the order; and it is curious to observe how the two groups have



SIDE AND PALATAL VIEWS OF SKULL OF EXTINCT THREE-TOED HORSE.—After Zittel.

undergone an almost exactly parallel development, although differing so essentially from one another in the structure of their limbs and teeth. In both, for instance, the cheek-teeth have acquired tall crowns, with complicated foldings of the enamel, and the front teeth are separated by a long gap from those of the cheek-series. Then, again, both have the feet supported by a long cannon-bone,

although in the Ruminants this is formed by the fusion of two distinct elements, and in the horses of but one original constituent. Moreover, both groups have the two bones of the lower segment in the fore and hind-limbs fused together, and in both the process by which the second vertebra of the neck articulates with the first has assumed a spout-like form.

Equus. The whole of the existing representatives of the horses are included in the genus *Equus*, of which the following are distinctive characteristics. In the upper cheek-teeth the portion called the anterior pillar (marked *p* in the middle figure on p. 487) is connected by a narrow neck of enamel and ivory with the adjacent crescent in the middle of the same side of the tooth; and each foot has but a single toe. The total number of teeth in the males of all the living species is 42; these comprising $\frac{3}{3}$ incisors, $\frac{1}{1}$ canines, and $\frac{7}{6}$ cheek-teeth. The first upper tooth of the cheek-series, that is to say the first premolar, is, however, very small in all the living species, and is frequently wanting, thus reducing the number of teeth to 40. It is, however, larger in many fossil species, and a few of these also have a small first premolar in the lower jaw, thus bringing up the number to the typical 44. The canines of the males are rather small and pointed, and in the females are either rudimentary or wanting. When present, they are placed near to the incisors, but are separated by a long gap from the teeth of the cheek-series.

Form. The horses are such well-known and familiar animals, that it would be superfluous to describe their form and appearance in detail. It may be observed, however, that the ears are long, and that the tail is likewise elongated, but may be either clothed with long hairs throughout its length, or merely tufted at the extremity. The neck carries a mane, which may be either erect or pendent, and the fore-limb has a hard naked callosity above the wrist joint. In most wild species some portions, or the whole, of the body and limbs are



SHIRE STALLION ("MARS VICTOR").—The property of Sir Walter Gilbey, Bart.

marked with transverse dark stripes, but these disappear more or less completely in the domesticated breeds.

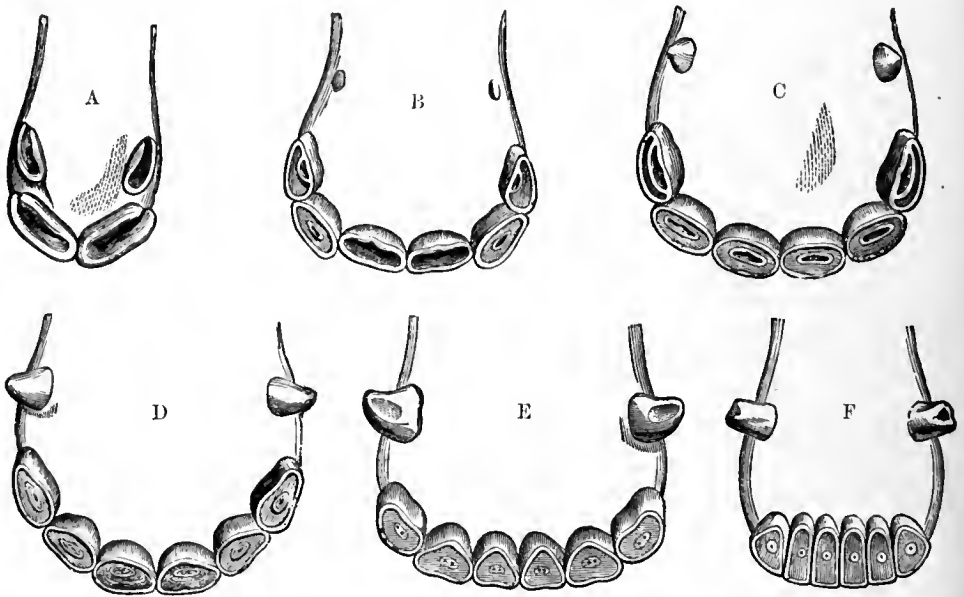
Distribution. With the exception of those that have been introduced by man into other regions, horses are now confined to the Old World, and are especially characteristic of Africa. They may be divided into true horses, zebras, and asses.

Nomenclature of Limbs. Before, however, proceeding to the consideration of these groups, it may be well to mention that the terms commonly applied to the various segments of the limbs of the members of the horse family are not the same as those used by the zoologist and anatomist. For instance, what is commonly designated the knee of the horse is really its wrist, while the so-called hock in the hind-limb is the ankle-joint. The true knee is, of course, in the hind-limb, and is commonly known as the stifle-joint, while in the fore-limb the elbow-joint is situated, as in other animals, at the lower end of the humerus. The fore and hind cannon-bones respectively correspond to the human middle metacarpal and metatarsal bones, and the so-called pastern and coronet bones to the three joints of the

middle finger and toe; the fetlock being the joint at the lower end of the cannon-bone.

It will thus be evident that the horse is an animal which is supported exclusively by a bone in each fore-foot corresponding to the terminal joint of the human middle finger, and in the hind-foot by the representative of the same joint of the middle toe. In this respect the members of this family differ from all other mammals. Indeed, as is well remarked by Sir W. H. Flower, had we not become so thoroughly accustomed to the horse, we should regard it as a very strange and wonderful animal, as in truth it is.

Indications of Age. In this place it will be convenient to refer briefly to the changes which take place in the incisor teeth of the horse, with age. As already mentioned, the summits of these incisors are characterised by an infolding



THE UPPER INCISOR AND CANINE TEETH OF THE HORSE AT VARIOUS AGES.

A at 30 days; B at 3 years; C at 6 years; D at 8 years; E at 15 years; F at 30 years.

of the enamel, deeper in those of the upper than in those of the lower jaw, and common to both the milk and the permanent series. When the teeth are first protruded, as in A of the accompanying figure, the whole of the fold is covered with enamel, but when the teeth are worn (as in C) the edges are cut through, and the centre of the crown is occupied by a pit surrounded with a ring of enamel, this being technically known as the "mark." In the figures, A shows the jaw of a very young colt, with only the first and second milk-incisors protruded, both being unworn; the third milk-incisor would appear later. In B, which indicates a horse about three years old, the first permanent incisor has just appeared, after pushing out the corresponding milk-tooth. Between three and a half and four years the second permanent incisor would have likewise appeared, and about half a year later the tusk protrudes from the gum. At five years the third incisor would have displaced its predecessor, and the dentition would then be complete. This state is

shown at C, which represents the jaw of a six-year-old horse, in which the third incisor is partly worn, although still retaining a large mark. Up to five years the age of a horse can consequently be determined with accuracy, and also approximately for some years longer. As a rule, the mark disappears in the first incisor of the lower jaw at six years, in the second at seven, and in the third at eight, while in the corresponding upper teeth it persists about two years longer. D shows the upper jaw of a horse about eight years of age, when the mark has nearly disappeared in the first incisor. After the mark has been lost in all the incisors no indications of age are afforded. In old horses, as in E, a kind of spurious mark is, however, produced, owing to the tooth having become so much worn down that the pulp-cavity of its basal portion is exposed. Such spurious marks have, however, no ring of enamel, and cannot be made to counterfeit the true mark, although attempts to make them pass for this were, and perhaps still are, made by unscrupulous dealers. When the spurious mark makes its appearance, the section of each incisor forms a wide triangle, the broad and flattened crown having been completely worn away; and in extreme old age, when the teeth are ground down to their very roots, as at F, they become very narrow.

THE HORSE (*Equus caballus*).

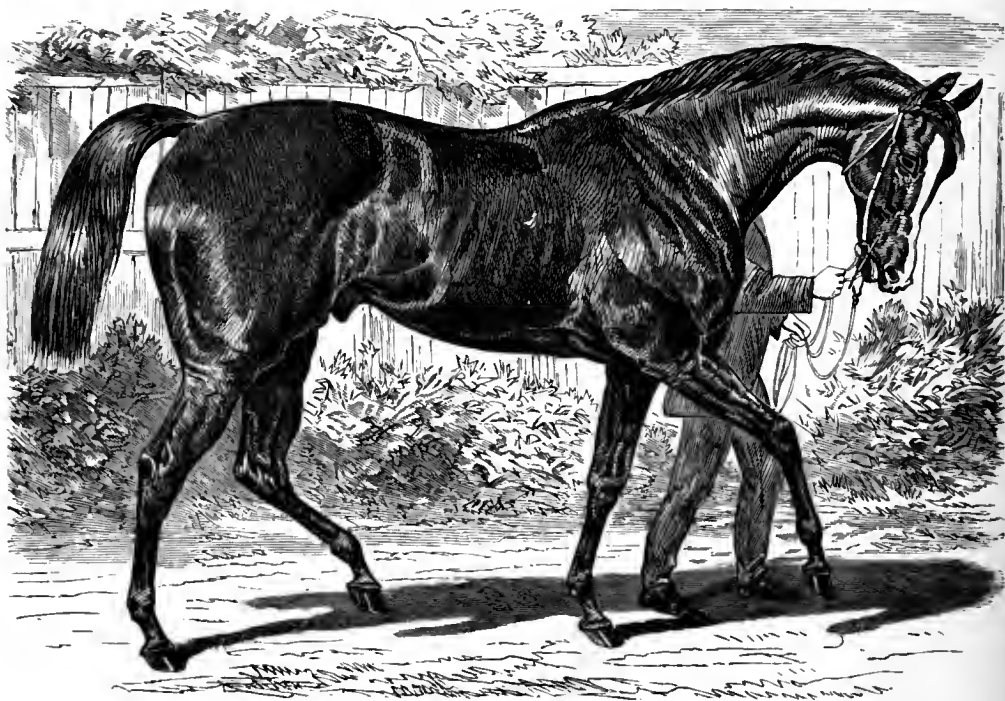
The horse differs from the other members of the genus in having the tail thickly covered with long hairs from the root to the extremity, and also by the mane being longer and more flowing. It has also a bare callosity on the inner side of the hind-limb a little below the heel-joint, or hock, so that such callosities are present in all the four limbs. Moreover, the head is smaller, the ears are shorter, the limbs proportionately more elongated, and the hoofs broader than in any of the other species. In colour, domesticated horses vary greatly, but they seldom show any definite markings beyond a more or less distinct dappling. The wild horses of the Asiatic steppes are, however, of a dun colour; and since domesticated dun-coloured individuals—especially in India and Argentina—frequently show a dark streak down the middle of the back, and sometimes two or even three transverse shoulder-stripes, and likewise dark bands on the limbs, it has been inferred that originally the horse was a dun-coloured animal, more or less marked with dark stripes. The height among the domesticated breeds is no less varied than the coloration. Thus, while cart-horses frequently attain the height of 17 or 18 hands (5 feet 8 inches or 6 feet) at the withers, the Shetland pony seldom exceeds 11 hands (3 feet 8 inches), and is occasionally as low as 8½ hands (2 feet 10 inches). The Asiatic wild horses are of medium stature.

From what is known of the present wild or half-wild races, it is probable that the horse was originally an inhabitant of open steppes, where it dwelt in large droves headed by an old stallion. And from the habit displayed by domestic horses of clearing away the snow from their pasture in winter by scraping with the front hoof, Darwin was of opinion that the original habitat of the species was in regions where the ground is covered during a portion of the year with snow.

Distribution. So far as we know at present, the true horse in its original wild state was mainly confined to Europe and Asia, although it extended

eastwards from the latter continent into Alaska. It has, indeed, been stated that certain wild horses found in the Argentine in 1530 could not have been introduced, and must accordingly have been indigenous. Even, however, if this be so (and the story is denied by Dr. Trouessart), there is no evidence to show that the horses in question were identical with *E. caballus*, of which fossil remains appear to be unknown in the New World south of Alaska.

Fossilised remains of horses are extremely common in the brick-earths, cavern-deposits, etc., of England and the Continent, and since these are indistinguishable from the teeth and bones of the existing species, it may be pretty confidently considered they indicate the former existence of that animal in a wild state. And it



ENGLISH RACE-HORSE ("DONCASTER").

may be observed that the researches of Dr. Nehring have afforded reason to believe that during part of the Pleistocene period there existed in Western Europe a condition very similar to that now obtaining in the Russian steppes, where wild horses now live. Further evidence of the identity of these Pleistocene horses with the living species is afforded by certain rude drawings incised on fragments of slate, bone, or antler, which have come down to us from the ancient inhabitants of Europe during the later Stone Implement period. These drawings show that the Pleistocene horse was a rather small, heavily-built animal, with a large head, and a rough mane and tail, in all of which respects it agreed with the under-mentioned tarpan or wild horse of the steppes.

Dr. Nehring is of opinion that the wild horse of Western Europe was domesticated and tamed by the men of the later Stone Implement period at a time when

steppe-like conditions still prevailed in those regions; and there can be but little, if any, doubt that the horses used by the ancient Britons and Germans in the time of Caesar were derived from the same native stock. It is, however, probable that the existing domesticated horses of Europe have a twofold origin, and that, while the so-called thorough-bred and half-bred races have an Asiatic or perhaps partially North African descent, the breeds denominated by the Germans "cold-blooded" are derived from the primitive European stock.

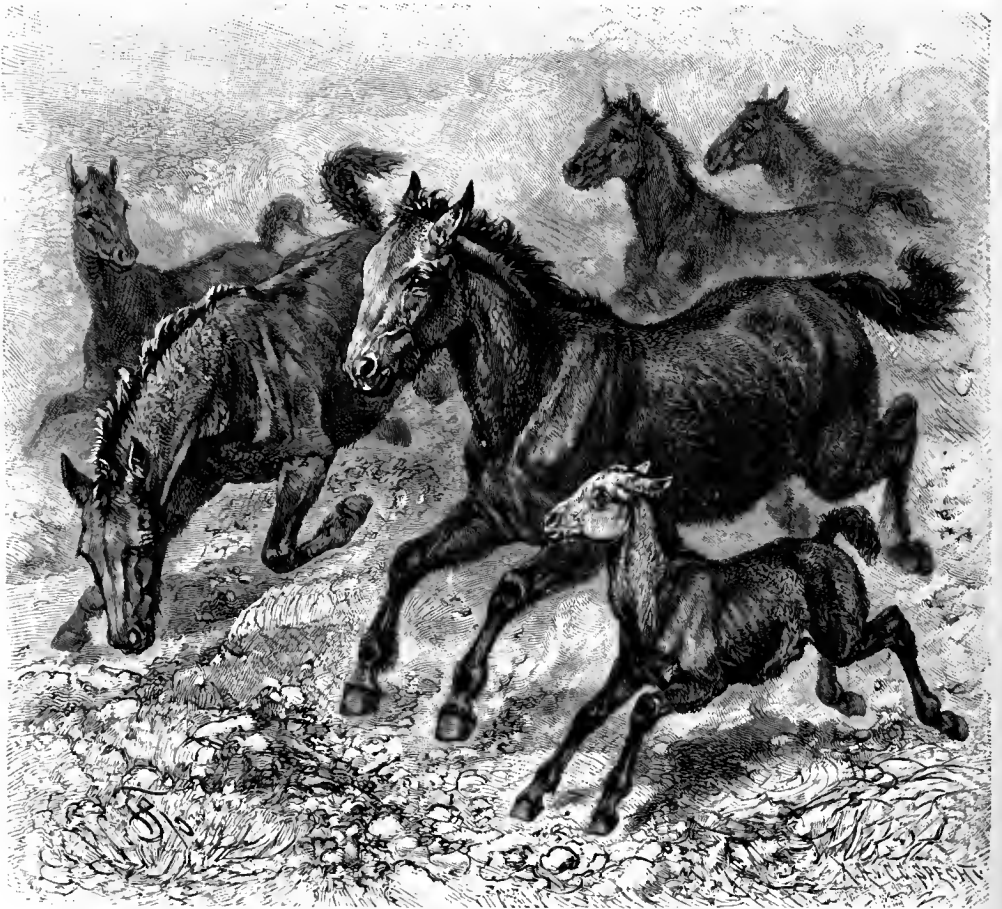
To how late a date the original wild horses of Western Europe existed as such, cannot now be definitely ascertained. It is true that Strabo relates that wild horses existed in his time in Spain and the Alps, and Pliny speaks of their existence throughout a great part of the north of Europe. The occurrence of these animals in the Ardennes is alluded to by Venantius Fortunatus, and in Italy a reference to them is made by Pope Gregory III. in the year 732. There is also evidence that about the year 1000 the monks of St. Gall were in the habit of using the flesh of wild horses as an article of diet, while so late as 1316 a document alludes to their existence in Westphalia. Moreover, Rösslin, in the year 1593, states that wild horses, which were more shy and difficult to approach than stags, were found in the Vosges, and were captured and tamed by the inhabitants of those districts. In all these cases it is, however, quite probable that these horses were feral rather than truly wild; that is to say, that they were derived from tamed races which had again taken to a wild life. This view is rendered the more probable from the circumstance that, during the historic period the greater part of Western Europe had become a forest-clad region quite different from the open steppes which we have reason to believe were the original home of the horse; but it is not impossible that a certain number of troops of wild horses might have adapted themselves to the changed conditions of their surroundings, and have lived on to the Middle Ages.

Tarpan. Although at the present day the tarpan, or wild horse of the steppes, is now confined to Central Asia, there is evidence that in the time of Pallas (*circa* 1760) its range extended westward to the region of the Urals and Volga. This explorer states that at that period the tarpan abounded in the steppes of Tartary and Mongolia, from the Dnieper to the Altai, and thence throughout Central Asia, in small droves seldom exceeding fifty head. The majority are of a reddish grey (dun) or pale grey colour; but from intermixture with individuals which have escaped from captivity, these colours are not invariable. In the pure-bred race, the mane, a streak along the back, and the tail, are reddish brown, while the nose is whitish, and the rest of the muzzle nearly black. They are smaller than the average domestic horse, and have thinner limbs, larger heads, with a convex profile, and longer ears which at their summits are bent backwards in a sickle-like manner. The hoofs are small and cylindrical; and the mane, which extends far on to the forehead and backwards on to the shoulders, is comparatively short, thick, and half-erect. In winter the coat is long, rough, and shaggy; and the bushy tail rather short. Young colts are easily tamed, but the adults are utterly intractable. Tarpan exhibit wonderful speed, and strenuously avoid the neighbourhood of man. They frequent the open steppes, and are never found in forests and mountainous districts.

Since the time of Pallas the tarpan has been steadily driven back to the

more remote parts of Central Asia, where it was met with by Colonel Prejevalski. The troops there are under the leadership of an old stallion, and they always move against the wind, with their ears and nostrils alert to detect the least trace of danger. During the winter the tarpan scrapes away the snow with its front hoofs in order to reach the scanty herbage beneath; and its coat at this season becomes so thick as to form a kind of thin fur.

It has been frequently stated that tarpan are feral rather than truly wild



THE TARPAN ($\frac{1}{2}$ nat. size).

horses. This opinion is, however, vehemently opposed by Dr. Nehring, who believes that in these animals we have the last survivors of the ancient prehistoric wild horses of Europe, which have been more or less modified by an infusion of domesticated blood through the intermixture of individuals escaped from captivity. If Darwin be right in concluding that the primitive horse was more or less striped, it is possible that this infusion of domesticated blood has led to the nearly uniform coloration of the tarpan.

Prejevalski's
Horse.

It may be mentioned in this place that a wild horse from Central Asia, described as *E. prejevalskii*, has been regarded as indicating

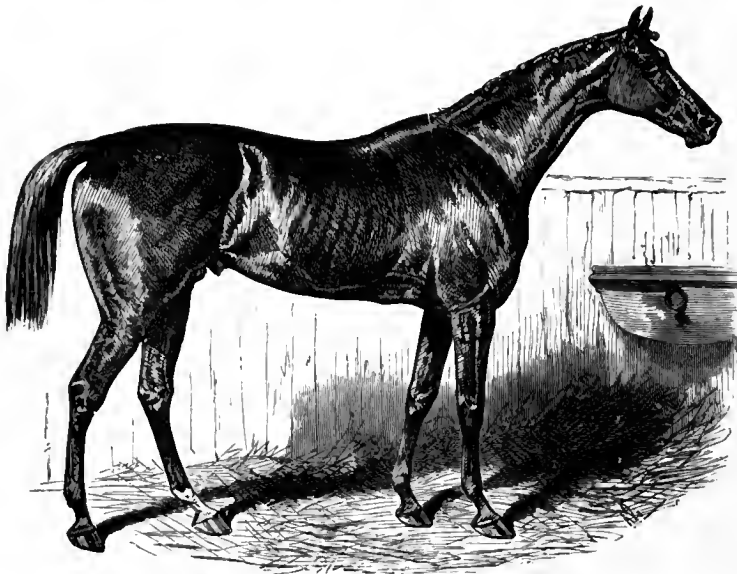
a distinct species. It is of dun colour, becoming darker on the back, where, however, there is no distinct stripe, and nearly white on the under-parts. Although agreeing in most respects with the horse, it differs by the mane being erect and without a forelock on the forehead, and by the hairs on the tail being confined to the lower half. Sir W. H. Flower suggests that this animal may prove to be a hybrid between the tarpan and the kiang.

Domestication. We have seen that in Europe the horse was probably domesticated during the prehistoric period; and we turn now to the evidence afforded by the Egyptian monuments as to the date of its first use in that ancient country. It appears that no pictorial representations of the animal occur in the frescoes of the so-called old kingdom; and that such are seen for the first time at about the 18th dynasty (1800 or 1900 B.C.), when the reign of the Asiatic Hyksos, or shepherd-kings, who had for so long a period ruled over the valley of the Nile, came to an end. At this period the horse seems to have only been used in war; and it is possible that it may have been introduced by the kings of the 18th dynasty from Syria. Both in Egypt and in Europe it was only at a comparatively late period that the horse replaced the ox as a beast of draught.

In regard to Western Asia, it appears that the horse is of comparatively recent introduction into Arabia, the earliest accounts of the nomads of the Arabian deserts referring only to their possessing camels and asses; while the Arabs in the army of Xerxes are stated to have been mounted on camels. The sculptures of Nineveh show, however, that the war-horse was known at a very early date in Assyria; and it is hence probable that it was from Mesopotamia that the horse was introduced at first to the Syrians on the Mediterranean, and from them to the Egyptians in the valley of the Nile. It is a somewhat curious circumstance that in all the Assyrian sculptures in which mounted warriors armed with the bow are depicted, the horse is invariably led by a second horseman, thus suggesting that at this date the Assyrians were by no means such good riders as the Persians and Parthians subsequently became. The Greeks may have derived their war-horses from the same Asiatic stock; and from Greece and Italy these Asiatic horses probably became intermingled with the native breed originally domesticated in Western Europe. From Mesopotamia the horse probably spread westwards as a domesticated animal into Persia and India, in neither of which countries is there any evidence of the existence of an original wild breed.

In America. Apart from the question whether an indigenous species may have still lingered on in Argentina, at the time of the Spanish conquest horses were unknown in at least the greater part of America. When introduced, from Europe, they soon multiplied, and reverted to a semi-wild condition, and spread over large areas of the country, where they now exist in vast numbers in the open plains. Mr. W. H. Hudson states, however, that in certain parts of Patagonia wild horses are unable to exist owing to the number of pumas; and he suggests that it may have been these animals which led to the practical if not total extinction of the indigenous horses of the New World. In the Falkland Islands the horses introduced by the French in 1764 have become thoroughly wild, and have multiplied to a considerable extent, although not so much so as might have been expected. At the time of Darwin's visit these wild horses were, for

some unknown reason, restricted to the eastern corner of the island; and their comparatively slow rate of increase is attributed to the wandering habits of the stallions, which compel the mares to accompany them, whether or no the foals are able to follow. These Falkland horses have roan and grey for their predominating colours; and in one part of the island are small and pony-like. The late Prof. Moseley was, however, informed that their small stature in this locality was due to the inferior size of the stock from which they are descended. In the peninsula of Lafonia, where the wild horses of the Falklands are of larger size, Prof. Moseley writes that "the strong and active horses each guard their own herd of mares. They keep the closest watch over them, and if one strays at all, drive her back into the herd by kicking her. The younger horses live in herds apart, but the



ENGLISH RACE-HORSE ("BEND-OR" by "DONCASTER").

more vigorous ones are always on the look-out to pick up a mare from the herds of the older ones, and drive her off with them, and they sometimes gather a few mares for a short time and hold them, till they are recaptured. When they think they are strong enough, they try the strength of the old horses in battle, and eventually each old horse is beaten by some

rival and displaced. The fighting is done mainly with the tusks, and front to front, not with the heels. Thus the most active and strongest males are constantly selected naturally for the continuation of the herds." As in the continent of South America, these wild horses are captured either by the lasso or the bolas. When caught, Moseley states that they "are often broken in by tying them with a raw-hide halter to a post, and leaving them for several days without food or water. After long ineffectual struggles to break loose, the animals become convinced of the absolute power over them of the halter, and in future become cowed and docile directly a halter or lasso is over their heads. The wild horses, when broken in, are very tame and quiet to ride."

The habits of the wild horses of continental South America appear to be very similar to the above. There they are known by the name of cimarrones; and are captured and tamed by the Gauchos, who generally mount them at once and ride them till they are tired out. The Gaucho rides with a loose rein, and his horse's head almost at liberty; and so well are the animals broken, that merely pressing

the part of the reins next to the hand against that side of the neck from which the horse is required to turn is sufficient, without making him feel the bit at all.

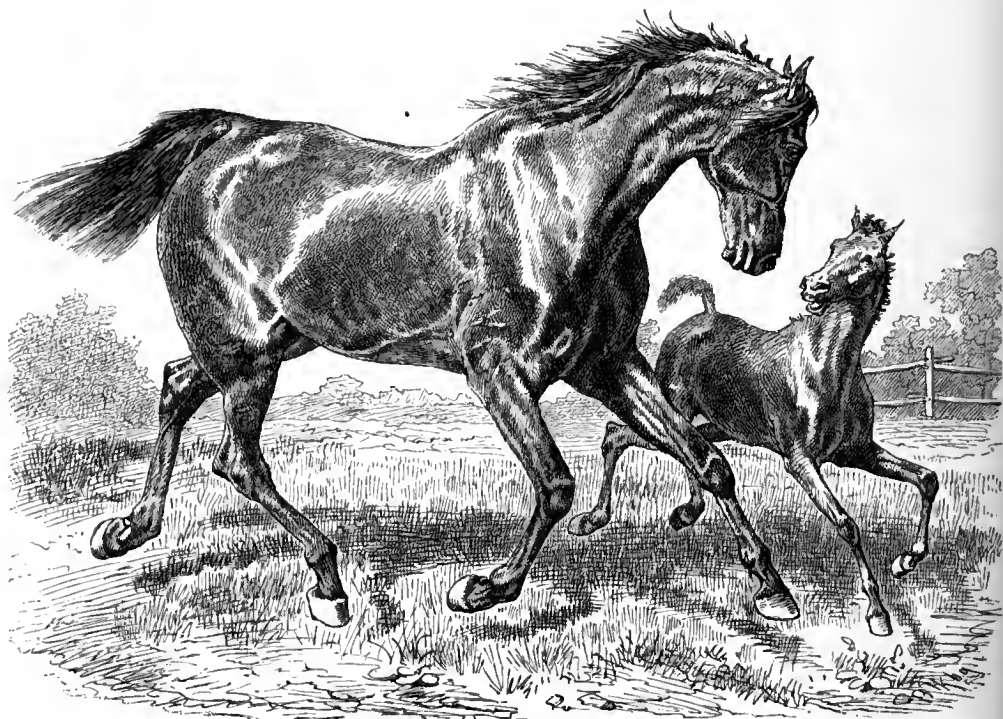
Australia. Feral horses are as abundant in Australia, where they are known as brumbies, as in Southern America. Indeed, so numerous are they in certain districts as to become a positive nuisance to the settlers, by whom they are sometimes shot down in large numbers.

Barbs and Arabs. Proceeding to the consideration of some of the leading breeds of domesticated horses, we may commence with those known as Barbs and Arabs, which have had such an important share in the production of the modern race-horse. With regard to the Barbs, which take their name from their native region, Barbary, it may be premised that the generality of African horses are distinguished from those of Asia by their long limbs and small girth at the loins, thus resembling the foals of other breeds. They display great powers of enduring hunger and thirst; and are fleet, with a high and graceful action. The Barb comes nearest to this general African type, but displays some variation owing to a crossing with other breeds. Low says that these horses "are about 14½ hands high. They are sufficiently deep at the girth, but tucked up in the belly, giving that peculiar greyhound-aspect which is characteristic of this race. Their necks are long and well-formed, their heads moderately fine, the chafron tending to the convex; their shoulders are oblique, and the withers thin and well raised. Their limbs, though thin and delicate, are sinewy; their pasterns are oblique, and the feet well formed. They are gentle and full of spirit; they are somewhat careless in their paces, but distinguished by their graceful action. As compared with the Arabians, they are more swift, but less enduring."

Arab. The Arab horse is strictly a product of the country from which it takes its name; and the breed appears to have been derived from horses introduced into Arabia from the Caucasus or Asia Minor somewhere about the Christian era. They resemble in many respects the horses of these regions, "but," writes Low, "inhabiting a very dry and arid region, their characters have become adapted to these conditions of climate and food. They are more compact than the horses of Barbary, having a rounder body, shorter limbs, with more of sinew, or what is termed bone. Yet they are of the smaller class of horses, very little exceeding, on a medium, 14 hands, or 56 inches in height. As compared with the horses of countries abounding in the grasses, their aspect is lean, their form slender, and their chest narrow. But the slimmness of figure of these horses is not inconsistent with muscular force; and their movements are agile, their natural paces swift, and their spirit is unmatched. The power of their delicate limbs is indicated by the well-marked muscles of the fore-arm, and the starting sinews of the leg. The shoulder is sufficiently oblique; the withers are elevated; the back is moderately short; and the quarters are good. The head is well formed; the forehead is broad; the ears are somewhat long, but alert; the eyes full and clear; the veins prominent—the whole rather indicating a happy union of gentleness and spirit, than the fiery temper which is commonly associated with the desert horse." Although not remarkable for great speed, the Arab is pre-eminent for its endurance, hardy constitution, and the scanty fare on which it can exist. On a cold morning in Northern India, when the horses have been picketed round the

camp during the night, the Arabs will be found with their coats as sleek as if they had just come from a warm stable, while those of other breeds will be all awry. In their native home Arab horses will subsist on the scanty herbage found here and there in the desert, and, in the absence of these, on a little barley, chopped straw, dates, and, in extreme cases, camels' milk. They drink only at long intervals, and then but scantily; while their power of making long marches under a scorching sun is unrivalled. The affection with which the Arab treats his horse is too well known to need comment.

Levant and Persian Horses. The horses of the Levant and Persia are more or less closely related to the Arab, but are often of larger size. Indeed, in Southern Persia the horses are very similar to Arabs, though less delicately formed; but in



GERMAN HALF-BRED HORSE ($\frac{1}{2}$ nat. size).

the northern districts they are all larger. The Turkoman horses, which often stand 16 hands in height, are allied to those of Northern Persia.

The English Race-Horse. The English race-horse, of which examples are represented in the figures on pp. 492, 496, has been produced by a gradual improvement of the original native breed, which had been going on for several centuries, and subsequently by a large infusion of Eastern and African blood. The present breed is mainly the product of three foreign horses; of which the first was from the Levant, belonging to Capt. Byerly in 1689, and hence called the "Byerly Turk." From him was descended "Herod," which, as being the most celebrated of this stock, has given the name of the Herod-line to all his descendants. In the reign of Queen Anne the "Darley Arabian" (so called from the name of its owner) like-

wise exerted great influence upon the breed. From him were directly descended "Flying Childers" and "Bartlett's Childers"; while from the latter was derived "Eclipse," the fastest horse which has ever run on the turf. The horses descended from the latter are designated the Eclipse-line. The third horse was the "Godolphin Barb," born about 1724; from whose grandson, "Matchem," is derived the name of the third great line of English race-horses. It should be remembered that both "Herod," "Eclipse," and "Matchem" were closely related to one another; and it is only the descendants of the breed thus produced to which the term "thoroughbred" applies. The form of the race-horse is designed solely for speed, and cannot be taken as a model of equine beauty; the frequent presence of a "ewe-neck" detracting from perfect symmetry. Neither are such horses safe to ride. They have the broad forehead, brilliant eyes, delicate muzzle, expanded nostrils, and wide throat of the Arab and the Barb; while the body is long and light, with the last rib widely separated from the pelvis. The chest is deep but narrow, thus affording due space for the lungs without making the fore-limbs too wide apart. The obliquity of the shoulder gives full play to the upper part of the leg; while the extreme length of the haunch, and the elongated hind-limbs, with their long sloping pasterns, are essentially adapted for the maximum development of speed. The most common colour is bright bay or brown, with black legs, mane, and tail; but chestnut is not unfrequent. Black and grey are rarer; while dun, roan, or piebald but seldom occur.

Hunters, etc. The English hunter has been produced by infusing the blood of the race-horse with the native races to a larger or smaller degree; but it does not form an exclusive breed like the racer. Indeed, any good riding-horse may be a hunter. The requisite qualities of the hunter are strength, good action, and the power of enduring fatigue, coupled with a speed second only to that of the race-horse. The neck must be muscular, and the chest of sufficient breadth to indicate strength without being heavy. The long stride of the racer not being needed, the body should be comparatively short and well "ribbed home," that is to say the last rib should be close to the pelvis. The legs should also be relatively shorter and stouter. In fact, the English hunter may be described as the perfect development of the horse. In Germany the half-bred or three-quarter-bred horse in use as a hunter is commonly known as the *Trakehner*, and is represented in our illustration. From half-bred horses of the hunter type there is a complete transition to the ordinary saddle and carriage-horses, which, although formerly with but little or no foreign blood in them, now generally exhibit more or less breeding. The Cleveland bay is the most highly esteemed English carriage-breed; and has been produced by mingling thorough-bred blood with a native horse of stouter build than the one selected as the stock for the hunter.

Leaping Powers. With regard to the length a horse can leap, "Chandler's" big jump at Warwick in 1847 is still the subject of occasional discussion. The distance was variously measured; and for a number of years was thought to have been 39 feet, but the editor of the sporting paper in which the record was first published afterwards explained that this was a printer's error, and that the distance was in reality 37 feet. This in itself is big enough; so big, in fact, that there are many horsemen in England who will regard it as exaggerated. The portion of the

race in which the jump occurred, is reported as follows in a description of the race in *Bell's Life* of March 28, 1847:—

This left the lead with "King of the Valley," but he refused at the top of the hill, and soon after "Regalia" caught up with him. They raced together to the brook, with "Chandler" following them. "Chandler's" rider pulled back as they approached it, expecting that "Regalia" would bring grief to somebody, and when they arrived at it sent the spurs into his horse and followed them with all steam on. Both went into the brook, and while they were there "Chandler," who was not able to stop, whatever inclination he may have had to do so, made an extraordinary jump and cleared the brook, horses and riders together. The account goes to say that "Chandler" won the race with ease. The length of the leap was immediately measured, but there was some doubt as to where the animal had landed, as the ground was soft and a number of hoofprints had been made. Captain Broadley, the rider, said that the distance was 37 feet. This beats the record, so far as known, the best previous record being that of "Lottery," who cleared between 33 feet and 34 feet. One of the witnesses of the jump was William Archer, who stated that the distance was 39 feet. The Hon. F. Sawley, a well-known sporting writer in England, was also present, and declared that the tape measured but 34 feet. This is the minimum estimate. Summing up, it may be said that while there is some doubt as to the exact number of feet cleared, "Chandler's" performance was an unusual and important one. The same may be said of a horse called "Proceed," who is said to have cleared 37 feet while running in a steeplechase about the time of the above event. A horse called "Culverthan" is reported to have jumped 33 feet on one occasion, and "Lather," a hunter owned by Lord Ingestre, is said to have jumped 37 feet and 5 inches over a pit. None of these measurements are absolutely authentic. With regard to speed it may be noted that "Flying Childers" ran a distance of 4 miles 1 furlong and 138 yards in seven and a half minutes; but this pace was considerably exceeded by "Eclipse."

The American trotter is an excellent instance of the results **American Trotter.** obtained by breeding for a particular end; in this case, extreme speed in trotting. The breed appears to have been produced by the infusion of both Barb and Arab blood on an English stock; and the breeders of the United States strongly controvert the common opinion that the trot is not a natural pace of the horse. The maximum recorded pace of the American trotter up to the year 1885 was one mile in 2 minutes 8 $\frac{3}{4}$ seconds.

Shetland and other Ponies. The Shetland Islands have long been famed for the hardihood and docility of their indigenous ponies, the small size of which has already been mentioned (p. 496). These ponies are allowed to run almost wild, with no shelter, and but little food beyond what they can procure for themselves. Their coats are very long and thick, and in winter become matted upon their bodies in a manner calculated to afford them most efficient protection from the inclemency of the climate. They are generally bay or brown in colour, but sometimes blackish, and at others more or less mixed with white. From their agility and cleverness, these ponies are in great request for equestrian exhibitions. The ponies of Scandinavia and Iceland are very similar to those of Shetland; but those of the Orkneys are larger and coarser, and of less pure breed. In the Hebrides there are

two races of ponies, the one small and long-haired, and the other taller; and there are likewise indigenous breeds in the hilly and forest-districts of several parts of the British mainland. Among the latter may be mentioned the hardy and sure-footed, but coarse and ugly Dartmoor breed; and the smaller long-haired race of Exmoor, which are extremely active, and run nearly wild. The New Forest



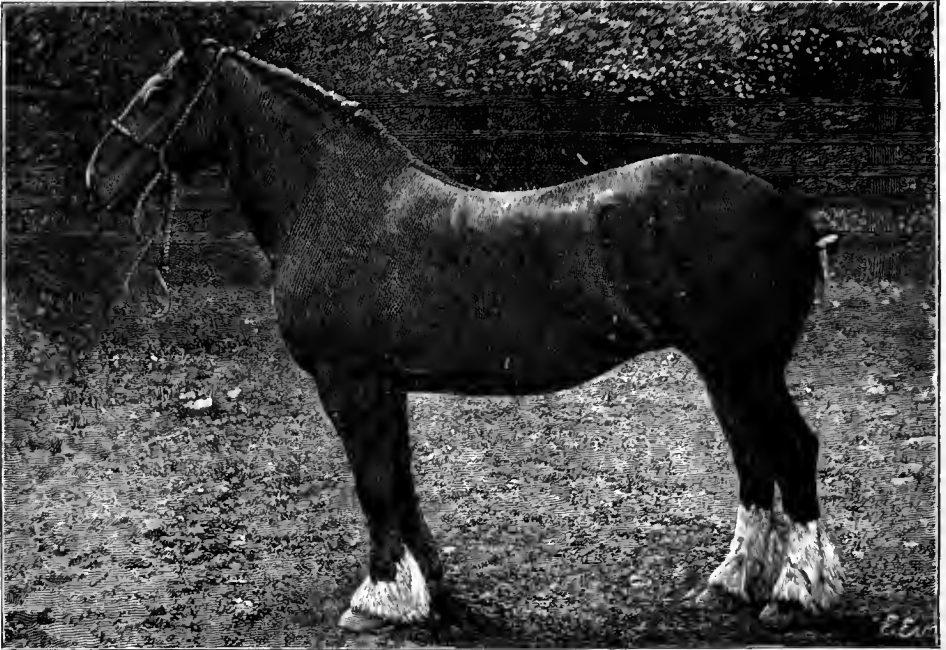
PERCHERON CART-HORSE ($\frac{2}{3}$ nat. size).

ponies, again, form a race which although ugly, large-headed, and short-necked, are hardy, sure-footed, and capable of bearing the roughest treatment.

Cart-Horses. Under the title of cart-horses may be included all the heavily-built European breeds which originally contained no admixture of foreign blood, and are specially adapted for heavy draught. In England there are four chief races, known as the English black or Shire horse, the breeds of the north-eastern counties, the Clydesdale, and the Suffolk punch.

The old English black or Shire horse was characteristic of the fen-districts and some of the other midland counties from whence it has extended north and south,

and it also occurs in the so-called Low Countries and other parts of the Continent. Typically the black horse, as shown in the illustration on p. 489, has a round and massive body, a broad chest, a powerful muscular neck, and short, stout, and long-haired limbs; its physical strength being great, but its speed slight. The size varies considerably; the larger and most powerful races being produced in the fens. The more modern breed generally has a white star on the forehead, and more or less of the same colour on the feet and legs, and often on the muzzle. Low says that "the main defects of his conformation and temperament are his too great bulk of body, and want of action and mettle. For a pull with a heavy



CLYDESDALE MARE ("WOODBINE").—The property of the Marquis of Londonderry.

weight he is admirable; but he steps out short, and is slow in all his motions." Of recent years the aim of breeders has been to remove these defects.

To the north of the Humber the native breeds of cart-horses are of smaller bulk, and generally brown, or still lighter in colour; while they are altogether more active than the black horse. This lighter build appears to be largely due to an infusion of the blood of the higher races among the horses of these districts, which is not wanting even among those employed solely for heavy draught.

Clydesdale. The Clydesdale breed takes its name from the valley of the Clyde in Lanarkshire; and is supposed to have originated by crossing the black horse of the Low Countries with the native breeds. Clydesdales may be either black, brown, bay, or grey in colour, and usually stand about 16 hands, which is considerably less than the height of the black horse. They are also longer in the body and less weighty, with a compact and muscular build, and a characteristic free and long stride.

Suffolk Punch. Lastly, we have the well-known Suffolk punch of East Anglia, famed for its steadiness of draught, and the pertinacity with which it will exert itself against a dead pull. The original breed derived its name from the stout and "punchy" form, and was further distinguished by the colour being light dun or sorrel, sometimes darkening to chestnut, with lighter mane and tail. The height was medium, the pace rather slow, but the power of endurance very great, and the constitution hardy. The form was, however, somewhat ugly, the head being large, with a coarse muzzle, the neck short, and the shoulder low and heavy. On the other hand, the limbs were short, and the back straight, with wide loins and well-developed haunches. The breed, which has of late years been much modified by mixture, is believed to have been introduced from Normandy; and Low is of opinion that its dun or sorrel colour indicates a near affinity with the wild tarpan of the Asiatic steppes.

Foreign Breeds. Among well-known Continental breeds, the percheron, represented on p. 501, while somewhat deficient in bulk and strength, is remarkable for its energy and pluck. Belgium possesses two distinct original breeds known as the Ardennes breed, from the valley of the Meuse, and the Frisian, from the sea-coast. By crossing there has been produced the Brabant horse, which although inferior in bulk and strength to the Clydesdale, has more breed and energy. Harnessed to heavy country carts, weighing about 3000 lbs., they will drag a load of from 6000 to 10,000 lbs. on the level; and thus vastly exceed in power the original light Ardennes horse, which is fast disappearing.

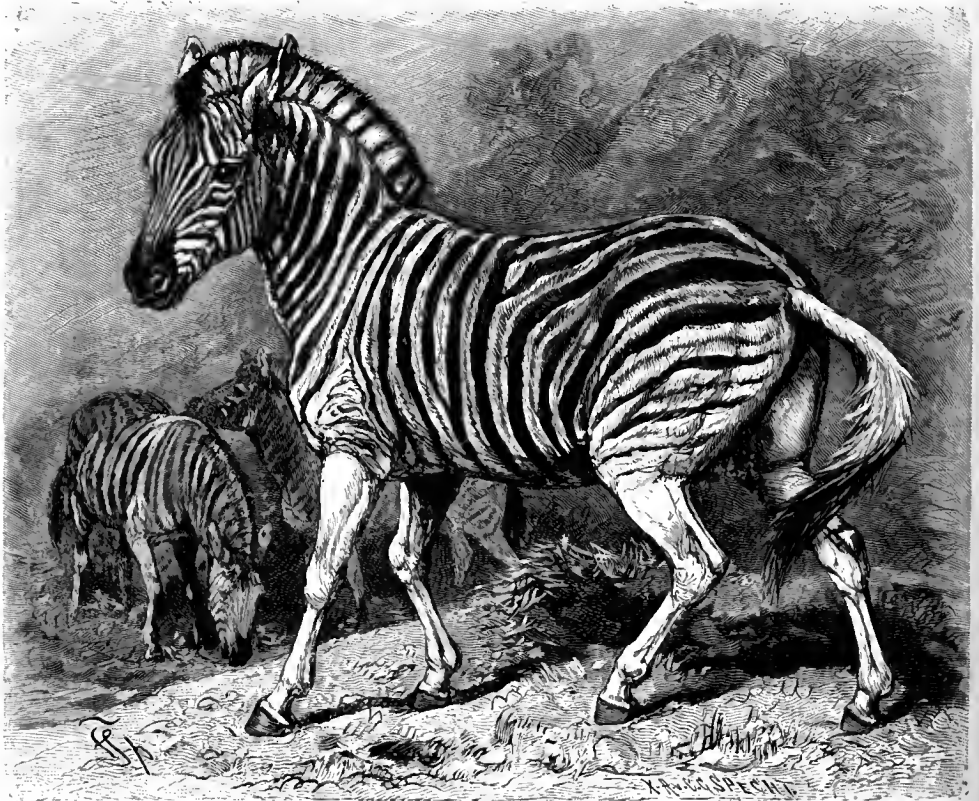
THE ZEBRAS (*Equus zebra*, etc.).

The three species of zebra, together with the quagga, form a group agreeing in essential character with the asses, but distinguished by their more or less completely striped heads and bodies. In both these groups the mane is erect, and the upper part of the tail is free from long hairs; while there are naked callosities on the fore-limbs only, and the ears are longer, the head relatively larger, and the hoofs narrower than in the horse.

True Zebra. The true or mountain zebra (*E. zebra*) is the typical representative of the striped group, and is essentially an inhabitant of hilly districts. It is the smallest of the three species, standing from 4 feet to 4 feet 2 inches (12 to 12½ hands) at the withers, and has relatively long ears and a comparatively short mane, with the tail but scantily haired. The general ground-colour of the hair is white, while the stripes are black, and the lower part of the face is bright brown. With the exception of the under-parts of the body and the inner sides of the thighs, the whole of the head, body, and limbs, as well as the upper part of the tail, are striped. On the hind-quarters, the dark longitudinal stripe running down the middle of the back is connected with the uppermost of the oblique longitudinal stripes by a series of transverse bars, which are wanting in the next species; and there may be a longitudinal stripe running up the middle of the chest. This species was originally common in the mountains of the Cape Colony, but has now been exterminated except in some of the districts on the east side. Here a few herds remain on the summits of the Zwartberg,

Sneeuwberg, and Winterhoek ranges, where they are strictly protected by special laws.

Burchell's Zebra. Burchell's zebra (*E. burchelli*), commonly known by the Boers as the quagga, is a rather stouter and taller animal than the last, standing from 4 feet 4 inches to 4 feet 6 inches (13 to 13½ hands) at the shoulder. It is further distinguished by its shorter ears, longer and more fully-developed mane, and more thickly-haired tail, as well as by the absence of the transverse bars connecting the stripe on the middle of the back with the uppermost of those



BURCHELL'S ZEBRA ($\frac{1}{10}$ nat. size).

on the haunches, and likewise by the union of every alternate body-stripe with its fellow on the middle of the under surface of the body. In the typical form (as represented in our illustration) the tail and legs are quite devoid of stripes, but in the so-called Chapman's zebra, which is only a variety of this species, both may be striped, although the stripes never extend on to the pasterns. The general ground-colour of the hair varies from white to yellowish brown, and the stripes may be dark brown or black. The hoofs are said to be much more like those of a pony than are those of the preceding species.

Distribution and Habits. Burchell's zebra is a plain-dwelling animal, which never appears to have ranged southwards of the Orange River. It now appears to be practically exterminated in the Transvaal, but is still to be met with in numbers





ZEBRA.

in the districts to the south of the Botletli River, to the north of the Kalahari, while in wet seasons a few range further south into the latter district; and it is common on the plains of the Chobi and Zambesi, as well as in East Africa. How far northwards it extends does not appear to be ascertained.

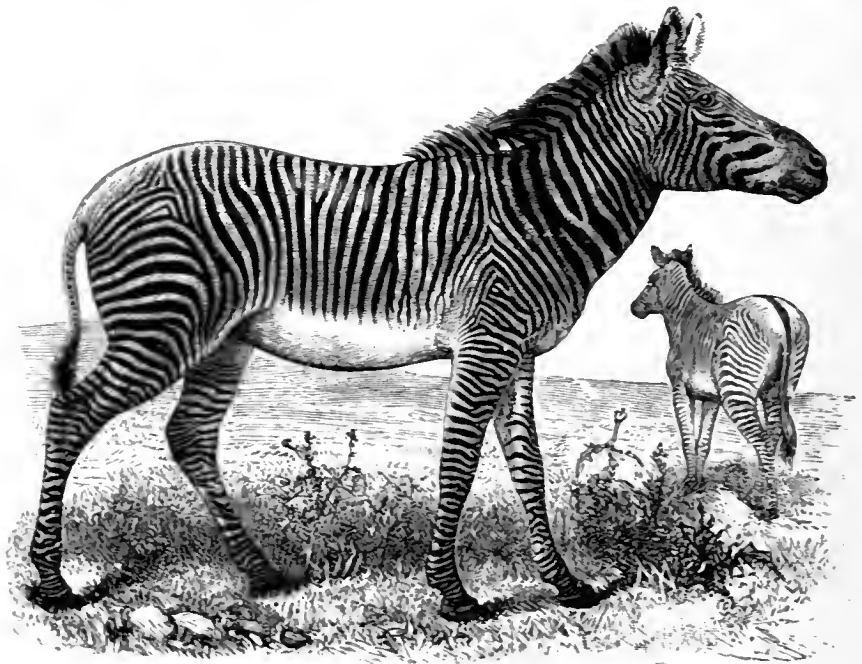
Messrs. Nicolls and Eglington state that zebras of this species "may sometimes be found in herds of from fifty to one hundred, but more often numbering from ten to fifteen, and they are commonly found associating with ostriches, blue wildebeests, and hartebeests. On being hunted, and if not urged too much at the start, they keep generally in single file, the stallions being in front; but when hard pursued they run more in a lump, and at such times it requires a really good horse to overtake them. When one is wounded, it will invariably separate from the remainder of the troop. The neigh of this species resembles in sound the subdued whining bark of a dog. The flesh, although unpalatable to Europeans, is much relished by the natives, on account of its containing a quantity of yellow fat. A large number of these zebras are also slaughtered for the sake of their hides, while others fall a prey to lions, who seem to have a great partiality for horse-flesh." It is this species of zebra which is the one commonly met with in menageries. Many attempts have been made to break it to harness; and, in the Transvaal, teams composed partly of mules and partly of zebras have of late years been worked more or less successfully. Zebras were known to the ancients under the name of hippotigris, and were exhibited from time to time in the Roman circus; such individuals not improbably belonging to the next species.

All who have seen zebras in their native haunts, speak of the beautiful appearance presented by a drove, as they stand for a moment to gaze at the hunter, and then wheel round to seek safety in flight; and as they afford but unsatisfactory trophies, it seems a pity that so many are killed for the mere sake of sport. It has been stated that, when standing on sandy ground in full moonlight, a zebra harmonises so exactly with the colour of its surroundings as to be quite invisible at a short distance.

The third representative of the group is Grévy's zebra (*E. grevyi*), from the mountains northwards of the Victoria Nyanza, and thence onwards to the highlands of Shoa and Somaliland, which has only been made known to science within the last few years. This species is a taller and slimmer animal than the true zebra, with which, however, it agrees in having the limbs striped right down to the hoofs, in the absence of stripes on the under-parts of the body, and the long ears. On the other hand, it resembles Burchell's zebra in the long mane and abundantly-haired tail. It is distinguished from both by the much greater number of the stripes, which are very narrow, deep black in colour, and separated by equally narrow white streaks. The arrangement of the stripes is, moreover, quite different, those which run transversely across the sides occupying a much greater extent of the body, and the obliquely longitudinal ones on the haunches being proportionately shortened.

Habits. Colonel J. A. Grant, who in company with his fellow-explorer, Speke, first met with these zebras in the mountains north of the Victoria Nyanza, writes that they are found in herds comprising from two to nine individuals. "One of their number, probably the largest male, takes general charge

of the herd: and it was noticed that a large antelope kept watch and gave the alarm on our appearance. They are rarely found outside the forest, preferring it to the open plain, which is generally bare of grass; or they frequent a country with clumps of dense brushwood, or with out-crops of granite, around which they get abundant food; and they were never seen far from running water and hills. Their breeding-season was determined by goats following their mothers in the month of January, and by the shrill calls we heard, which came, I presume, from the goats. The first time I heard their call, I mistook it for that of a bird, and could scarcely be persuaded till I heard the decided donkey-notes following the shriller sounds. They showed much sympathy when a comrade was wounded, lingering with the

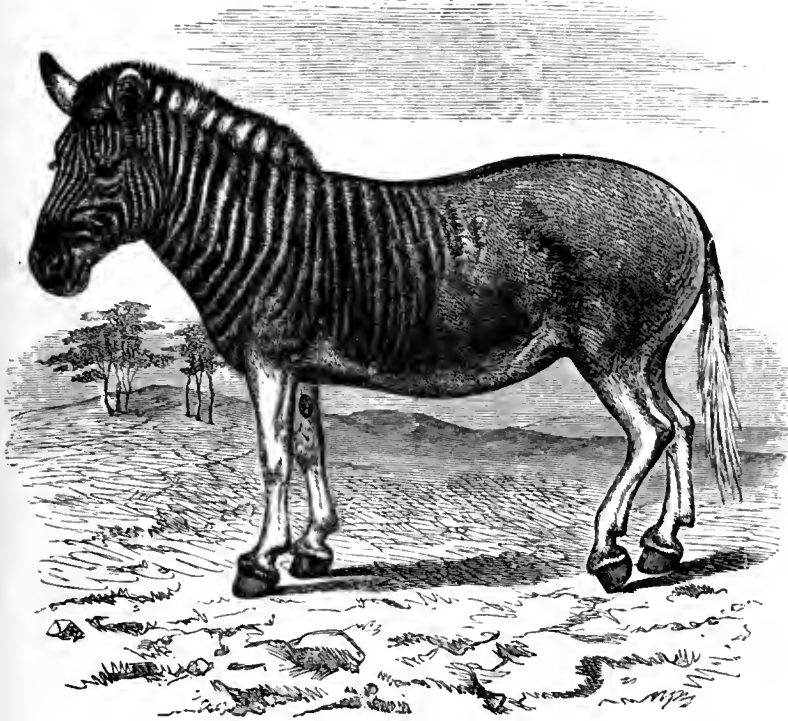


GRÉVY'S ZEBRA. (From Sclater, *Proc. Zool. Soc.*, 1882.)

wounded at the risk of their lives: they mingled with our laden donkeys one day on the marsh." These zebras are found at elevations varying from two hundred up to two or three thousand feet above the sea.

Quagga. The quagga or couagga (*E. quagga*), so far as colour is concerned, forms a connecting link between the zebras and the asses; but in its short ears, and the extent to which the tail is haired, approximates to the horse. In height it stands about the same as the true zebra; in colour the upper parts are of a light reddish brown, with the head, neck, and front half of the body marked with irregular chocolate-brown stripes, gradually becoming fainter, until they are quite lost on the hind-quarters. There is a dark stripe running down the back on to the upper part of the tail; but the rest of the tail, together with the under-parts, the inner sides of the thighs, and the legs, are white.

Distribution. When Sir C. Harris visited the Cape Colony in the year 1839, he described the quagga as existing in immense herds, but it is now, owing to incessant persecution for the sake of its hide, either completely or very nearly exterminated. According to Mr. H. A. Bryden, the quagga always had a very restricted distribution, and, although "formerly so abundant upon the far-spreading 'karroos' of the Cape Colony and the plains of the Orange Free State, appears never to have been met with north of the Vaal River. Its actual habitat may be precisely defined as within Cape Colony, the Orange Free State, and Griqua-



THE QUAGGA.

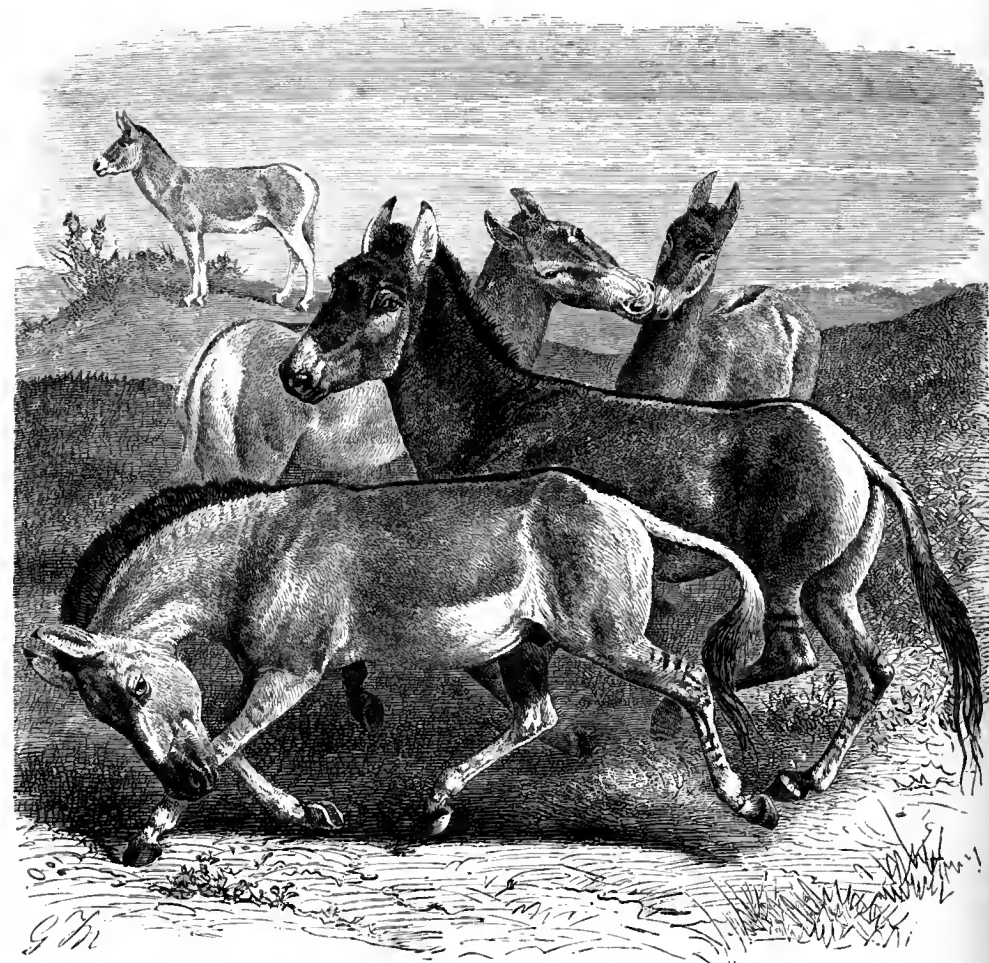
land West. I do not find that it ever extended to Namaqualand and the Kalahari Desert to the west, or beyond the Kei River, the ancient eastern limit of the Cape Colony to the east."

Habits. The name couagga is derived from the shrill bark-like neigh of the animal. In habits this species appears to have been very similar to the other members of this group; and it was formerly much sought after by the Boers in order to supply their native servants with food. It may be added that all the zebras, with the exception of *E. grevyi*, which has not hitherto been exhibited in this country, will interbreed with either the horse or the ass. Indeed, the skeletons of all the living *Equidae* are so alike that, except from size, it appears impossible to distinguish the teeth or limb-bones of the various species from one another.

THE ASSES (*Equus hemionus* and *asinus*).

The true asses differ from the zebras in having their bodies without a series of stripes, although there is always a dark streak down the back, and sometimes another across the shoulders, and likewise irregular transverse bars on the limbs.

Wild asses are widely distributed over the more arid regions of Asia, ranging from Syria to Persia and Western India, and northwards



THE TIBETAN WILD ASS, OR KIANG ($\frac{1}{3}$ nat. size).

over a large extent of Central Asia. It was long considered that there were three distinct species of these animals, but although there are at least two well-marked varieties, Mr. Blanford is of opinion that the whole of these form but a single species (*E. hemionus*). These asses have moderate-sized ears and rather long tails, and stand from 3 feet 8 inches to 4 feet (11 to 12 hands) at the withers. They have a dark brown stripe, sometimes bordered with white, running from the back of the head to the upper portion of the tail, the fore-part of this stripe being formed

only by the mane; the colour of the rest of the upper parts varying from reddish grey to fawn or pale chestnut, while the under-parts are creamy white. In some cases there is a dark shoulder-stripe, while in others the legs are faintly barred with rufous, and the end of the tail is dark.

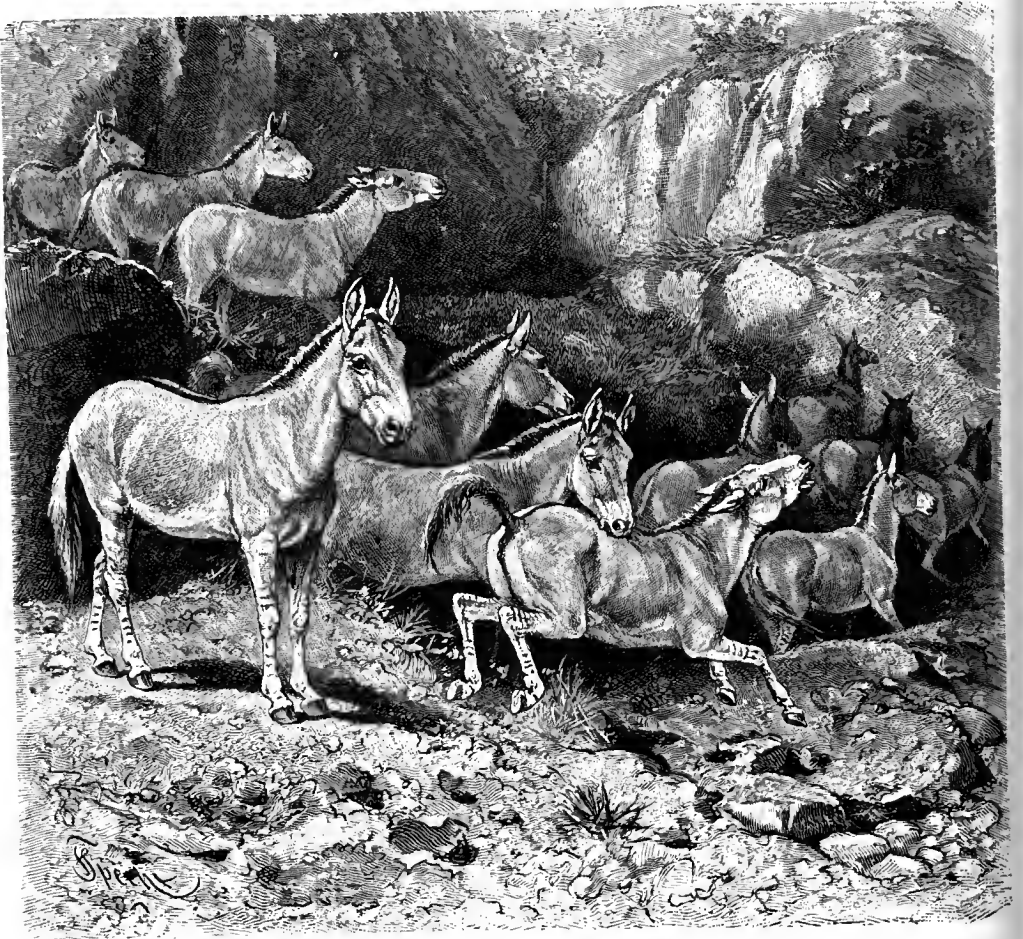
Varieties and Distribution. There are three varieties of Asiatic wild asses, of which the first is the kiang or kulan, of Tibet and Mongolia, characterised by its large size, dark reddish colour, and the narrowness of the stripe down the back. The ghorkhar, or onager, from Western India and Baluchistan, is a smaller and paler-coloured variety, with a broader dorsal stripe, its general colour being sometimes silvery white. Lastly, there is a third variety from Syria and Persia, which apparently differs very slightly from these. In Western Tibet the kiang lives at elevations of fourteen thousand feet and over, while in Cach the ghorkhar is found at the sea-level.

Habits. The Asiatic wild ass is remarkable for its fleetness and its capacity for getting over rough and stony ground at a great pace. As a rule, these animals inhabit desert plains or open rolling table-lands, and are generally found in small parties of from two to four or five individuals, or in herds varying in number from twenty to thirty or forty. In North-Western Afghanistan a herd estimated to contain upwards of one thousand head has, however, been seen in the month of April, and it is stated that the larger herds are composed solely of mares and foals. In the districts to the west of the Indus the foals are born during the summer from June to August; and it is probable that the period of gestation is about eleven months, as with the other members of the genus.

The food of these wild asses consists in the lowlands of different kinds of grasses, which are frequently dry; but in Tibet it is chiefly composed of various woody plants, which form the main vegetation of those arid regions. In the hills to the west of the Indus these animals are to be found wandering pretty well throughout the year; but in the early summer, when the grass and the water in the pools have dried up from the hot winds, the greater number, if not all, of the ghorkhars migrate to the hills for grass and water. It is stated that in Western India and Persia the wild asses are very shy and difficult to approach. This is, however, by no means the case with the kiang of Western Tibet, which is one of the most curious and inquisitive of all animals, frequently approaching within fifty yards or less of any strange object. Indeed, these asses are often a positive nuisance to the sportsman, as they will come up to him as he is engaged in a stalk, and thus alarm and drive away his quarry. In Ladak I have frequently ridden among a herd of kiang, who would gallop close round my pony in circles; and on one occasion a kiang, apparently actuated by extreme curiosity, walked straight into the middle of my camp, where the cooking was going on, much to the alarm of the Indian servants.

The speed of the ghorkhar is so great that it appears to be impossible for a single horseman to ride down an adult in good condition. It is stated, indeed, that this has been done in Cach, but Mr. Blanford is of opinion that in such cases mares in foal were the objects of pursuit. In the Bikanir Desert the foals are captured during the summer by mounted parties of Baluchis, who, by relieving one another, hunt them till they fall from sheer exhaustion, when they are taken and bound.

Such of these foals as can be reared are taken into India and sold to the native princes, by whom high prices are given for these animals. Whether ghorkhars thus taken are capable of being tamed and broken to harness or the saddle, I am not aware; but a kiang which I once saw in captivity in Leh was a most vicious and intractable brute, with which nothing could be done. The late Sir O. B. St. John states that it was told him by the Persians that if the sportsman can manage to conceal himself and his horse in the vicinity of a spring, and wait till the wild



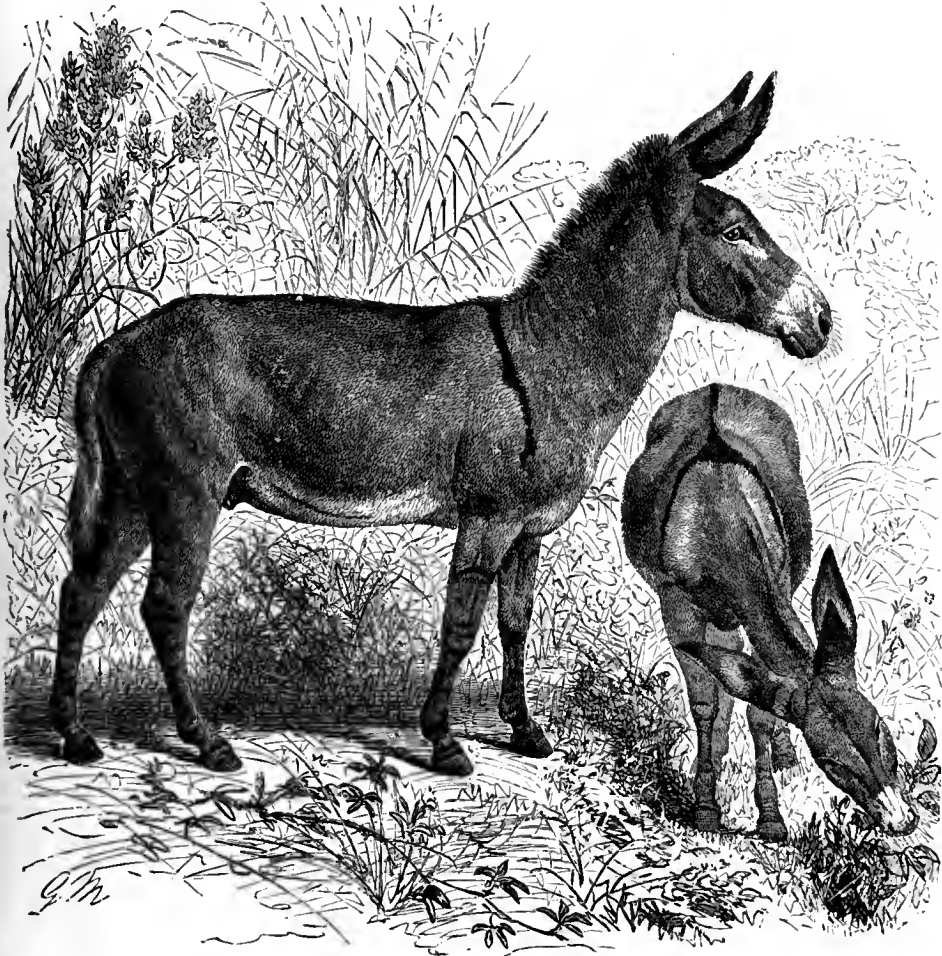
A TROOP OF PERSIAN WILD ASSES.

asses have quenched their thirst, they can readily be come up with when full of water by a short spurt on a fast horse. At other times they are caught by relays of horsemen and greyhounds. It is further stated by the same writer that the flesh of the ghorkhar is only eaten by the Persians when other food is scarce.

There has been some amount of discussion as to the nature of the voice of the kiang, some observers comparing it to that of the common ass, while others think it has more resemblance to the neigh of the horse. The general opinion is, however, that it is decidedly ass-like, and it has been described as a shrieking bray.

African Wild Ass.

The African wild ass (*E. asinus*) is a very distinct animal from its Asiatic cousin, having much longer ears, a shorter mane, and the tail more scantily haired. The general colour of the hair is a creamy or bluish grey, without any decided rufous tinge, and there is usually a well-defined dark shoulder-stripe, as well as dark bars on the limbs. The muzzle, a patch under the throat, and the under-parts are white, and there is frequently a large amount of



THE AFRICAN WILD ASS ($\frac{1}{15}$ nat. size).

white on the limbs. There is some amount of individual variation in regard to the relative length of the ears, mane, tail, and limbs; and the degree of development of the shoulder and leg-stripes is also variable, the former being sometimes very narrow and faintly marked, while in other cases the latter markings may be absent. The height may reach 4 feet 8 inches (14 hands) at the withers.

Distribution and Habits.

The African wild ass is widely distributed in the desert regions of North-Eastern Africa, occurring in Abyssinia; Somaliland, the Sudan, and other districts in the neighbourhood of the Red Sea. Sir Samuel Baker

says that on the margin of the Atbara Desert "the tracks of wild asses had been frequent, but hitherto I had not seen the animals, as their drinking hour was at night, after which they travelled far into the desert. However, on the morning of the 29th June, shortly after the start at about 6 A.M., we perceived three of these beautiful creatures on our left—an ass, a female, and a foal. They were about half a mile distant when first observed, and upon our approach to within half that distance they halted and faced about. They were evidently on their return to the desert from the river. Those who have seen donkeys in their civilised state have no conception of the beauty of the wild and original animal. Far from the passive and subdued appearance of the English ass, the animal in its native desert is the perfection of activity and courage; there is a high-bred tone in the deportment, a high-actioned step when it trots freely over the rocks and sand, with the speed of a horse. When it gallops freely over the boundless desert, no animal is more difficult to approach, and, although they are frequently captured by the Arabs, those taken are invariably the foals, which are ridden down by fast dromedaries, while the mothers escape." The author then proceeds to notice how admirably the coloration of these animals harmonises with that of their desert surroundings. Their food consists of the wiry herbage found in such regions, but, in spite of such apparently poor diet, these animals are always found in fine condition. The flesh is eaten by the Arabs. It appears that these asses are found either in parties of two or three or in small herds, but that they do not assemble in large troops. Their bray is practically indistinguishable from that of the domestic race.

Domestic Ass. The domestic ass is evidently the tamed African ass, in most cases deteriorated by bad food and hard usage. Any description of such a well-known animal would be superfluous; but it may be observed that, while grey is the ordinary colour, the tint may vary in one direction until it passes into white, while in the other it gradually darkens into a deep brown or even black. The dark stripe running down the back is usually distinct in the lighter-coloured varieties, but the shoulder-stripe is less constant, being frequently absent, although in some instances duplicated. The bars on the legs are generally wanting in the adult, although they are frequently more or less distinctly marked in the foal.

The ass was known to the ancient Egyptians long before the horse, and was, indeed, probably first domesticated in the valley of the Nile, whence it has spread over almost the whole of the habitable regions of the globe. We are not aware, however, of any instances where these animals have reverted to a semi-wild condition. In Europe, the largest and finest breeds are produced in the more southern countries, such as Spain, Italy, and Malta; but there are others of still finer proportions in the United States, where they reach a height of 15 or 16 hands. These larger races are mainly kept for the purposes of mule-breeding, and show that the small size of the ordinary form is due in great part to the rough treatment and bad food which is usually its share. In England the ass was known in the reign of Ethelred, when it fetched the then high price of twelve shillings; but it has been considered that it subsequently became extinct, and was reintroduced about the time of Queen Elizabeth; and it is certain that it did not become common till after the reign of the latter.

The ass is valued not only as a beast of burden and draught, but likewise on

account of its milk; and it is stated that in one district of Equatorial Africa large droves of these animals are kept solely for the sake of their milk. A peculiarity in the disposition of the ass, is its reluctance to cross even the smallest stream of water; this aversion being doubtless a direct inheritance from its desert-haunting wild ancestors.



DOMESTIC ASS.

Mule. The term mule is strictly applicable only to the hybrid between the male ass and the mare; the product of the union of the opposite sexes of these two species being known as the hinny. Mules, although they frequently display the stubbornness and obstinacy of the ass in an intensified degree, are for some purposes more valuable than either of their parents, being very sure-footed and with great powers of endurance. Some of the finest mules are bred in Spain, the United States, and North-Western India, where they frequently attain the height of 16 hands. In Spain they are generally employed to carry burdens, and march in long droves, following in single file a leader distinguished

by a bell. Among the dun-coloured mules of the Punjab, dark stripes on the legs are very common.

There appear to be no authenticated instances of mules breeding among themselves; although the female mule will occasionally produce offspring with the male horse or ass. And it is somewhat remarkable that it does not appear that the hybrids between any other members of the Equine family are mutually fertile.

FOSSIL HORSES.

It has already been mentioned that remains, undistinguishable from the existing horse, occur in the superficial deposits of Europe and Arctic America; but that those found in the corresponding formations of the United States and South America appear to belong to extinct species of the genus *Equus*. In the upper molar teeth of all these species the front inner pillar marked *p* in figure B on p. 487 is much elongated from front to back. In the figured tooth which belongs to an extinct species (*E. sivalensis*) from the Siwalik Hills of India, that pillar is, however, shorter; and in Steno's horse (*E. stenorhis*), from the Pliocene deposits of Europe, it is so much shortened as to be almost cylindrical. The same is the case with certain extinct species from the later deposits of the United States and Argentina, which, on account of the great length of the slit for the nose in the skull, are separated as a distinct genus, under the name of *Hippidium*. All the foregoing have but a single toe to each foot, but we now come to certain other species in which there were three distinct hoofs. One of these is the *Protohippus* of the lower Pliocene strata of the United States, in which the upper molar teeth approximate to the one represented in Fig. B on p. 487, but have shorter crowns. The other is the European and Asiatic hipparion, or three-toed horse, of which an upper molar tooth is represented in Fig. C of the page quoted. From that figure it will be seen that the front inner pillar *p* is completely separated from the portion *pl*. That the *Protohippus* was the ancestor of the true extinct horses of America, there can be but little doubt; but, from the separation of the inner pillar of the molars, it is not so certain that the hipparion gave rise to the existing European members of the family.

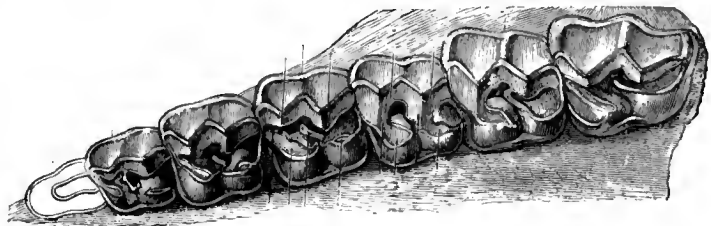
OTHER EXTINCT ODD-TOED UNGULATES.

Ancestry of the Horse. The foregoing observations indicate that there is a complete transition from the modern single-toed horse to species with three distinct toes to each foot, and with rather shorter-crowned and simpler molar teeth. From these three-toed horses there is a further gradation to other extinct Ungulates, which cannot be included in the Equine family, but some of which were doubtless the direct progenitors thereof. One of these was the Miocene anchitherium, common to both Europe and the United States. From the figures given on p. 487, it will be seen that the upper molar teeth of these animals, although formed on the general plan of those of the horse, have very low crowns, with a simpler arrangement of the pillars and ridges, and the intervening valleys perfectly open, owing to the absence of cement; and it may be added that other species show a complete

transition from the molars of the anchithere to those of the earlier horses. Further, the lateral toes of the anchithere, as shown in the figures on p. 153, were relatively larger than in the three-toed horses. Moreover, in the anchithere, the radius and ulna in the fore, and the tibia and fibula in the hind-limb, were perfectly distinct and fully-developed bones. The largest anchithere approached an ordinary pony in size, while the smallest was not larger than a sheep; and in all these animals there was the full typical number of forty-four teeth, while the "mark" characteristic of the incisors of the horse was but faintly indicated in one species alone. Passing downwards in the geological scale, by a complete transition from the anchithere, we arrive in the lower Eocene London Clay at a small animal known as the hyracothere, which was not larger than a fox, and had four toes to the front, and three to the hind-foot; while the forty-four low-crowned teeth were of still simpler structure than in the anchithere, although formed on the same general plan. The last lower molar tooth of the hyracothere differs however from that of all existing Odd-toed Ungulates in having three complete lobes, and thus approximates to the corresponding tooth of the Even-toed group; and it may be added that the essential correspondence in the structure of the upper molars of the two groups will be apparent by a comparison of the figure of the molar of the anoplothere on p. 421, with that of the anchithere on p. 487.

A step from the hyracothere brings us to the still earlier phenacodus, in which each foot, as shown in the figure on p. 8 of the first volume, had five complete toes; while the molar teeth had their crowns with small isolated tubercles instead of ridges. This small primitive animal, with a most generalised type of structure, appears then to be the undoubted ancestral stock from which the modern horse has been slowly produced by some process of evolution, which was going on throughout the long ages of the whole Tertiary period; and it is at least noteworthy that the true horse only made its appearance on the globe at or about the same time as his master, man.

Palaotheres and Lophiodons. In addition to the animals referred to above, as forming the direct ancestral line of the modern horse, there were a number of other more or less closely-allied types belonging to the Odd-toed group. Among these some of the best and longest known are the palaotheres, from the upper Eocene strata of Europe, of which, as far back as the early portion of the present century, nearly complete skeletons discovered in the gypsum quarries, near Paris,

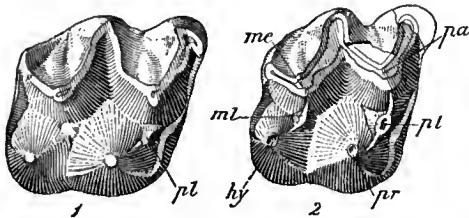


THE LEFT UPPER CHEEK-TEETH OF THE GREAT PALEOTHERE
($\frac{1}{2}$ nat. size).—After Gaudry.

were described by Cuvier. These palaotheres were tapir-like animals, with three toes to each foot, and molar teeth approximating to those of the anchithere in structure, but having a somewhat elongated neck. While some of the species were not taller than a sheep, others must have fully equalled the largest tapirs in size. They probably resembled the tapirs in having a short proboscis to the snout, and

likewise in their general mode of life. The lophiodons are somewhat older animals, being mainly characteristic of the middle Eocene strata of Europe. Some of them were as large as a rhinoceros; and their upper molar teeth approximate to those of the tapirs having their outer columns conical, instead of assuming the flattened form characteristic of the palæotheres. The lower molars, moreover, differ from those of the palæotheres in having their transverse ridges nearly straight instead of crescent-like; and the total number of teeth is only forty, owing to the loss of the first premolar in each jaw. So far as known, the number of toes to the feet was the same as in the tapirs; and while the true lophiodons apparently indicate a group which died out without leaving any descendants, certain allied forms probably indicate the ancestral stocks of both the tapirs and the rhinoceroses.

Titanotheres and Chalicotheres. In the Miocene period there existed in North America and the Balkans certain gigantic rhinoceros-like Ungulates, which, while belonging to the Odd-toed group, were quite unlike any other forms, and approximated in bulk to the elephants. These titanotheres, as they are called, had skulls somewhat like those of rhinoceroses, but furnished with a pair of bony processes placed transversely in the region of the nose, which were doubtless furnished with horny sheaths during life. The limbs were massive, and furnished with four toes in front, and three behind, one of the fore-feet being figured on p. 152. Some of the species had the full number of forty-four teeth, placed in close apposition to one another; but in others the whole of the lower and one pair of the upper incisors were wanting. The molar teeth are of the type of those shown in the accompanying figure, and differ very markedly from those of other Odd-toed Ungulates; they consist of four columns, of which the outer ones are flattened, and those on the inner side more or less conical. The teeth are further



TWO RIGHT UPPER MOLAR TEETH OF
PALEOSYOPS. (From Earle.)

remarkable for the extreme lowness of their crowns. North America also yields remains of smaller but allied Ungulates, such as *Paleosyops*, which extend downwards to the highest beds of the Eocene, and have no bony processes on the skull.

The most extraordinary modification of the Odd-toed Ungulate type is, however, presented by the chalicotheres, which is common to the Pliocene and Miocene

deposits of Southern Asia, Europe, and the United States. In these animals the molar teeth were of the type of the titanotheres; but the limbs terminated in long curved claws, very similar to those of the pangolins or scaly ant-eaters, described in the next volume. Indeed, so like are the limbs of the chalicotheres to those of the last-named animals, that they were originally regarded as indicating a member of the same group. Apparently, however, the chalicotheres must be regarded as specially modified Ungulates, more or less closely allied to the Odd-toed group, and adapted for a fossorial, or possibly arboreal mode of life.

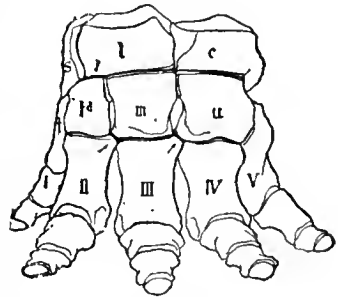
CHAPTER XXVII.

UNGULATES,—concluded.

HYRACES, ELEPHANTS, ETC.

WITH the exception of the extinct phenacodus, noticed among the ancestors of the horse, the whole of the Ungulates described in the seven preceding chapters are characterised by certain peculiarities in the structure of the wrist-joint. On referring to the figure of the fore-foot of the titanotherium on p. 152, it will be seen that the bones of the two rows of the wrist are arranged alternately to one another, that is to say, the bone marked *l* is placed immediately over the line of division between the bones *u* and *m*. Moreover, none of these animals have more than four toes to any one foot; while in no case do they walk on the whole sole of the foot after the so-called plantigrade fashion. Then, again, the huckle-bone, or astragalus, in the ankle-joint, is always deeply grooved, as shown in the hind-foot of a deer represented on p. 154, and in that of a rhinoceros on p. 455.

On the other hand, in most of the Ungulates remaining for consideration the component bones of the two rows of the wrist-joint, as shown in the accompanying figure of the fore-foot of an elephant, are placed directly one over the other, so that the line of division between the bones *l* and *c* is continuous with that between *m* and *u*, instead of being placed immediately above *m*. And it will be obvious that this type of structure is inferior from a mechanical point of view to that distinguishing the wrist-joint of the typical Ungulates. The existing and many of the extinct Ungulates described in this chapter frequently have five toes on each foot, and not less than four functional ones, with a rudiment of a fifth on the fore-foot. They may likewise walk partly or entirely in the plantigrade manner; while in the ankle-joint the upper surface of the huckle-bone is generally flat. In all respects, therefore, so far as foot-structure is concerned, these animals are less highly organised than the Ungulates of which we have hitherto treated. The sole living representatives of Ungulates with this generalised type of foot structure are the small hyraces, of which there are numerous kinds, and the two species of elephant. The latter are, however, the last survivors from a number of kindred animals; and there formerly existed several other groups of more or less nearly-allied Ungulates which are now totally extinct. Beyond the generalised structure of their feet, there is but



THE BONES OF THE LEFT FORE-FOOT OF AN ELEPHANT ($\frac{1}{3}$ nat. size).
—After Osborn.

little in common between the hyraces and the elephants, which respectively form the representatives of two groups as distinct from one another as is the Odd-toed from the Even-toed group of the typical Ungulates. The elephants have been enabled to survive to the present day by the development of a highly-specialised dentition, and, perhaps, also owing to their huge bodily size; while the small hyraces are sufficiently protected by their habits.

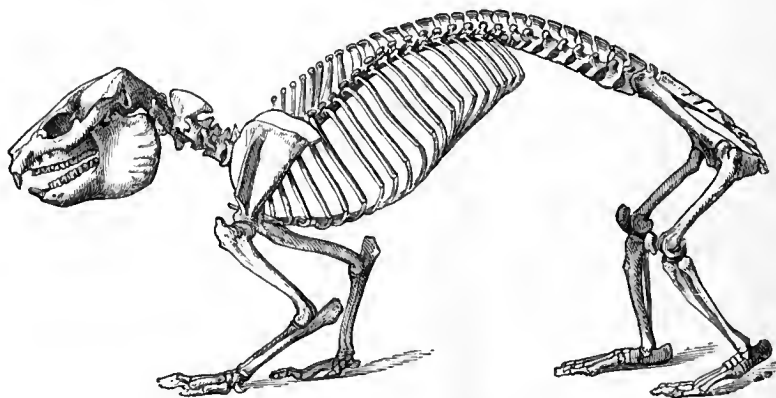
THE HYRACES.

SUBORDER Hyracoidea.

Family *PROCAVIIDÆ*.

The small animals now generally known as hyraces (from one of their scientific names) are so like Rodents in external appearance and habits, that in our translation of the Bible they are designated by the term coney, which belongs properly to the rabbit.

This Rodent-like appearance is largely due to the circumstance that (as shown in the figure of the skeleton) their jaws are armed in front with long,



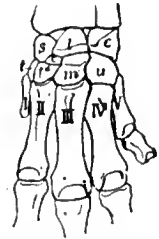
SKELETON OF THE CAPE HYRAX.

curved teeth, adapted for gnawing, and separated by a long gap from the teeth of the cheek-series. Their front teeth are, however, in reality very different, both in form and number, from those of the Rodent mammals. In the upper jaw there are a pair of incisor teeth, of semicircular form, and growing throughout life in the Rodent manner. Instead, however, of being chisel-like, they are triangular in section, and terminate in sharp points, their outer and inner front surfaces being covered with enamel, which is wanting on the hinder surface. In the lower jaw there are two pairs of front teeth, of which the outermost are nearly straight, with long conical crowns divided into three lobes; both pairs of these teeth are, however, rooted, and therefore quite unlike the continually-growing single pair of the Rodents. The cheek-teeth are seven in number on each side of both the upper and lower jaw; and in structure approximate to those of either the rhinoceros or

the palæothere, there being some amount of variation in the form and height of the crowns of these teeth in the different species.

Like other Ungulates, hyraces have no collar-bones (clavicles); and the tail is reduced to a mere stump. In the fore-foot there are four functional toes, of which the outermost is smaller than the others; the first digit being represented by a mere rudiment. The hind-foot has only three toes, of which the innermost is furnished with a long curved claw, while the other two, like all those in the fore-foot, carry broad and short nails, somewhat like those of a rhinoceros. All the bones of the limbs are fully developed and separate from one another; and the thigh-bone, or femur, lacks the distinct third trochanter characterising the Odd-toed Ungulates. In many species the socket of the eye is completely surrounded by bone, but in others it is partially open behind.

The hyraces have sharply-pointed muzzles and small rounded ears; and their bodies are covered with a thick coat of nearly uniformly-coloured hair, which varies in length in the different species. Near the middle of the back there is a gland, surrounded and partly covered by a patch of hairs differing in colour from those on the rest of the body. Frequently the central part of this gland is naked,—in one species for a length of fully two inches,—but it is generally concealed by the convergence of the surrounding hairs. In most species the female has three pairs of mammæ, one of which is placed near the fore-limbs, while the other two are situated posteriorly; but in three species of tree-hyrax there is but a single pair.



THE BONES OF THE UPPER PART OF THE LEFT FORE-FOOT OF THE TREE-HYRAX. (From Osborn.)

Distribution. The various species of Hyrax, about fourteen in number, are confined to Africa, Arabia, and Syria. In Africa they are found in the extreme south at the Cape, and thence range along the eastern and western coasts about as far north as the 20th parallel of north latitude; while they also occur in the central equatorial regions. They are usually found in rocky districts, at elevations varying from near the sea-level to upwards of eleven thousand feet.

Abyssinian Hyraces. The whole of the species of hyrax are now included by Mr. O. Thomas in the single genus *Procavia*; and as it will be unnecessary to notice all of them, we shall confine our remarks to some of the best known. Of these the Abyssinian hyrax (*P. abyssinica*) agrees with the majority in the light colour of the patch of hairs surrounding the gland on the back. It is of medium size; the total length along the curves of a female specimen measured by Mr. Blandford being 20 inches, and the height at the shoulder 8 inches. Its fur is coarse and harsh, and in specimens from high elevations somewhat elongated, but short in those from the lowlands. The light spot round the gland is very small and inconspicuous.

Habits. Mr. Blandford says "that these hyraces live in rocky or stony places, in communities, like rabbits, haunting holes beneath the rocks. A large pile of loose blocks, especially if there are precipices around, is sure to be inhabited by them. They are frequently found, too, in rocky water-courses. They appear to feed at night and very early in the morning, their principal food being the leaves and young shoots of trees and bushes. During the

day they lie out upon rocks in the shade, or retire, especially towards midday, beneath the rocks. They are timid and wary, rushing into their holes at the smallest intimation of danger. The only sound I heard made by them was a shrill squeak when suddenly alarmed. They can climb over smooth surfaces of rock in a wonderful manner, their large feet aiding them in obtaining a hold." The typical race of this species occurs in the highlands of Abyssinia, the lowland form being of considerably smaller size. Its habits may be taken as characteristic for all the species, with the exception of those frequenting trees. Two other species inhabit Southern Abyssinia, viz. the Shoan hyrax (*P. shoana*), and Bruce's hyrax (*P. brucei*). The former of these inhabits Southern Abyssinia and Shoa, and is nearly or quite the largest of the group; it differs from all others, except the Cape hyrax, in having the spot on the back entirely black, and is distinguished from the



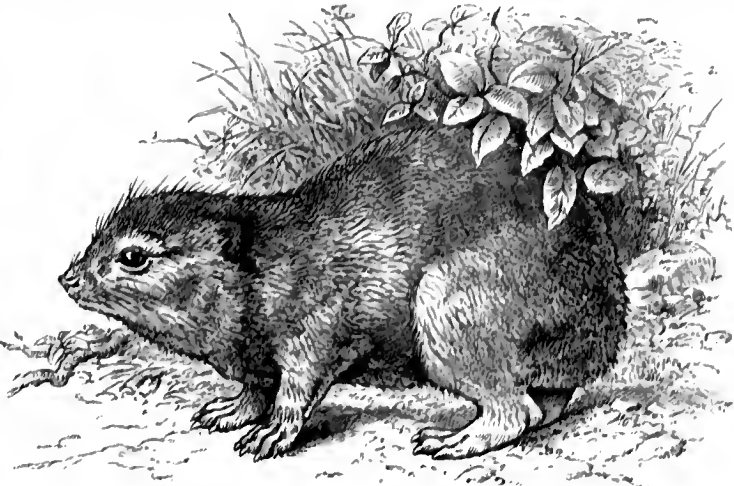
SYRIAN HYRAX.

latter by the great length of its soft and silky hair. Bruce's hyrax, which ranges from Southern Abyssinia to Somaliland and Mozambique, is a small and rare species, with the spot on the back long and narrow, and yellowish or whitish in colour. It has been found at elevations of from seven thousand to eight thousand feet.

Cape Hyrax. The Cape hyrax (*P. capensis*) is confined to the Cape Colony and Natal, where it is known to the Dutch colonists as the klip-das, or rock-badger. It is characterised by the hair being soft and fine, and of medium length, with the spot on the back of an irregular oval form, and black in colour; the general hue of the fur being dark sepia-brown, speckled with pale yellow or white. The late Professor Moseley writes that these animals "come out to feed in the mornings and evenings, but also bask sometimes in the hot sun at midday. They are very inquisitive, and sit up on a rock, and look at one, and then suddenly dash into their hiding-place. After a time, if one remains quiet, they come out for another look, and afford a good chance for a shot. Their cry of alarm is a

short, hissing noise. They had young at the time of our visit [November], and I met with two litters, each of three young, which were about the size of very large rats, with soft chocolate-brown downy hair. The young play about on the rocks together like kittens, chasing one another, and darting in and out among the clefts."

Syrian Hyrax. The Syrian hyrax (*P. syriaca*) is the coney of Scripture, and the only species found out of Africa, its range including Syria, Palestine, the Sinaitic Peninsula, and the whole of Arabia. It is a small or medium-sized and rather variable species, with somewhat soft and shaggy hair of a dull orange-yellow or fawn colour; and the spot on the back rather small, oval, and its component hairs yellow throughout their length. Canon Tristram states that these hyraces produce from three to six young at a birth, but that four appears to be the ordinary number. He observes that "they are far too wary to be taken in traps, and the only chance of securing one is patiently to lie concealed, about sunset or before sunrise, on some overhanging cliff, taking care not to



TREE-HYRAX.—After Thomas.

let the shadow be cast below, and thus to wait till the little creatures cautiously peep forth from their holes. . . . They make a nest of dried grass and fur, in which the young are buried like those of a mouse. The flesh is much prized by the Arabs. We found it good, but rather dry and insipid, as dark in colour as that of the hare."

Tree-Hyraces. Three species of the genus, of which one is from Western and two are from Eastern Africa, and not improbably a third from the central equatorial region, differ from the rest in their arboreal habits. These three species agree in that the females have but a single pair of teats; and are respectively known as *P. valida* from Mount Kilima-Njaro, readily distinguished from all the others by the bright fulvous hue of the under-parts, *P. arborea* from Eastern and South-Eastern Africa, and *P. dorsalis* ranging on the west coast from Liberia to the Cameruns and Fernando Po. The latter species is of large size, and characterised by its long shaggy fur, black at the base and white at the tips of the hairs, and the relatively large size of the head compared to the body. The Kilima-Njaro species is found at elevations of from seven thousand to eleven thousand feet in the dense forests clothing the mountain. They live entirely in the trees, making their lairs and breeding-places in holes in the boughs and trunks; and

they are stated to make a great noise at night. A female captured by Mr. H. H. Johnston gave birth to three young. Mr. H. C. V. Hunter states that many of them are captured alive by the natives for the sake of their skins, of which several are sewn together to make cloaks.

It is somewhat remarkable that at present no extinct animals have been discovered which appear allied to the hyraces.

ELEPHANTS.

SUBORDER Proboscidea.

Family *ELEPHANTIDÆ*.

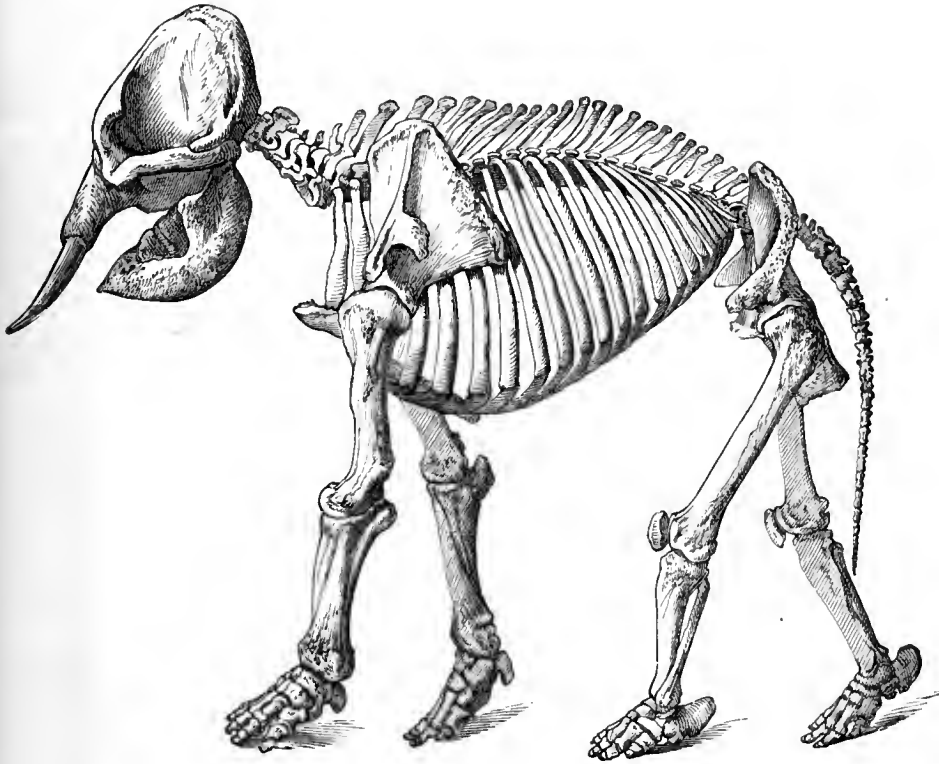
From their peculiar bodily conformation, their huge size, which exceeds that of all other terrestrial mammals, and the high degree of intelligence which they have been supposed to display, elephants have always excited an amount of popular interest far surpassing that accorded to most other animals. And in truth this deep and widespread interest is by no means misplaced, since elephants really are among the most extraordinary and remarkable forms with which the zoologist is acquainted. Through long experience we are now thoroughly familiarised with their appearance, but if we were to see one for the first time we should probably regard it as the strangest mammal that ever existed; and, indeed, we should not be far wrong in doing so. It has already been mentioned that, so far as regards the structure of their feet, elephants are some of the most generalised of all living mammals; and a similar remark will apply with equal truth to the structure of the rest of their limbs. When, however, we take into consideration the peculiar nature of their dentition, and their marvellously constructed proboscis, we find them possessing characters of the highest specialisation; and it is this combination of generalised and specialised features which render elephants so peculiarly interesting to the zoologist.

At the present day these animals are represented only by the Indian and African species, but in past epochs there were a number of extinct forms, some of which serve to connect the living ones, to a certain limited extent, with other Ungulates; and since it is only by a thorough comprehension of the characters presented by the dentition of these extinct elephants that the structure of the teeth of their living representatives can be understood, it will be necessary in our account of the group to devote almost as much attention to the fossil as to the existing species. It is worthy, however, of note that although some of the extinct elephants do, as already stated, depart less widely from ordinary Ungulates than is the case with the living Indian and African species, yet such approximation to the normal type is only one of degree, and we are at present totally unacquainted with any animals which are absolutely intermediate between elephants and other Ungulates. The origin of the group is, therefore, still totally known, although their nearest relations may prove to be certain extinct groups noticed in the sequel.

Characters.

The most striking external peculiarity of elephants, and the one from which their title of proboscideans is derived, is the long, flexible

proboscis, into which the nose is produced; this proboscis having the nostrils at its extremity, and being used as an organ of prehension, and for the purpose of conveying water to the mouth. Their build is extremely massive and bulky, the head being of great proportionate size, the ears large and flapping, the neck very short and thick, and the limbs long and stout. A peculiarity of the limbs, as shown in the figure of the skeleton, is that the humerus in the fore, and the femur in the hind-leg, are very long in proportion to the lower segments; the feet themselves being very short indeed. It will also be noticed that the bones of the limbs are set nearly vertically one above another; and from this cause, together with the



SKELETON OF THE INDIAN ELEPHANT.

great relative length of their upper segments, the knee and elbow-joints are not partially enclosed within the skin covering the body, as is the case in most Ungulates. Consequently, the knee of the elephant is more readily identified with that of man than is the case with that of a horse. It is further owing to this peculiarity in the structure of its limbs that an elephant kneels down, with its fore-feet stretched out in front and the hinder ones behind. The short feet are extremely broad, and have five toes each, of which the middle one (as shown in the figure on p. 517) is the largest; and from the extreme shortness of the feet the ankle-bone is placed close to the ground, instead of being raised half-way up the leg as in the horse. The whole of the toes are enclosed in a common skin, with a flat cushion-like sole; the position of the toes being indicated by the broad flat nails, of which there may

be either three or four in the hind-foot. The fore-foot is broader than the hinder one, and generally has five nails.

In most cases the males, and sometimes the females also, have a pair of tusks in the upper jaw; these tusks corresponding to one of the pairs of incisors of other mammals, and not to the tusks of the wild boar and hippopotamus, which are canines. There are no other front teeth in the upper, and none at all in the lower jaw of the living species. The eyes are small in proportion to the size of the head; the tail is nearly cylindrical, and of considerable length, with a tuft of bristly hairs at the end; but the skin is nearly naked in the two existing species. The female has a single pair of teats placed between the fore-legs.

In addition to the proportions and position of the bones of the limbs already referred to, it may be observed in connection with the skeleton that the two bones of the lower segment of each leg are perfectly distinct from one another; and that in the ankle the huckle-bone, or astragalus, is nearly flat both above and below, and is of slight vertical thickness, but of great horizontal extent. The vertebræ of the back have very tall spines for the attachment of the powerful ligaments necessary to support the enormous weight of the head; and the ribs are of great length, and thus afford ample space for the viscera. It will be noticed in the figure of the skeleton that the blade-bone, or scapula, has a backwardly recurved process projecting from its space; and it is remarkable that a nearly similar condition of this acromial process is found in the Rodents.

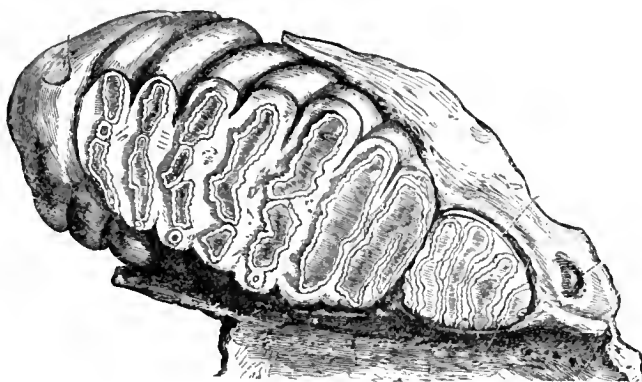
Skull. From the enormous size of the skull it might be inferred that elephants have very large brains. This, however, is far from the case, the brain not only being very small in proportion to the size of the animal, but likewise of a low degree of organisation. The brain of an elephant occupies indeed only a comparatively small portion of the space lying between the socket of the eye and the region where the vertebræ of the neck articulate with the skull. The whole of the elevated upper portion of the skull is occupied by a mass of bone, honeycombed into cells, and thus affords space for the attachment of the huge muscles of the jaws, and forms an adequate support for the trunk without unduly adding to the weight; the great size of this region being also essential in order to harmonise with the immense development of the lower part of the skull, which has to accommodate the enormous tusks and molar teeth. Similar cells also enter into the structure of the hinder and basal region of the skull. There are many other peculiarities in the conformation of the elephant's skull, but it must suffice to mention here that the nasal aperture is situated high up in the front of the face, and that the nasal bones are reduced to mere triangular nodules, instead of having the elongated form characteristic of most mammals.

Teeth. Of the teeth a more detailed notice is necessary, since these afford some of the most essential characteristics of the group. As already mentioned, elephants have no canine teeth in either jaw; while in the living species the tusks are developed only in the upper jaw. In the young elephant there is a minute pair of milk-tusks, which are shed at a very early age. The permanent tusks, which are nearly cylindrical in section, and taper to their extremities, continue to grow throughout the life of their owners, and thus remain permanently open at their bases, which are enclosed in sheaths of the premaxillary bones extend-

ing as high up in the skull as the aperture of the nasal cavity. In the young state the tusks of the living species of elephants are tipped with enamel; but this is soon rubbed off by use, and they then consist of ivory alone. This ivory differs from that of other mammals in its structure, which renders it easy to distinguish elephant-ivory from all other; and if a transverse section of a tusk be examined, it will be found to present a pattern like the engine-turning on the back of a watch-case; this peculiar pattern being absolutely distinctive of true ivory.

We come now to the consideration of the molar or cheek-teeth of the elephants, which in their structure and mode of succession are unlike those of all other mammals. In the first place, an elephant has six cheek-teeth on each side of both the upper and lower jaws; but instead of all these being in use at once, in the existing species only two

are ever above the gums at any one time, and one of these is but partly protruded; while in old animals there is but a single tooth remaining. The molar teeth are elongated from front to back, and are composed of a number of transverse ridges closely packed together. The anterior teeth, as shown in the accompanying figure, are small, and include but few

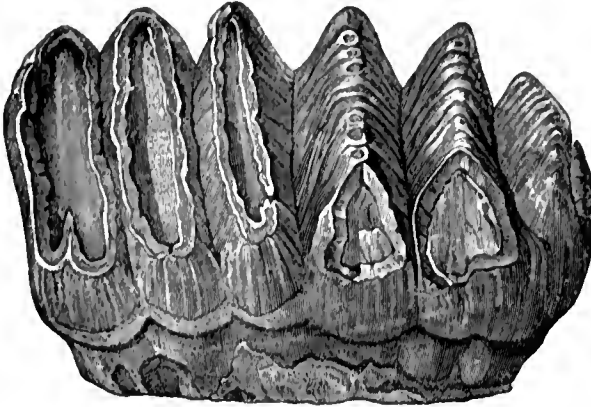


THE FIRST AND SECOND RIGHT UPPER MOLAR TEETH OF THE MAMMOTH (nat. size).—After Sir R. Owen.

ridges; but each succeeding tooth is larger, and comprises a greater number of ridges, reaching in the last molar of the Indian species to as many as twenty-four. The individual teeth succeed one another from before backwards in an arc of a circle; and as the tooth in front is worn away, its place is gradually taken by the one rising from behind, till at length the sixth and last tooth alone remains. Although this mode of succession appears strange and peculiar, it is in reality only an ultra-development of what takes place among the pigs, and more especially in the African wart-hogs. In all the pigs the last molar does not come into use till the teeth in front of it are considerably worn; and in the wart-hogs, as we have already seen, the last molar is of unusually large size, and may be the only cheek-tooth remaining in the adult condition, owing to those in front being shed. It should be added that while the last three cheek-teeth of the elephants correspond to the true molars of an ordinary mammal, the three anterior ones represent the last three milk-molars of such an animal as the pig, and not, as would at first sight appear to be the case, the premolars. That the three teeth in question are really milk-molars is proved by the circumstance that in some of the extinct species they were vertically succeeded by teeth of simpler structure corresponding to the premolars of the pig.

In order to understand the structure of the molar teeth of the elephants, it will be advisable to take those of one of certain extinct species which, like Clift's elephant, exhibit a simpler conformation than those of the existing species. Such

a tooth is represented in the accompanying woodcut, and will be seen to be composed of a number of low roof-like transverse ridges (in this case six), separated by open valleys. When unworn, as on the right side of the figure, such ridges are crowned by a number of small tubercles; but the effect of wear, as shown in the three ridges on the left side of the figure, is to perforate the enamel of which the ridges are externally composed, and thus to reveal an elliptical surface of ivory surrounded by a narrow border of enamel. In the figured tooth the valleys between the ridges are completely open and devoid of cement, but in the teeth of other species of nearly similar type they contain a certain amount of this constituent. Now it only requires that the ridges in a tooth like that of Clift's elephant should be greatly increased in height, with a concomitant diminution of



A LEFT UPPER MOLAR TOOTH OF CLIFT'S ELEPHANT ($\frac{1}{3}$ nat. size).

their basal width, which would admit of a greater number being borne in the same length of space, and by the intervening valleys being completely filled with cement, to produce a tooth like that of the Indian elephant. In such a tooth, as shown in the figures on pp. 525 and 528, the ridges have become so tall as to assume the appearance of thin and nearly parallel plates, with their investing enamel thrown into a series of fine plications, or puckers; and the intervening valleys have become so deepened and narrowed, that their contained cement is also in the form of exceedingly thin plates. When worn, as in the figure on p. 528, such a tooth presents on its surface a series of very narrow ellipses of yellow ivory, surrounded by an elevated rim of the harder white enamel, marked by its characteristic puckers; while between the ellipses of enamel-bordered ivory come the layers of cement. The succession of layers in such a tooth is therefore arranged in the following order, viz. cement, enamel, ivory, and so on. The worn crown forms a slightly convex or concave surface, marked by transverse ridges of different degrees of hardness and height, and thus yields a masticating instrument of the greatest power and efficiency.

Habita. In their food, elephants are strictly herbivorous, subsisting chiefly upon roots, twigs, leaves, and young shoots of trees, or grass and other herbage; such food being conveyed to the mouth by the aid of the flexible trunk, which is admirably adapted for such a purpose, as it is for drawing up water. There is, however, much popular misapprehension as to the other uses of the elephant's trunk, in regard to which a few words are expedient. In addition to its use as a purveyor of food and water to the mouth, the trunk is the organ of touch and smell, and is altogether extremely delicate and sensitive. When any danger is impending, elephants, except in some cases when charging an enemy, invariably curl up the trunk out of harm's way. In regard to the alleged

employment of the trunk of the Indian elephant for all manner of purposes, Sanderson observes that "the idea that he can use it for any purpose, from picking up a needle to dragging a piece of ordnance from a bog, is, like many others, founded entirely on imagination. An elephant might manage the former feat, though I doubt it; the latter he would not attempt. Elephants engaged in such work as dragging timber, invariably take the rope between their teeth; they never attempt to pull a heavy weight with the trunk. In carrying a light log, they hold it in the mouth as a dog does a stick, receiving some little assistance in balancing it from the trunk. Tuskers generally use their tusks for this and similar purposes, and are more valuable than females for work. An elephant is powerful enough to extricate a cannon from a difficult situation, but he does it by pushing with his head or feet, or in harness—never by lifting or drawing with his trunk."

Intelligence. An equal degree of misapprehension is prevalent as to the intelligence of elephants, at least so far as the Indian species is concerned; and all competent observers who have had much practical experience of these animals are of opinion that their intellectual faculties have been greatly overrated in popular estimation. It is true, that when in captivity the Indian elephant exhibits a marvellous docility and obedience, and is also capable of learning to perform certain kinds of labour, such as stacking logs of timber, which at first sight appear to demand a considerable amount of intellectual power. There is here, however, a considerable amount of confusion, as Mr. Blanford remarks, between high intelligence and mere docility and capacity for receiving instruction; and there can be little doubt that the usefulness of the elephant is due to the latter rather than to the former trait. Indeed, the size and structure of the brain is quite sufficient to prove that the intellectual capacity of elephants is far inferior to that of dogs, and is probably below that of most other Ungulates.

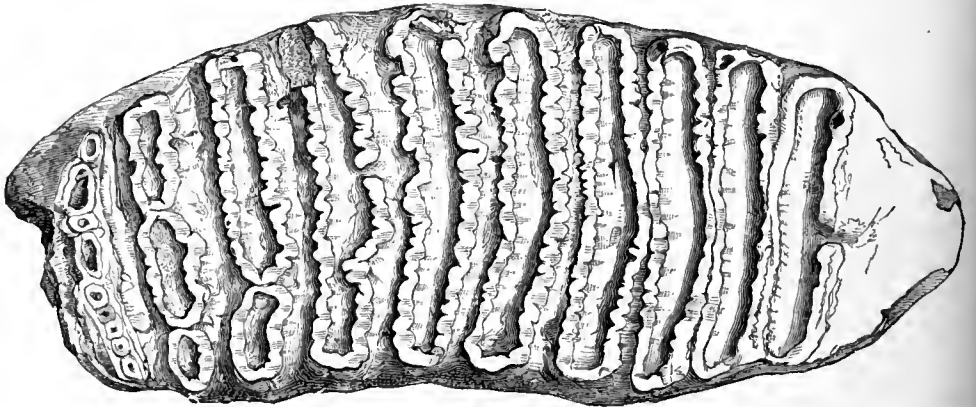
This view of their intelligence is strongly confirmed by the circumstance that elephants, in spite of many statements to the contrary, are wanting in originality, and do not rise to the occasion when confronted by any sudden emergency or event beyond the range of their ordinary daily experience. As Sir Samuel Baker pertinently observes, an elephant "can be educated to perform certain acts, but he would never volunteer his services. There is no elephant that I ever saw who would spontaneously interfere to save his master from drowning or from attack. An enemy might assassinate you at the feet of your favourite elephant, but he would never attempt to interfere in your defence; he would probably run away, or remain impassive, unless guided and instructed by his mahout. This is incontestable; the elephant will do nothing useful unless he is specially ordered to perform a certain work or movement." At the same time, in addition to its capacity for receiving instruction, an elephant undoubtedly appears to have a very retentive memory, both for acts of kindness and of cruelty; and this has doubtless partly contributed to its character for general intelligence.

In this connection it may be observed that the Indian species, at any rate, differs from all other mammals in the readiness with which it may be tamed and domesticated when fully adult; nearly all those which are captured in India being fully mature.

Never found dead. A curious circumstance in connection with these animals is, that the bones of those which have died a natural death are scarcely ever found in the forests of India, and we believe that the same is true with regard to Africa. It has accordingly been suggested that elephants are in the habit of resorting to particular spots when about to die, as is known to be the case with the guanaco in South America (*supra*, p. 415), but as no such mortuaries have ever been discovered in India, this seems scarcely tenable, and the subject accordingly still remains a complete mystery.

THE INDIAN ELEPHANT (*Elephas indicus*).

The Indian, or, as it might be better termed, the Asiatic elephant, is the more specialised of the two living species, and at the same time the one most familiarly known. It is characterised by its comparatively flat forehead, and relatively



A RIGHT UPPER MOLAR TOOTH OF AN ELEPHANT, allied to the existing Indian species ($\frac{2}{3}$ nat. size).

small ears; as well as by the nearly naked skin being smooth, and the tail having a row of long bristly hairs at the tip, and a few inches upwards, before and behind only. The fore-feet have each, as a rule, five nails, and the hinder ones four. Generally the males only have large tusks, those of the females being small and scarcely protruding beyond the jaws. In some males—known in India as mackna, the tusks are, however, not longer than those of females. The back of the Indian elephant is regularly convex, its middle point being higher than the withers.

Perhaps, however, the most important characteristic of this species is to be found in the structure of the molar teeth, which are of the same type as the example represented in the accompanying illustration. In these teeth the plates of enamel-bordered ivory are very thin and closely approximated, and may reach as many as twenty-four in the last of the series. The enamel is thrown into a number of fine puckerings, and each enamel-bordered area forms a greatly elongated and irregular ellipse. In the first tooth (as shown in the figure on p. 525), the number of the ridges is usually four, in the second eight, in the third and fourth about twelve, in the fifth sixteen, while in the last it may, as already mentioned, be as many as twenty-four.

Colour. The general colour of the skin is blackish grey, but there are frequently flesh-coloured mottlings on the forehead, the root of the trunk, and the ears. Occasionally so-called white elephants are met with, which are really albinos; the dark pigment being absent from a larger or smaller area of the skin; in Burma and Siam such albinos being highly valued, and considered as sacred or royal animals. Although, as already mentioned, the skin is nearly naked, it has a few sparsely-scattered hairs; and it has been quite recently discovered that there are faint remnants of a woolly fur, similar to that so fully developed in the extinct mammoth. This discovery is very important, since, taken in connection with the Indian elephant's well-known intolerance of heat, it indicates that the animal is descended from one inhabiting temperate or cold climates.

Dimensions. As in the case of most large animals, the height of the Indian elephant has been greatly exaggerated; but the tendency of recent observers has been rather to depreciate the maximum size which it may occasionally attain. On the average, the height of the adult male does not exceed 9 feet, and that of the female 8 feet; but these dimensions are occasionally considerably exceeded. Sanderson measured a male standing 9 feet 7 inches at the shoulder, and measuring 26 feet 2½ inches from the tip of the trunk to the extremity of the tail; and he records others respectively reaching 9 feet 8 inches and 9 feet 10 inches at the shoulder. An elephant shot by General Kinloch stood upwards of 10 feet 1 inch; and another measured by Sanderson 10 feet 7½ inches. These dimensions are, however, exceeded by a specimen killed by the late Sir Victor Brooke, which is reported to have reached a height of 11 feet; and there is a rumour of a Ceylon elephant of 12 feet. That such giants may occasionally exist is indicated by a skeleton in the Museum at Calcutta, which is believed to have belonged to an individual living between 1856 and 1860 in the neighbourhood of the Rajmehal Hills, in Bengal. As now mounted, this enormous skeleton stands 11 feet 3 inches at the shoulders, but Mr. O. S. Fraser, in a letter to the *Asian* newspaper, states that it is made to stand too low, and that its true height was several inches more. If this be so, there can be no doubt that, when alive, this elephant must have stood fully 12 feet. It may be added that the height of an Indian elephant is almost precisely twice the circumference of its fore-foot.

With regard to the maximum weight of this species, we have no information. An immature male of 8 feet in height weighed, however, 2 tons 17 cwt. 1 qr. and 25 lbs.; while a second, of 7½ feet in height, turned the scale at 2 tons 11 cwt. and 23 lbs.

The tusks of the male vary greatly in length and weight. A pair obtained by Mr. Sanderson measured 5 feet along the curve, with a girth of 16 inches at the point of emergence from the jaw, their weight being 74½ lbs. The single perfect tusk of the elephant referred to above as having been killed by Sir V. Brooke measured 8 feet in length, and nearly 17 inches in circumference, and weighed 90 lbs. This weight is, however, exceeded by a shorter tusk of about 6 feet in length, which reached 100 lbs.; and specimens obtained from the Garo Hills are reported to have respectively weighed 155 and 157 lbs.

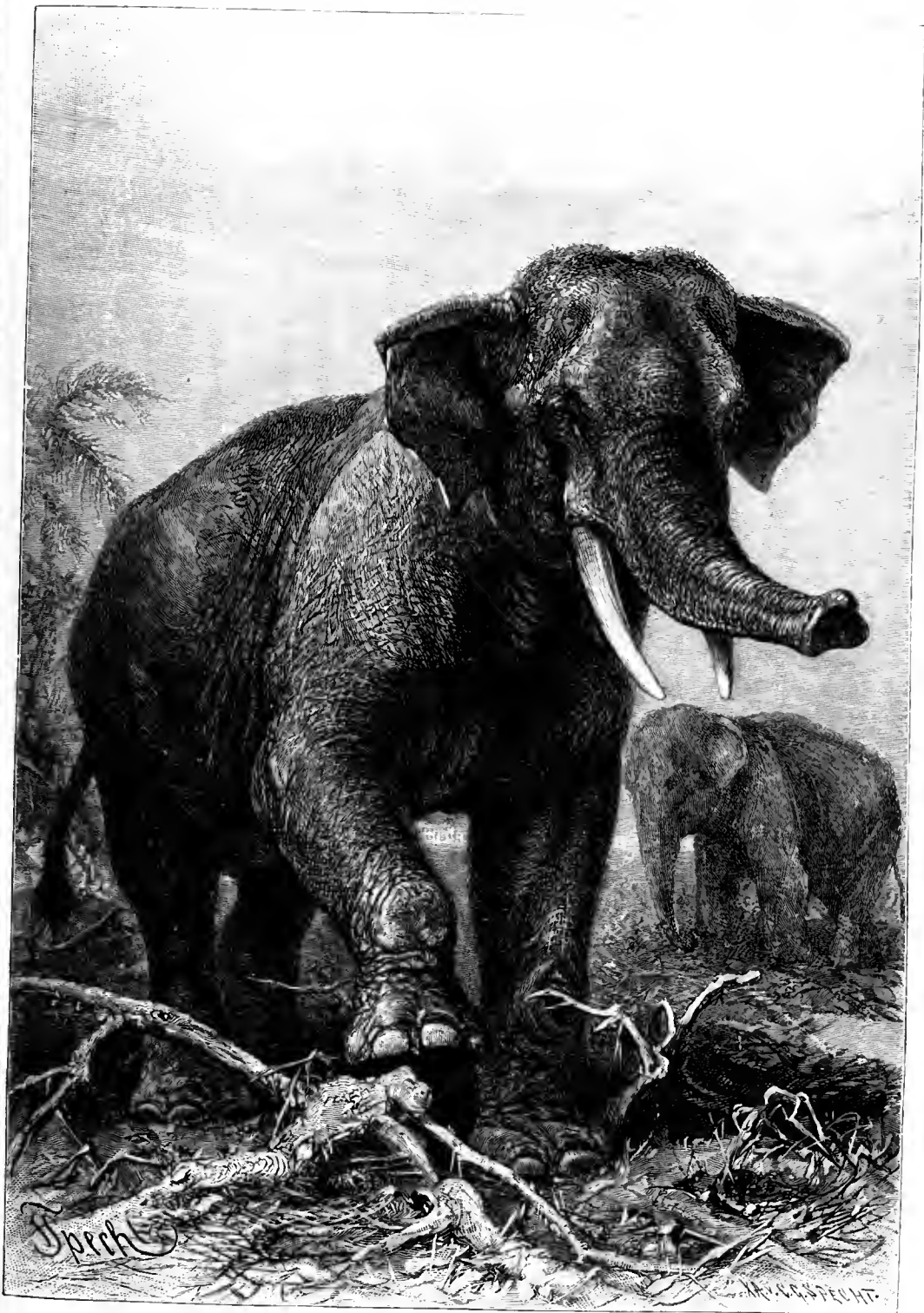
Age. It is of course impossible to obtain any accurate data as to the age which the Indian elephant may attain in its wild state, and we can only, therefore, suggest an approximation to what this may be from captive specimens. Although full grown at the age of twenty-five, an elephant, as determined by the condition of its teeth, is not then mature. A female captured in Coorg in 1805, when about three years of age, did not appear to be particularly old-looking in 1878, although she had then passed her prime. Other individuals have been known to live in captivity for over a century; and since it is obvious that the artificial mode of life which prevails in this state cannot be one tending to promote longevity, it is probable that the estimate of a century and a half as the duration of life in the wild state is not excessive.

Distribution. At the present day the Indian elephant inhabits the forest-regions of India, Ceylon, Assam, Burma, Siam, Cochin-China, Sumatra, and Borneo; although Mr. Blanford is of opinion that its occurrence in the island last named may be due to human agency. According to the same writer, in India elephants "are still found wild along the base of the Himalaya as far west as Deira Dun; also in places in the great forest country between the Ganges and Kistna as far west as Bilaspur and Mandla, in the Western Ghats as far north as 17° or 18°, and in some of the forest-clad ranges of Nagpore and farther south. They do not appear to ascend the Himalayas to any elevation, but are sometimes found at considerable elevations above the sea in Southern India, and in Ceylon they range near Newera Ellia, over seven thousand feet." In former times their distributional area in India was still more extensive.

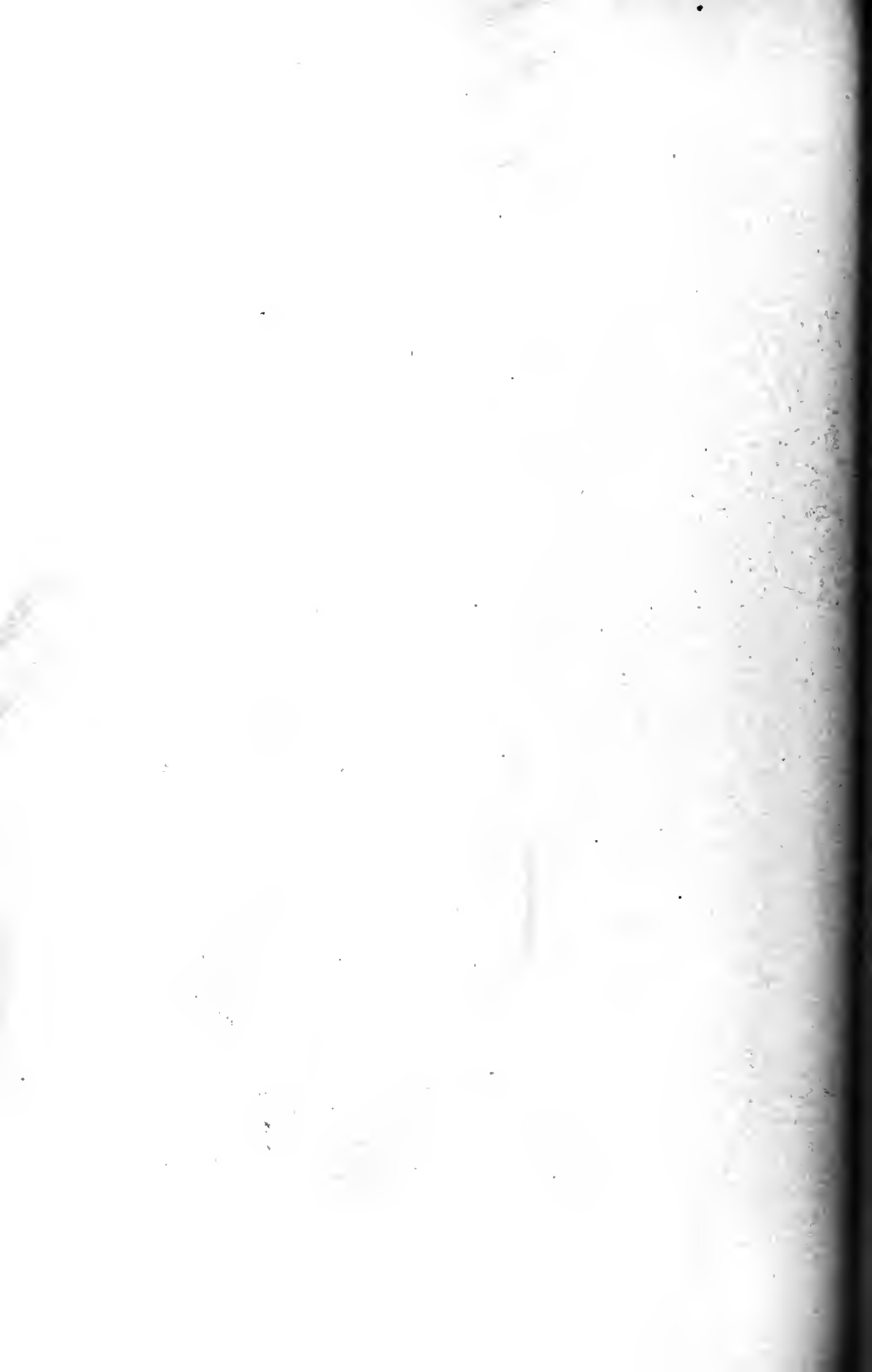
Habits. For full accounts of the habits of the Indian elephant, both in the wild and domestic state, we are largely indebted to the writings of Sir Emerson Tennent, Mr. G. P. Sanderson, and Sir Samuel Baker. The accounts of the former were, however, largely drawn from native sources, and are therefore, in some respects, less reliable than those of the other two. It is accordingly mainly from the latter that the following summary is compiled.

Elephants chiefly frequent districts covered with tall forest, where the ground is undulating or hilly, and where bamboos grow in profusion. During the hot months, in the early part of the year, they keep chiefly to the densest portions of the forest, in the neighbourhood of water; but with the commencement of the rains they venture out into the open glades to feed upon the young succulent grass, and in the late summer in the Madras districts descend at times to the lower jungles. Contrary to general opinion, the Indian elephant is exceedingly intolerant of the burning rays of the sun, to which it never voluntarily exposes itself. As Sir S. Baker observes, "its dark colour and immense surface attract an amount of heat which becomes almost intolerable to the unfortunate creature when forced to carry a heavy load in the hot season in India. Even without a greater weight than its rider, the elephant exhibits signs of distress when marching after 9 A.M." In cloudy and showery weather elephants move about a good deal during the time that they are in the open country; and when travelling from one forest to another they almost invariably march in single file.

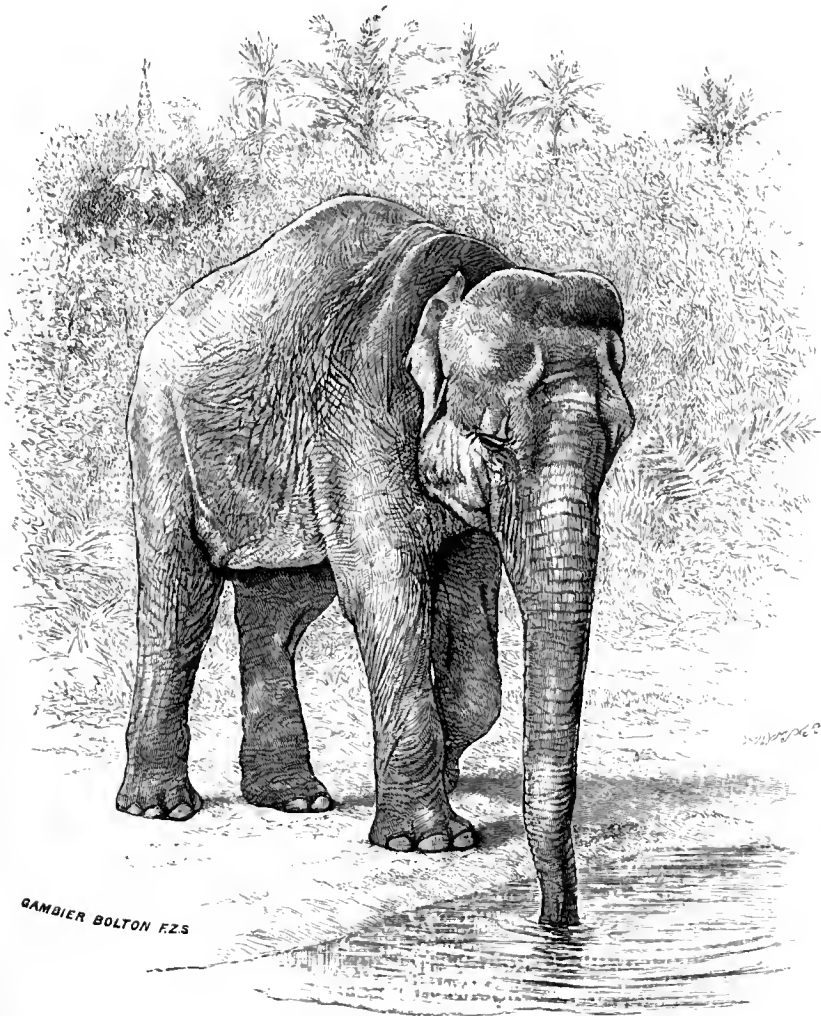
Herds of elephants usually consist of from about thirty to fifty individuals, all of which belong, as a rule, to a single family; although females and young males



INDIAN ELEPHANT.



are said occasionally to migrate from their own proper herd to another. In some cases a herd may include as many as a hundred head; but when fodder is scarce all the larger herds break up into smaller parties of from ten to twenty individuals, these smaller parties keeping within a distance of two or three miles of one another,



INDIAN ELEPHANT DRINKING.

and reuniting when conditions are more favourable. A female seems to be invariably the leader of the herd, although in it may be included males of all ages, and on the march the females with their calves occupy the van, while the tusked males bring up the rear. The old bulls are frequently solitary for a time, but generally each belongs to a particular herd, which it visits occasionally. Solitary male elephants are known as "rogues," and are generally characterised by their fierce and quarrelsome disposition; according to Mr. Sanderson, elephants

that are permanently solitary are, however, comparatively rare, the majority of the so-called rogues really belonging to herds. These leave their companions, as a rule, merely for a time, in order to visit the cultivated lands, where the less venturesome females hesitate to follow, and where they inflict enormous damage on the growing crops.

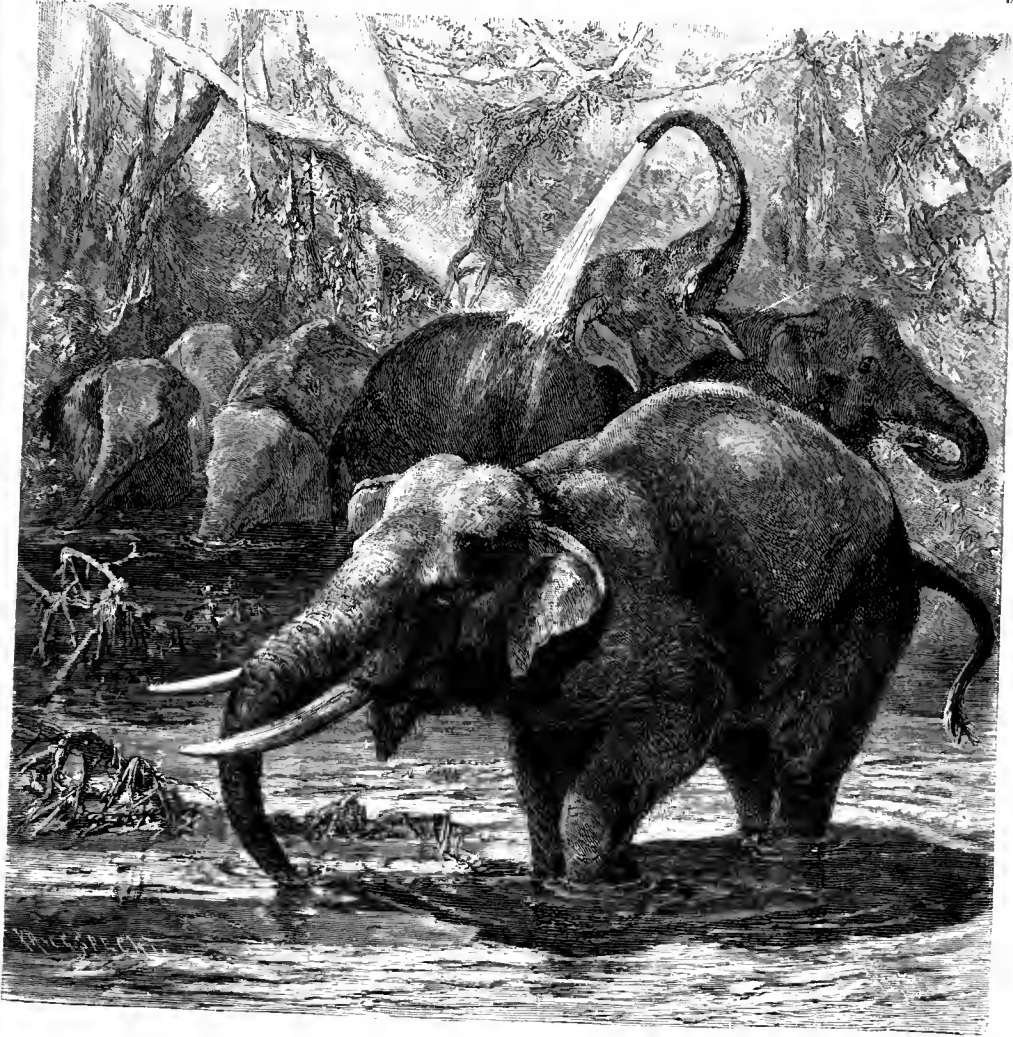
The food of the Indian elephant is mainly composed of grass, leaves, and young shoots of the bamboo, stems, leaves, and fruits of the wild plantain, and the leaves, twigs, and bark of certain trees, more especially figs. The generally succulent nature of its food is in harmony with the structure of the molar teeth, which present a relation to those of the African species almost exactly analogous to that which exists between the molars of Burchell's and the common African rhinoceros. In plucking tussocks of grass or branches of trees, the elephant coils the end of its trunk around them and then tears them off; and the same method is employed in stripping leaves from a bough, or bark from a stem. Small objects such as fruit are, however, picked up by the small finger-like process forming the termination of the trunk above the aperture of the nostrils. When drinking, elephants immerse the end of the trunk in water, which is sucked up to a distance estimated at from 15 to 18 inches in its tubes, and then emptied into the mouth. As a rule, the times of drinking are soon after sunset and shortly before sunrise. Grain is drawn up into the trunk, and then blown out into the mouth.

Wild elephants are in the habit of roaming about and feeding both during the day and night, although they usually rest from nine or ten o'clock in the morning till three in the afternoon, and again from eleven at night till three in the morning. When sleeping, they lie down in the usual manner, and although the members of a herd at once scatter in all directions on any sudden alarm while feeding, they quickly reassemble.

When the season of the year is not too cold, elephants are fond of bathing, or rolling themselves in wet mud, but unless the weather be unusually warm they seldom indulge in such pastimes after sundown. When heated, they squirt water over their backs from their trunks, and when unable to obtain water externally, they have the power of drawing fluid from their mouths or throats by the aid of the trunk. At times, when exposed to a scorching sun, they protect themselves by throwing dust, leaves, or straw on their backs.

Swimming. In common with its African cousin, the Indian elephant is an excellent swimmer, and is perhaps more thoroughly at home in the water than any mammal whose habits are not essentially amphibious or aquatic. Mr. Sanderson states that a herd of seventy-nine elephants under his charge once had a swim of six hours' duration, and after a short rest on a sandbank accomplished their journey by water in three hours more. An elephant swims very deep in the water, sometimes only showing the end of its trunk, but at others allowing the greater part of its head to appear above the surface. In the case of tame individuals the mahout, or driver, generally stands on the neck of his animal. The pace that an elephant swims is estimated at about a mile an hour; but this, of course, depends largely on whether the animal is swimming with or against the stream. Unlike that of a hippopotamus, the body of a freshly-killed elephant floats in water.

Paces. In regard to movement on land, Mr. Sanderson says that "the only pace of the elephant is the walk, capable of being increased to a fast shuffle of about fifteen miles an hour for very short distances. It can neither trot, canter, nor gallop. It does not move with the legs on the same side together, but nearly so. A very good runner might keep out of an elephant's way



INDIAN ELEPHANTS ENJOYING THEMSELVES.

on a smooth piece of turf, but on the ground in which they are generally met with, any attempt to escape by flight, unless supplemented by concealment, would be unavailing." An elephant is totally unable to leap in either the horizontal or the vertical direction, and since its maximum length of stride is about $6\frac{1}{2}$ feet, a 7-foot ditch forms an effectual barrier to its progress. Elephants are, however, capable of ascending or descending steep and difficult places with great facility, sometimes sliding down on their bent hind-limbs. When a herd of them descends one of the steep alluvial banks bordering most of the Indian rivers, it is surprising how

rapidly the soil becomes broken down under their weight so as to form a regular sloping road.

Cries. The Indian elephant, under different circumstances, gives vent to a variety of sounds, some of which are produced in the trunk, while others originate in the throat. Of these utterances, the first, writes Mr. Blanford, is "the shrill trumpet, varying in tone, and expressive, sometimes of fear, sometimes of anger. Secondly, a roar from the throat caused by fear or pain. A peculiar hoarse rumbling in the throat may express anger or want, as when a calf is calling for its mother. Pleasure is indicated by a continued low squeaking through the trunk. Lastly, there is a peculiar metallic sound made by rapping the end of the trunk on the ground and blowing through it at the same time. This indicates alarm or dislike, and is the well-known indication of a tiger's presence."

Senses. The intelligence of the animal having been already sufficiently discussed, all that need be said about its senses is that while smell is strongly developed, both sight and hearing appear to be by no means acute.

Disposition. At most seasons of the year the Indian elephant is a timid animal, much more ready to flee from a foe than to make an attack. Solitary "rogues" are, however, frequently an exception to this rule, and sometimes make unprovoked attacks on passers-by. Indeed, there are instances on record where a "rogue" elephant has taken up a position near a road, and rendered it impassable to travellers. Females with calves are at all times dangerous to approach. Contrary to what is stated to be the case with the African species, when an Indian elephant makes a charge, it does so with its trunk tightly curled up, and it makes its attack by trampling its victim with its feet or knees, or, if a male, by pinning it to the ground with its tusks. At certain periods of the year the male elephant is subject to paroxysms of excitement, generally supposed to be due to sexual causes, and is then highly dangerous, not only to human beings, but to its fellow-animals. The creature is then said to be *mast*, or mad; and the approach of such attacks is indicated by the copious flow of a dark tar-like liquid from two small orifices in the forehead. At the first indications of one of those seizures, domesticated elephants should be promptly secured.

Breeding. Not the least remarkable fact connected with elephants in captivity, is the circumstance that in India at least they very rarely breed when in this condition; thus showing what a profound effect the change from a wild to a domesticated mode of life must have on the animal's entire organisation. It is stated, however, that in some parts of Burma and Siam, young are produced much more freely from captive females. The ordinary period of gestation is about nineteen months, but it appears that in some cases it may be a month less, while in others its duration may be as much as twenty-two months. As a rule, the young are born in the autumn, from September to November; and there is generally but one produced at a birth, although in rare instances twins occur. The new-born calf stands about a yard in height, and weighs about 200 lbs.; it suckles its parent with its mouth, and not, as has sometimes been supposed, with its trunk.

Elephant-Shooting. Elephant-shooting, which is always practised on foot, is pronounced to be the most dangerous of all sports by Sir Samuel Baker, since although many elephants may be killed without any danger or harm, it is almost inevitable that the charge of a wounded animal will have to be encountered sooner or later by the sportsman. In shooting the Indian elephant a thorough knowledge of the position of the brain in the skull is essential; as the three chief head-shots depend entirely on this. Of these three shots the one known as the front-shot should be planted in the forehead about three inches above the line of the eyes when the elephant is standing with its head in the ordinary position and facing the sportsman. When, however, the elephant is charging with its head thrown up, the front shot to prove fatal must be aimed much lower down, in the upper part of the trunk, and as the bullet has then to traverse a great thickness of flesh and bony tissue before reaching the brain, everything depends upon its penetrating power. Indeed, although elephants have frequently been killed by well-planted bullets from small-bore rifles, all who have had much experience of this sport are unanimous as to the importance of shooting with rifles of heavy calibre. The other two fatal shots in the head are the side, or temple-shot, and the rear-shot just behind the ear. The shot behind the shoulder is not in much favour.

Allusion has already been made to the generally timid and pacific nature of the wild Indian elephant; and there can be little doubt that in many cases, when these animals charge, they do so more from sudden alarm and fright than from any innate viciousness.

When an elephant does charge, it requires all the coolness and presence of mind of the sportsman to avoid a catastrophe. "A grander animated object," writes Mr. Sanderson, "than a wild elephant in full charge can hardly be imagined. The cocked ears and broad forehead present an immense frontage; the head is held high, with the trunk curled between the tusks, to be uncoiled in the moment of attack; the massive fore-legs come down with the force and regularity of ponderous machinery; and the whole figure is rapidly foreshortened, and appears to double in size with each advancing stride. The trunk being curled and unable to emit any sound, the attack is made in silence, after the usual premonitory shriek, which adds to its impressiveness. The usual pictorial representations of the Indian elephant charging with upraised trunk are accordingly quite incorrect."

In some cases the sportsman has to stalk a herd of elephants, and to pick out the finest tuskier from among the males in the rear; while at other times he has to track up a particular solitary male, which may be either a "rogue" or a herd-tuskier temporarily separated from his companions. When a herd discovers the presence of a foe, the individual that first scents him usually gives vent to a short, shrill trumpet, upon which the rest stand perfectly still for a few minutes before making up their minds in which direction to flee. But at other times the whole herd may make off at once, without a sound being uttered. Sometimes the herd will mistake the direction of the danger, and stampede straight for the sportsmen, whose position is then one of considerable danger; his best plan being to stand alongside a tree or clump of bamboo. In cases where they are unaccustomed to the sound of firearms, Mr. Sanderson states that elephants will stand huddled together, shrinking at the

shots, which they perhaps mistake for thunder. When first starting, they make off at a rapid pace, but soon settle down to a steady walk.

In shooting single tuskers, it is advisable that the sportsmen should be at his work betimes, as in the case of bulls belonging to a herd they usually rejoin their companions by eight or nine in the morning. When such solitary animals are feeding, the noise they make allows of a close approach without much risk of discovery. Bulls that are permanently solitary usually rest at about ten o'clock, and after that time may be found asleep, either lying down, or resting against the trunk of a tree. When first disturbed, one of these solitary tuskers makes off with a tremendous rush, but soon subsides into a walk, when he proceeds so quietly that he may disappear without the sportsman being in the least aware of it.

The following account of the death of a tusker, by Sanderson, gives some idea of the danger often encountered in this kind of sport. The narrator writes, that having ascertained that the herd comprised about fifty head, "a shrill trumpeting and crashing of bamboos about two hundred yards to our left broke the stillness, and from the noise we knew it was a tusker-fight. We ran towards the place where the sounds of combat were increasing every moment: a deep ravine at last only separated us from the combatants, and we could see the tops of the bamboos bowing as the monsters bore each other backwards and forwards with a crashing noise in their tremendous struggles. As we ran along the bank of the nalla to find a crossing, one elephant uttered a deep roar of pain, and crossed the nalla some forty yards in advance of us, to our side. Here he commenced to destroy a bamboo-clump (the bamboos in these hills have a very large hollow, and are weak and comparatively worthless) in sheer fury, grumbling deeply the while with rage and pain. Blood was streaming from a deep stab in his left side, high up. He was a very large elephant, with long and fairly thick tusks, and with much white about the forehead; the left tusk was some inches shorter than the right. The opponent of this Goliath must have been a monster indeed to have worsted him. An elephant-fight, if the combatants are well matched, frequently lasts for a day or more, a round being fought every now and then. The beaten elephant retreats temporarily, followed leisurely by the other, until by mutual consent they meet again. The more powerful elephant occasionally keeps his foe in view till he perhaps kills him; otherwise, the beaten elephant betakes himself off for good on finding he has the worst of it. Tails are frequently bitten off in these encounters. This mutilation is common amongst rogue-elephants, and amongst the females in a herd; in the latter case it is generally the result of rivalry amongst themselves. The wounded tusker was evidently the temporarily-beaten combatant of the occasion, and I have seldom seen such a picture of power and rage as he presented, mowing the bamboos down with trunk and tusks, and bearing the thickest part over with his fore-feet. Suddenly his whole demeanour changed. He backed from the clump and stood like a statue. Not a sound broke the sudden stillness for an instant. His antagonist was silent, wherever he was. Now the tip of his trunk came slowly round in our direction, and I saw that we were discovered to his fine sense of smell. We had been standing silently behind a thin bamboo-clump, watching him, and when I first saw that he had winded us, I imagined he might take himself off. But his frenzy quite overcame all fear for the moment; forward

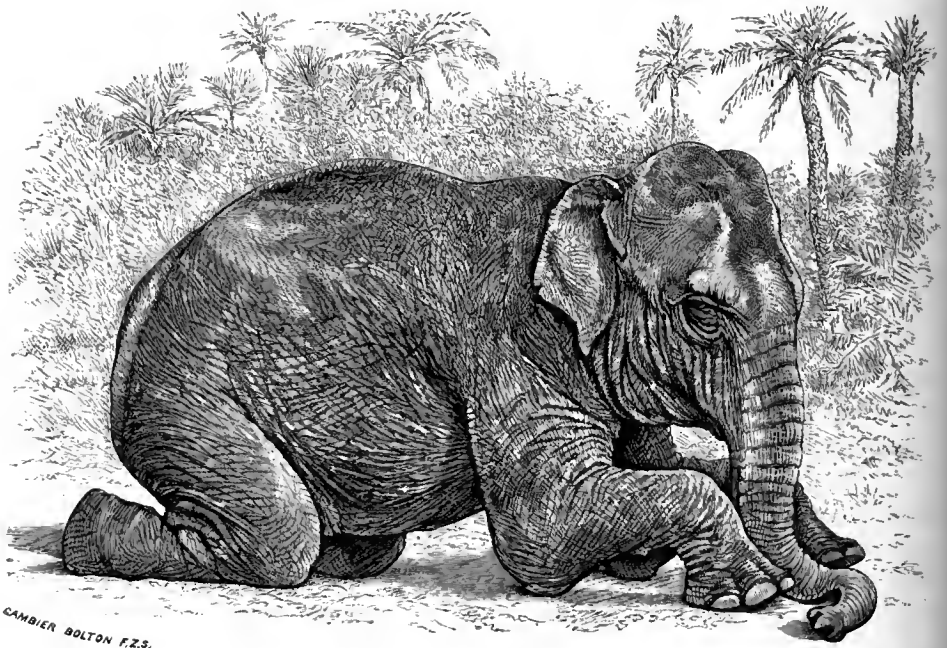
went his ears and up went his tail, in a way which no one who has once seen the signal in a wild elephant can mistake the significance of, and in the same instant he wheeled round with astonishing quickness, getting at once into full speed, and bore straight down upon us. The bamboos by which we were partly hidden were useless as cover, and would have prevented a clear shot, so I stepped out into open ground the instant the elephant commenced his charge. I gave a shout in the hope of stopping him, which failed. I had my No. 4 double smooth-bore loaded with ten drams in hand. I fired when the elephant was about nine paces distant, aiming into his curled trunk about one foot below the fatal bump between the eyes, as his head was held very high, and this allowance had to be made for its elevation. I felt confident of the shot, but made a grand mistake in not giving him both barrels; it was useless to reserve the left as I did at such close quarters, and I deserved more than what followed for doing so. The smoke from the ten drams obscured the elephant, and I stooped quickly to see where he lay. Good heavens! he had not been even checked, and was upon me! There was no time to step right or left. His tusks came through the smoke (his head being now held low) like the cow-catchers of a locomotive, and I had just time to fall flat to avoid being hurled along in front of him. I fell a little to the right; the next instant down came his ponderous fore-foot within a few inches of my left thigh, and I should have been trodden on had I not been quick enough, when I saw the fore-foot coming, to draw my leg from the sprawling position in which I fell. As the elephant rushed over me he shrieked shrilly, which showed that his trunk was uncoiled; and his head also being held low instead of in charging position, I inferred rightly that he was in full flight. Had he stopped I should have been caught, but the heavy bullet had taken all the fighting out of him. Jaffer had been disposed of by a recoiling bamboo, and was now lying almost in the elephant's line; fortunately, however, the brute held on. I was covered with blood from the wound inflicted by his late antagonist in his left side; even my hair was matted together when the blood became dry. The mahout had jumped into the deep and precipitous nalla to our left at the commencement of hostilities."

Capture.

Since the elephant in India will not breed to any appreciable extent in captivity, the stock has to be continually replenished by the capture of wild individuals. The methods in vogue are, by driving into *keddas*, or enclosures; by hunting with trained females; by means of pitfalls; and by noosing from the backs of specially-trained tame animals. Of these, the first only is employed for the capture of whole herds.

A kedda-party in Bengal comprises three hundred and seventy men, who go out during the winter prepared for a sojourn of two or three months in the jungle. When a herd is discovered, the party divide and go off in opposite directions so as to surround it, leaving two of their number at distances of about every fifty yards, or rather more. When complete, the circle should have a circumference of six or eight miles; and when once found, it must be the fault of the men if the herd is not captured. A light fence of split bamboo is rapidly formed round the ring, as are likewise shelters for the men; and the animals are kept in by firing shots by day and by lighting bonfires at night. After the first two days, however, if the ring be sufficiently large and contain plenty of cover, the elephants give but little

trouble. In the middle of the circle the construction of the kedda is then pushed on apace. This is built in a secluded spot, and is formed of massive posts of about twelve feet high, supported by props, and arranged in a circle of from twenty to fifty yards in diameter, with an entrance of about four yards in width. From the entrance proceed two diverging lines of palisades, which at their terminations, a hundred yards or so from the gate, are about fifty yards asunder. When all the arrangements are complete, the herd is driven down the funnel-shaped entrance, and when within the kedda itself imprisoned by dropping a kind of portecullis at the gate. After a time the process of securing the various members of the herd commences; for which purpose tame elephants, each carrying a mahout on its neck and a rope-tier behind are employed. These tame elephants separate the wild ones



INDIAN ELEPHANT KNEELING.

from their companions one by one, when the hind-legs of the captives are tied together with ropes. Each captive then has a rope placed round its neck, and another round one hind-leg; after which it is led out and secured to a tree in the neighbouring forest, where it remains until sufficiently tamed to undergo further treatment.

As the finest tuskers are seldom caught in the keddas, another plan is adopted for their capture. A party of four or five trained female elephants, with their mahouts (who partially conceal themselves under blankets), proceed to the resorts of a solitary wild tusker; and gradually approach him by grazing in an unconcerned manner, unless the male saves them this trouble by coming up of his own accord. Having established an acquaintance, the females remain constantly with the male until he is thoroughly tired out and in need of sleep, which may not take place for two or three days; during which time the mahouts have been relieved

one by one by relays. When the wild tusker is sound asleep, the females close up around him, upon which two of the mahouts slip off, and tie his hind-legs securely together. Sometimes this is all that is then done, but in other cases he is made fast to a tree. When awakened, the male, if tied to a tree, makes every effort to escape, but in vain; while, when his legs are merely hobbled, he makes off in the best way he can. In the latter case he is followed by the females until exhausted, when he is made fast to a neighbouring tree. The efforts made by elephants thus caught to escape from their trammels, frequently produce such injuries as to result in the death of a large percentage of the number.

Pitfalls. The pitfall mode is chiefly or entirely employed by natives, and is a barbarous one, owing to the frequency with which the bones of the animals are broken or dislocated in the fall. To obviate this a bar is usually fixed across the middle of the pit, which, although itself broken, somewhat mitigates the shock of the fall. The pits are about fifteen feet in depth, by ten and a half in length, and seven and a half in width; this relatively small area being intended to hinder the animal from digging his way out with his tusks. It is remarkable that an animal which displays such caution in venturing over bridges and other artificial structures as does the Indian elephant, should so readily fall into these pits.

Chasing. The fourth method of capture employed in India is by far the most exciting, and is in fact a simple chase. Three or four fast tame elephants, each carrying a mahout on its neck, a nooser kneeling on a small pad on the back, and a driver near the tail, are fitted with a girth round the body, attached to which is a rope with a running noose. When the wild elephants are approached, they make off at their topmost speed, closely followed by the tame ones. Two of the tame elephants select a single wild animal, and urged to their utmost speed by the blows of a spiked mallet wielded by the drivers behind, perhaps eventually come alongside of it. When this takes place, the nooses are thrown, and generally encircle the victim by the neck. The tame elephants are then checked, but if this is done too suddenly the captive may be choked; indeed, the whole party are liable to injury from being dragged down ravines or other precipitous places; and the work is at all times very harassing to the tame animals employed. This method, which is only employed in Bengal and Nipal, has the further disadvantage that only the less fleet, and therefore inferior, animals can be captured by its means.

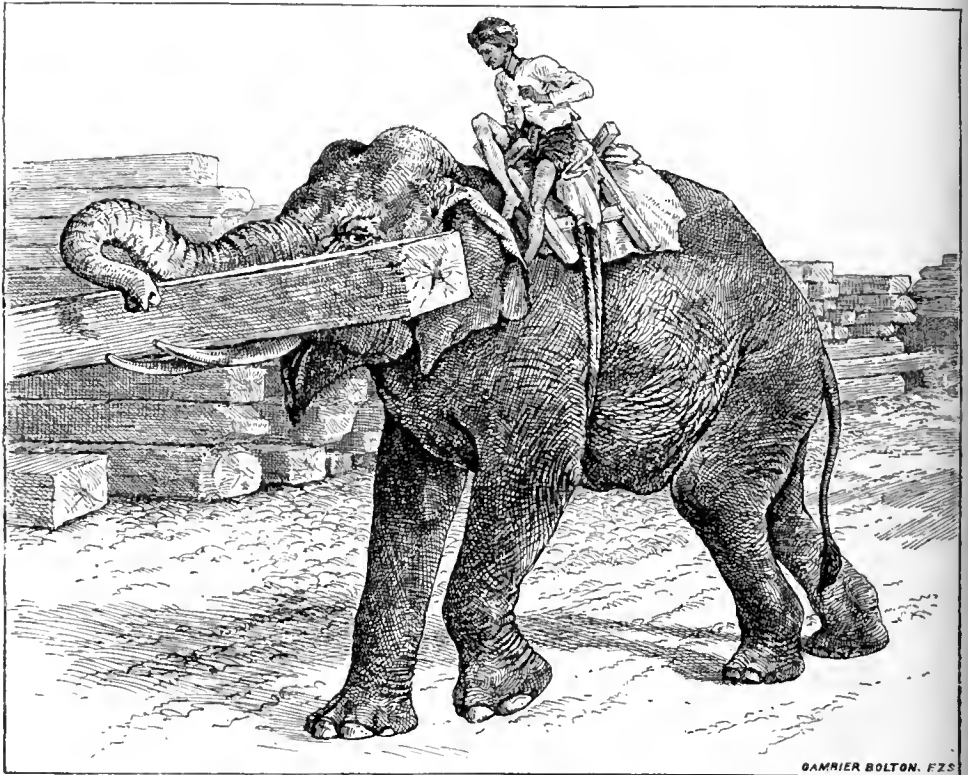
Noosing. In Ceylon wild elephants are noosed by a couple of hunters on foot, who with marvellous skill encircle the hind-legs of an animal running away from them, and make fast the end of the trailing rope to a tree.

Value. An immature female elephant is worth about £150 (we presume counting the rupee at its nominal value of two shillings), while good working females will fetch from £200 to £300. Tuskers are, however, far more valuable, ranging from £800 to £1500 or £1600, or even more if all their "points" be perfect.

Uses of Elephants. The domesticated elephant is largely employed in India for the transport of heavy camp-equipage, for dragging timber to the rivers, and in lieu of horses for artillery; and is of especial value in traversing districts where roads are either wanting, or are so bad as to be impassable for other animals when laden. Elephants may be employed either as beasts of burden or of draught;

and in the former case their loads should not exceed half a ton for continuous marching, while in hilly districts they should be reduced to about 7 cwt. In dragging timber of moderate dimensions, a short rope is attached to one end of each log, which the elephant seizes between his teeth, and thus raising his burden from the ground, half carries and half drags it away. Tuskers are both stronger and more useful than females, since their tusks often aid them in the performance of their duties.

The majority of the animals employed in tasks like the above, belong to what



ELEPHANT STACKING TIMBER.

the natives term the inferior castes; tuskers of the finest and most approved form being far too expensive to be put to such uses. The majority of such animals are, indeed, purchased by the native princes, by whom they are used in state pageants, and the taller the animal, the greater his value.

By the sportsman the elephant, as we have already had occasion to mention, is extensively employed in tiger-shooting; and, indeed, in many districts this sport can only be enjoyed by the aid of these animals. For sporting purposes, the elephant carries a howda, which should be so constructed as to combine lightness with strength, and to allow of the occupant firing from it with equal ease in any direction. One of the most remarkable features connected with the taming of the Indian elephant, is the extent to which its natural timidity in presence of its dreaded enemy the tiger may be overcome by means of careful training. To enter

into any particulars with regard to the mode of employment of elephants in tiger-hunting, would, however, be entirely beyond the scope of a work on Natural History.

The Mammoth. As being extremely closely allied to the living Indian species, the extinct elephant of the Pleistocene deposits of Europe and Northern Asia, commonly known as the mammoth (*E. primigenius*), may be conveniently noticed in this place. So close, indeed, is the relationship between the mammoth and the Indian elephant, that it may be a great question whether they are anything more than varieties of one single species, specially modified for the climates of their respective habitats. It is true that the tusks of the mammoth are much more curved upwards than are those of the Indian elephant, and assume a spiral curvature; while the plates of the molar teeth are narrower and more numerous. These, however, are differences which scarcely constitute more than a well-marked variety; and it is noteworthy that when we reach the warmer regions of Asia Minor, the place of the mammoth was taken during the Pleistocene period by an allied species known as the Armenian elephant (*E. armeniacus*), which had molar teeth intermediate between those of the former and those of the living Indian elephant. In Siberia, where its carcasses have been found preserved in the frozen soil, the body of the mammoth was covered with a thick coat of brownish woolly fur, among which were a number of longer bristly black hairs; but it is by no means certain that the animal was thus protected from cold in the more southern and warmer portions of its habitat. Apart, however, from this, the discovery alluded to on p. 529, that the Indian elephant retains traces of a woolly covering similar to that of the mammoth, shows that in this respect there is no essential difference between the two forms; and indicates that the development or loss of the hairy coat was entirely due to climatic conditions.

The mammoth is found in great abundance in Siberia, its remains becoming more numerous the further north we proceed. In Northern Europe, with the exception of the district to the East of the White Sea, it is, however, rare or unknown; none of its remains having been discovered in Norway, and but few in Denmark and Sweden. Although rare in Scotland and Ireland, mammoth-remains are extremely common over the greater part of England, and a large area of Central Europe. They abound in France and Germany, and in Italy extend as far south as Rome, but according to Sir H. H. Howorth are unknown southward of the Pyrenees. Great numbers are dredged from the Dogger Bank in the North Sea. From Eastern Asia the mammoth travelled across what is now Behring Strait into Alaska; but in the United States, and extending as far south as Texas and Mexico, the place of the mammoth was taken by a closely-allied species or variety, known as the Columbian elephant (*E. columbi*).

That the mammoth lived in Siberia in the area where its frozen remains are found, may be considered certain; and there is considerable evidence to indicate that the climate of these regions was far less inclement than it is at present. This, however, only renders it the more difficult to account for the manner in which its remains were—as they must have been—frozen up in the soil immediately after death. Sir H. Howorth calls in the aid of a sudden cataclysmic change from heat to extreme cold; but it is somewhat difficult to accept such a theory. However,

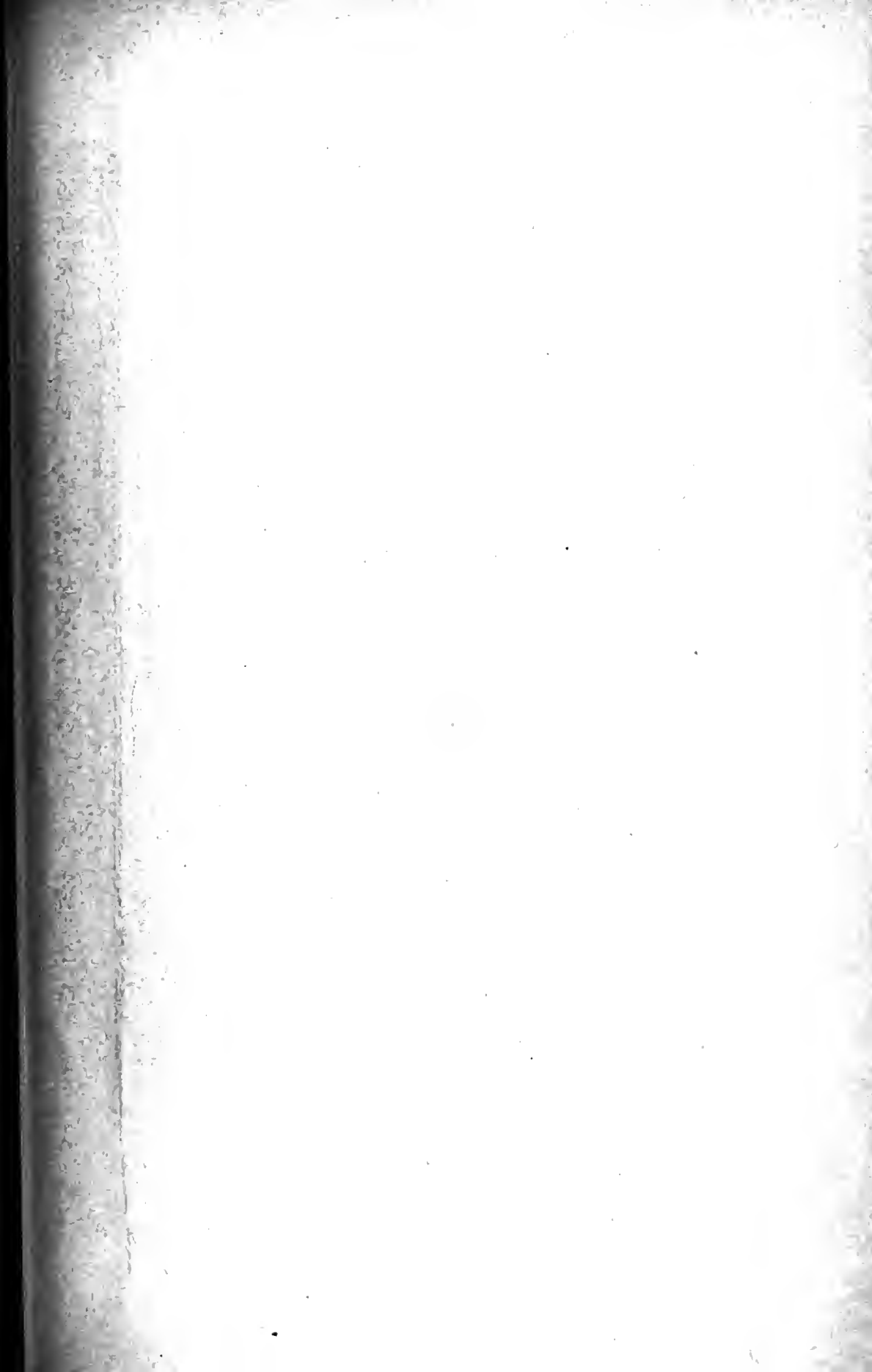
without some such explanation, the mode of entombment remains a complete puzzle. In Europe the mammoth seems to have made its first appearance before the great cold of the glacial period; a fact, which so far as it goes, is in favour of Sir H. Howorth's view, as tending to show that the creature never inhabited a very cold climate.

Numerous finds of frozen carcases of mammoths in the soil of Siberia have been recorded; but it may be pretty safely asserted, that these form only a small proportion of those which have been brought to light by the action of the weather during the historic period. Of the recorded examples, almost the earliest is one found on the river Alasega in the year 1787; and somewhere about the same time another appears to have been discovered at the mouth of the Lena; while a third occurred in 1805 on the shores of the Polar Sea. The most celebrated of the earlier finds is, however, the one recorded by the naturalist Adams, in 1806, which had been disclosed by the gradual melting of the ice on a peninsula at the mouth of the Lena. The first indication of this carcase was noticed by a native in the year 1799, who observed a hummocky mass in the ice, which melted in the summer of 1801 sufficiently to show one tusk and the side of the monster. The carcase was then entire, showing the eyes and trunk well preserved, and the thick coat of wool and hair clothing the skin. During the cold summer of 1802 the ice melted little, but in the following year the carcase slid down on to a sandbank; and in 1804 a native hacked out and carried off both tusks. It was not till two years later, that Adams arrived on the scene; by which time the dogs of the yakuts had consumed nearly all the flesh, while one limb had been removed bodily. The rest of the skeleton, together with a large amount of hair, were, however, taken to St. Petersburg, where they are now preserved.

Another mammoth-mummy was discovered in 1840 on a tributary of the Yenisei, and its skeleton taken to the Museum at Moscow. Some long stiff hair, of a reddish colour, found with this specimen, probably belonged to the mane; the existence of such a mane having been proved by the rough sketches made by the yakuts of Adams's specimen. A half-grown mammoth, with part of the skin remaining, was discovered in 1843 near the river Taimyr, only a comparatively short distance from the Polar Sea, in 1843. Some time between 1840 and 1850, a well-preserved carcase was discovered in the circle of Yakutsk, on the banks of the river Kolyma. It had a long mane, extending from the head to the tail; and fragments of twigs, on which the animal had been browsing shortly before its death, were found between its teeth.

Between 1860 and 1862 the yakuts discovered another frozen carcase on a tributary of the Lena; and an expedition from St. Petersburg, which unfortunately arrived too late, was despatched to secure the prize. The summer 1867 revealed another of these frozen carcases, this time near the Polar Sea in the neighbourhood of the River Alasega, and some distance beyond the northern limit of trees. About the same time news arrived of the discovery of a mammoth on the river Kolyma; while a third was discovered in 1870 near the Alasega.

These isolated finds of frozen carcases give no idea of the number of mammoths that inhabited Siberia at a time when its climate must apparently have been far less rigorous than at present; and in order to obtain some adequate conception on



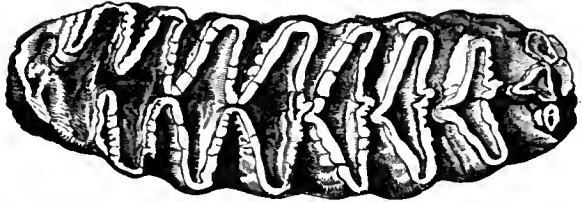


AFRICAN ELEPHANT.

this point, we must turn our attention to the trade in mammoth ivory. It appears that in 1872 no less than 1630 of these tusks, and in the following year 1140, were imported into England; and it may be estimated that for a long time fully 120,000 lbs. weight of fossil ivory found its way year by year into the market. This means that within a period of twenty years, over 20,000 mammoths must have been discovered; which affords ample proof that Siberia was as thickly inhabited by these animals, as was ever Africa by the elephant of modern times. It may be added that only about 14 per cent. of the tusks imported afford first-class ivory, in addition to which about 17 per cent. are capable of being used where ivory of the best quality is not required.

THE AFRICAN ELEPHANT (*Elephas africanus*).

The African elephant differs widely from its Asiatic congener, not only in external form, but likewise as regards the structure of its molar teeth; the males also reaching larger dimensions than those ordinarily attained by the latter. The most striking external characteristic of the African species is the enormous size of the ears, which, when in repose, completely cover the shoulders, but during periods of excitement are elevated at right angles, and thus communicate a most extraordinary appearance to their owner. The head is also much more convex in the region of the forehead, the eye is larger, and the extremity of the trunk, instead of having one long finger-like process on its front edge, has two nearly equal-sized processes, one in front and the



A RIGHT UPPER MOLAR TOOTH OF THE AFRICAN ELEPHANT
($\frac{1}{3}$ nat. size). (From Sir R. Owen.)

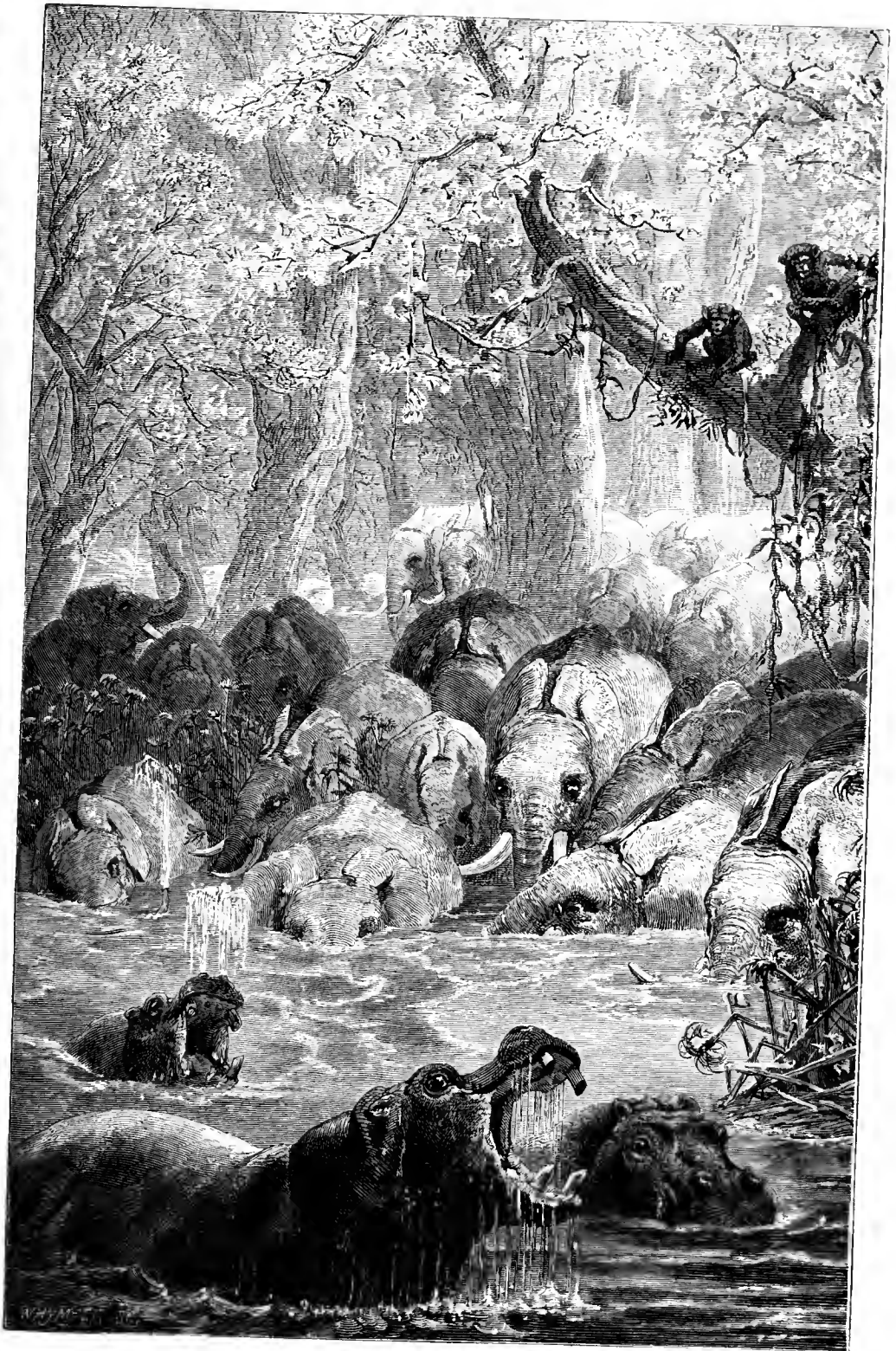
other behind. The colour of the skin is also somewhat darker. In general form, the African species is distinguished by the middle of the back being hollowed, and the shoulder the highest point, while the hind-foot carries three, in place of four, nails. As a general rule, both the males and females are furnished with well-developed tusks, which attain larger dimensions than those of the Indian elephant; but Mr. Blanford states that in Eastern and Northern Abyssinia all the elephants appear to be almost tuskless, or to have very small and short tusks. The molar teeth are distinguished by the smaller number and greater thickness of their plates; each of these plates expanding in the middle in an angulated form, so that when worn (as shown in the accompanying figure) each plate presents a lozenge-shaped area of ivory bordered by enamel. Moreover, the enamel is not puckered in the manner characterising the molars of the Indian species. The number of plates in the first molar is usually three, in the second six, in the third and fourth seven, in the fifth eight, and in the last ten.

Dimensions. That the African elephant frequently attains a height of 10 feet and over at the shoulders is well ascertained, but we have no records of its maximum dimensions in the wild state. A male killed in South Africa by H.R.H. the Duke of Coburg, which stood 10 feet at the withers, had a length

of 23 feet 5 inches from the tip of the trunk to the end of the tail, with a maximum girth of 16½ feet; its weight being 4 tons 8 cwts. and 4 lbs. In one killed near Lake Nyasa by Sir John Kirk, the height at the withers was 10 feet 3 inches, the total length 25 feet 2 inches, and the maximum girth 18 feet. These dimensions are, however, largely exceeded by those of the well-known "Jumbo," formerly in the London Zoological Society's Gardens, whose height at the withers was 11 feet, and his weight 6½ tons. As this animal was brought up in captivity, there can be no doubt but that wild individuals must attain considerably larger dimensions; and Sir Samuel Baker states that he has seen very much larger animals than "Jumbo."

In regard to the dimensions of the tusks, Sir S. Baker gives about 140 lbs. for the average weight of a pair in a full-grown male; but owing to the exclusive use of one tusk for digging, the two would not be of equal weight. The same writer states that a single tusk sold in London in 1874 weighed 188 lbs.; and one in the possession of Sir E. G. Loder weighs 184 lbs., with a length of 9 feet 5 inches, and a girth of 22½ inches. Another mentioned by Sir S. Baker weighed 172 lbs.; while one recorded by Sir J. Kirk had a weight of 160 lbs., a length of 9 feet 4 inches, and a girth of 20½ inches. A fine specimen in the collection of Mr. Rowland Ward has the same length as the last, but its weight is 110 lbs., and its girth 18 inches. The longest on record appears, however, to be one mentioned by Gordon Cumming, of which the length is given as 20 feet 9 inches, and the weight 173 lbs.

Distribution. Although its fossilised remains have been found in the superficial deposits of Spain, Sicily, and Algeria, this species is now confined to Africa south of the Sahara, where it was formerly spread over the whole of the wooded districts. Owing, however, to constant persecution for the sake of its tusks, the African elephant has been greatly reduced in numbers, and is now practically exterminated from large areas in the southern portion of the continent. Indeed, if measures are not shortly taken for its protection, it stands a good chance of sharing the fate which has already befallen the quagga and Burchell's rhinoceros; although it may survive for some time in the more remote equatorial districts and the Sudan. In the districts lying to the southward of the Zambesi, Messrs Nicolls and Eglington state that, with the exception of a few scattered herds in the more unfrequented parts of Matabililand, and the extremity of North-Eastern Mashonaland, elephants "are now only met with in anything like reasonable quantities in the impenetrable bush of the low-lying coast country in the region of Sofala Bay. A few herds may possibly exist in the extreme north and north-east of Ovamboland, bordering on the Cuneni and Okavango Rivers; but if so, they are only a few tuskless males or young females. The last herd frequenting the Botletli and the neighbourhood of Lake Ngami was completely destroyed three years ago [1889] by Bechuanas; and although a good many are certainly to be met with in the country between the Chobi and Zambesi, it is improbable that they will survive the attacks of the Barotsi natives during the next two or three years." Some herds are preserved in a protected state by the Government in the forests in the east of the Cape Colony. In East Africa, in the Kilima-Njaro district, elephants are still fairly plentiful. There they ascend, at



THE HAUNT OF THE AFRICAN ELEPHANT.



certain seasons of the year to an elevation of nine thousand or ten thousand feet among the damp forests clothing the sides of the mountain; while they are found at heights of from seven thousand to eight thousand feet above the sea-level in the Abyssinian highlands.

Habits. All observers seem to agree that the African elephant is a more powerful and more active animal than its Asiatic cousin, displaying marvellous capacities for getting over precipitous and rocky ground, and being altogether more rapid in its movements. Moreover, most writers consider its disposition is decidedly fiercer than that of the other species.

Although there is probably some local difference in this respect, the African elephant, according to Sir Samuel Baker, is far less intolerant of intense solar heat than the Indian species; and in the Sudan these animals may frequently be observed "enjoying themselves in the burning sun in the hottest hours of the day, among plains of withered grass, many miles from a jungle."

The difference in the structure of their molar teeth would of itself be an indication of a marked distinction in the diet of the two species; and from what we know in the analogous instance of the two African species of rhinoceros it would be inferred that the nutriment of the African elephant is composed of coarser and harder substances than those eaten by the Indian species. This inference appears to be supported by the results of observation. Thus, in parts of South Africa, Livingstone states that great numbers of trees may be seen "broken off by elephants a foot or two from the ground, in order that they may feed on the tender shoots at the tops; the trees thus seem pollarded from that point. In spite of this practice, the elephant never seriously lessens the number of trees; indeed, I have often been struck by the very little damage he does in a forest. His food consists for the most part of bulbs, tubers, roots, and branches; the natives in the interior believe that he never touches grass; and the only instance I saw of his having grazed was near Teti, when the grass was in seed, and when he might have been attracted by the farinaceous matter, which exists in such quantities in the seed that the natives collect it for their own food." In another passage the great explorer states that the African elephant "is a most dainty feeder, and particularly fond of certain sweet-tasted trees and fruits, such as the mohonono [a tree said to resemble the cedar in appearance], the mimosa, and others, which contain much saccharine matter, mucilage, and gum. He may be seen putting his head to a lofty palmyra, and swaying it to and fro to shake off the seeds; he then picks them up singly and eats them. Or he may be seen standing by the masuka and other fruit-trees, patiently picking off the sweet fruits one by one. The selection of these kinds of food accounts for the fact that herds of elephants produce but small effect on the vegetation of a country—quality being more requisite to them than quantity."

From his experience in the Sudan, Sir Samuel Baker observes that "the African elephant is a more decided tree-feeder than the Indian, and the destruction committed by a large herd of such animals when feeding in a mimosa-forest is extraordinary; they deliberately march forward, and uproot or break down every tree that excites their appetite. The mimosas are generally from 16 to 20 feet high, and, having no tap-root, they are easily overturned by the tusks of the

elephants, which are driven like crowbars beneath the roots, and used as levers, in which rough labour they are frequently broken. Upon the overthrow of a tree, the elephants eat the roots and leaves, and strip the bark from the branches by grasping them with their rough trunks." In another passage the same writer expresses his belief that two elephants may sometimes unite their strength in order to overthrow a tree of more than ordinary size. The discrepancy in the two foregoing accounts as to the amount of damage inflicted by elephants in a forest, may be accounted for by the circumstance that while in the one district their food consists largely of twigs and fruits, in the other it is mainly composed of bark and roots. In South-Eastern Africa Mr. Selous bears testimony to the digging habits of the elephant, stating that he has seen large areas of sandy soil ploughed up by the tusks of these animals in their search for roots.

In digging, as already incidentally mentioned, it appears that the elephant always uses one particular tusk, which, in consequence, is much more worn than the other. According to Sir S. Baker, it is nearly always the right tusk which is selected for this duty; and the one so used is termed by the Sudanis the *hadim*, or servant. A curious question arises whether this preferential use of the right tusk has any connection with our own right-handedness.

In Southern Africa, at least, elephants drink almost every night, but only rarely during the day. In that part of the continent they seek the deepest shades of the forest during the heat of the day, and generally appear to sleep in a standing posture.

The African elephant associates in herds of varying size, which appear to be generally family parties; but the old bulls may be solitary, in pairs, or in small parties, and keep apart from the larger herds, which usually consist of young males, females, and calves. One of the largest herds seen by Mr. Selous was estimated to contain from one hundred to two hundred head, but such assemblages are rare. In many parts of Africa, including Abyssinia, Kilima-Njaro, and the Sudan, elephants undertake periodical migrations, apparently necessitated by the supply of food, or induced by the ripening of certain kinds of fruit in particular districts. At such times it appears that the old bulls rejoin the herds to which they belong. Once, and once only, Sir S. Baker had the opportunity of witnessing such a migration, which he describes as follows:—"We were marching through an uninhabited country for about thirty miles, and, in the midst of beautiful park-like scenery, we came upon the magnificent sight of vast herds of elephants.

"These were scattered about the country in parties varying in number from ten to one hundred, while single bulls dotted the landscape with their magnificent forms in all directions. In some places there were herds of twenty or thirty, entirely composed of large tuskers; in other spots were parties of females with young ones interspersed, of varying growth; and this grand display of elephantine life continued for at least two miles in length as we rode parallel with the groups at about a quarter of a mile distant. It would have been impossible to guess the number, as there was no regularity in their arrangement, neither could I form any idea of the breadth of the area that was occupied."

In describing his first view of the largest company of elephants he ever encountered, Oswell writes that "as I got clear of the bush I came upon at least

four hundred elephants standing drowsily in the shade of the detached clumps of mimosa-trees. Such a sight I had never seen before, and never saw again. As far as the eye could reach, in a fairly open country, there was nothing but elephants. I do not mean in joined masses, but in small separate groups. Lying on the pony's neck, I wormed in and out, looking for the bulls whose 'spoor' we had been following, and while doing so was charged by a very tall, long-legged, ugly beast, who would take no denial, and I was obliged to kill him."

Pace. It has already been stated that the maximum pace of the Indian elephant is estimated at about fifteen miles an hour; but this can only be maintained for a couple of hundred yards or so, after which the rate sinks to eight or six miles an hour. On the other hand, Sir Samuel Baker is of opinion that the African elephant might be able to maintain the maximum pace of fifteen miles an hour for a hundred yards longer than its Asiatic cousin, and that it would settle down to a pace of ten miles an hour, which could be kept up for at least that period of time. The relatively longer limbs and stride of the African species fully bear out this view as to its speedier movements.

Senses. The sense of scent appears to be very strongly developed in this species, inasmuch as it can discover the presence of a human being at an immense distance when the wind is favourable. As soon as an elephant scents a man, it starts off at once at a rapid pace, which will be maintained sometimes for hours; and since in most parts of Africa the wind is constantly veering, this constitutes one of the great difficulties in elephant-stalking. On the other hand, the sight of these animals is most defective; and it does not appear that their hearing is particularly good. On account of these deficiencies, it is possible to approach a wild African elephant from the leeward to within a very short distance; and we have been informed, on good authority, that a hunter once wagered that he would write his initials on the hind-quarters of one of these animals while alive, and that he actually succeeded in doing so.

Domestication. It is somewhat curious that the natives of Africa display no aptitude for the domestication of the wild animals of their country, in which respect they stand in marked contrast to the Malays and other Eastern nations. In the later ages of Rome, as shown on coins, the African elephant was tamed and exhibited in the arena; and these animals are commonly stated to have been employed by the Carthaginians in the Punic wars (B.C. 264-216), no less than thirty-seven of them accompanying Hannibal's army across the Alps. On this point, however, Oswell writes as follows:—"I believe some people suppose the Carthaginians tamed and used the African elephants; they could hardly have had mahouts, Indian fashion, for there is no marked depression in the nape of the neck for a seat, and the hemming of the ears, when erected, would have half smothered them. My knowledge does not allow me to raise any argument on this point; but might not the same market have been open to the dwellers at Carthage, as was afterwards to Mithridates, who, I suppose, drew his supply from India, where they have been broken and made to do man's work from time immemorial." In a note he adds that "I know in the representations on the medals of Faustina and of Septimius Severus the ears are African, though the bodies and heads are Indian; but these were struck nearly four hundred years after Carthaginian times, when

the whole known world had been ransacked by the Romans for beasts for their public shows; and I still think it possible that the Carthaginians—the great traders and colonisers of old—may have obtained elephants, through some of these colonies, from India.” From the disposition of “Jumbo,” it may be inferred that the species could be as easily tamed, and would prove as docile as the Indian elephant; but there is the difficulty that the natives of Africa probably could not be trained to act as efficient drivers, and without a dependable native attendant the best elephant would be worse than useless.

Hunting. The general testimony of those who have had experience of both the African and the Indian elephant points to the conclusion that the former is the more dangerous animal of the two, and the one that is more ready to charge. The females, especially those that are barren and have small tusks, are said to be far more dangerous than males, frequently charging without the least provocation, even when unwounded; and it is stated that hunters will sometimes take the trouble to kill one of these worthless females before attacking the tuskers. Indeed, Mr. W. H. Drummond is of opinion that the greater number of accidents that have occurred in African elephant-shooting may be set down to females. From the testimony of Gordon Cumming, supported by that of the writer last quoted, it would appear that the African elephant, unlike its Indian cousin, charges with its trunk uplifted, and loudly trumpeting.

Pits. Previous to the introduction of firearms, it appears that in South and South-Eastern Africa, at any rate, the natives but seldom attacked the elephant, and effected little, if any, diminution in its numbers. Occasionally, as narrated by Livingstone, they attacked the unfortunate animal with assegais, and gradually harried it to death from the loss of blood caused by hundreds of weapons. In other cases poisoned arrows were the weapons used. A more general method is that of digging pits in the paths frequented by the elephants on their way to water. These pits, according to Sir S. Baker, are usually twelve or fourteen feet in depth, and are covered with light wood and branches or reeds, upon which a thin covering of grass is spread. In some cases Sir Samuel states that several individuals out of a herd may be captured in this manner in Central Africa; the animals being put to death, when thus helpless, with spears. In the Kilima-Njaro district, however, the pit system, according to Mr. Hunter, does not appear to be very successful.

By Fire. During the dry season, when the grass of ten or fourteen feet in height is as inflammable as tinder, the natives of Central Africa have a cruel way of killing elephants by forming a circle of fire round a herd. As the fiery circle, which may be a couple of miles in diameter, gradually contracts, the elephants (to quote from Sir S. Baker's graphic description) “at first attempt to retreat, until they become assured of their hopeless position; they at length become desperate, being maddened by fear, and panic-stricken by the wild shouts of the thousands who have surrounded them. At length, half-suffocated by the dense smoke, and terrified by the close approach of the roaring flames, the unfortunate animals charge recklessly through the fire, burnt and blinded, to be ruthlessly speared by the bloodthirsty crowd awaiting this last stampede.” As many as a hundred, or even more, may be, it is said, killed by this method on a single occasion.

Hamstringing. The intrepid Hamram Arabs of the Sudan slay the elephant in the same manner as the rhinoceros, by hamstringing it with a long two-edged sword. Three or four mounted hunters, singling out a tusker and separating it from its fellows, follow it until, tired out, the animal faces its pursuers, and prepares to charge. Directly it does so, the hunter who is the object of the charge puts his horse to a gallop, and is closely followed by the elephant. Thereupon, two of his companions follow at their best pace behind; and as soon as they come up with the fleeing animal, one seizes the reins of the horse of his fellow, who immediately leaps to the ground, and with one blow of his huge sword divides the tendon of the elephant's leg a short distance above the heel. The ponderous beast is at once brought to a standstill, and is at the mercy of its aggressors.

A somewhat similar method, according to Mr. Selous, was formerly practised in Mashonaland, only there the hunters went on foot, and their weapon was a broad-bladed axe; with this they crept up behind a sleeping elephant, and severed the back tendon of the leg in the same manner as above.

Weighted Spears. Other tribes in the same district employ a heavily-weighted spear, which is plunged into the animal's back by a hunter seated on a bough overhanging one of the most frequented pathways. On receiving the weapon, the elephant of course immediately rushes off, and the weight of the spear, aided by blows from boughs, soon so enlarges the wound, that the animal quickly sinks to the ground, exhausted from loss of blood. In other districts, as in parts of Equatoria, the weighted spear is suspended from a horizontal bar fixed between two tiers or poles. The spear or knife, according to Major Casati's description, is kept in position "by a cord, which is held down by a stake that is directed horizontally towards the middle of the trap; and by another which, at a convenient angle, is interposed between this and the end. The animal, striking with his feet, loosens the contrivance, which then falls violently; the knife wounds the animal with singular exactness in the spot where the brain unites with the nape of the neck. The blow falls like a thunder-clap; and if the trap is well made, the elephant struggles and dies."

By Europeans. The European sportsman kills the African elephant either by lying in wait at one of its drinking-places, or by attacking it in the open, either on foot or on horseback. At the present day, however, most or all of the elephants remaining in South-Eastern Africa are restricted to districts infested by the tsetse fly, where horses cannot exist, and the pursuit must consequently be undertaken on foot. Owing to the conformation of its skull, the front-shot, so frequently employed in the case of the Indian elephant, is ineffectual with the African species, and there are but two spots where a bullet may be expected to prove fatal; one of these being in the head behind the eye, and the other in the shoulder immediately behind the flap of the ear.

Stories of hairbreadth escapes from charges of the African elephant may be reckoned by the score, but we cannot refrain from quoting one narrated by Mr. Selous. That gentleman had wounded a female elephant at a time when his horse was thoroughly knocked up. On a sudden the beast turned to charge, before there was time to get a fair start. "Digging the spurs into my horse's ribs," writes the

narrator, "I did my best to get him away, but he was so thoroughly done that, instead of springing forwards, which was what the emergency required, he only started at a walk, and was just breaking into a canter when the elephant was upon us. I heard two short sharp screams above my head, and had just time to think it was all over with me, when, horse and all, I was dashed to the ground. For a few seconds I was half stunned by the violence of the shock, and the first thing I became aware of was a very strong smell of elephant. At the same instant I felt that I was still unhurt, and that, though in an unpleasant predicament, I had still a chance for life. I was, however, pressed down on the ground in such a way that I could not extricate my head. At last, with a violent effort, I wrenched myself loose, and threw my body over sideways so that I rested on my hands. As I did so I saw the hind-legs of the elephant standing like two pillars before me, and at once grasped the situation. She was on her knees, with her head and tusks in the ground, and I had been pressed down under her chest, but luckily behind her fore-legs. Dragging myself from under her, I regained my feet, and made a hasty retreat, having had rather more than enough of elephants for the time being."

As Food. Although highly appreciated by the natives, the flesh of the African elephant is coarse and rank in the extreme; portions of the trunk, although tough, are however said to be fairly good. Baked elephant's foot, cooked in the skin, and scooped out like a Stilton cheese, was formerly considered a dainty, but most of those who have tasted it of late years express their disapproval.

EXTINCT ELEPHANTS.

In addition to the mammoth, there are a number of other extinct elephants more or less closely allied to the living species, together with others of a totally different type. The whole of these are confined to Europe, Asia, and North Africa; the only American species being the Columbian elephant alluded to above.

Sutledje Elephant. The earliest of the species allied to the living Indian one is the Sutledje elephant (*E. hysudricus*) from the Pliocene rocks of the Siwalik Hills at the foot of the Himalaya. This species had the plates of the molar teeth very thin, but less tall and less numerous than in the Indian elephant. Its skull resembled that of the latter; and it is quite possible that in this species we may have the ancestor of both the Indian elephant and the mammoth.

The Narbada Elephant. The Pleistocene deposits of the Narbada Valley in India yield the remains of a very large elephant (*E. namadicus*), which takes its name from the locality in question. In the structure of its molar teeth, one of which is represented on p. 528, this species connects the Indian elephant with the one following. It is characterised by its very short skull, which has an enormous ridge running transversely across the forehead, and some of the bones of this species appear to indicate animals of 13 or 14 feet in height, since they are vastly longer than those of the Calcutta skeleton of the Indian elephant mentioned on p. 529. This species ranged eastwards into Japan.

Straight-Tusked Elephant. The straight-tusked elephant (*E. antiquus*) from the Pleistocene deposits of Europe, differs from the mammoth by its smaller and comparatively straight tusks, and the fewer and wider plates in the molar teeth, of which the crowns are generally narrow. Indeed, some of these teeth come so close to those of the African elephant as to indicate the near relationship between that species and the fossil one. The straight-tusked elephant ranged from Yorkshire to Algeria.

Pigmy Elephants. We are so accustomed to regard elephants as the giants of creation, that it is at first difficult to believe in the existence of a species not exceeding 3 feet in height. Yet pigmy elephants (*E. mnaidriensis* and *E. melitensis*), of which the smallest is considered to have reached only those diminutive proportions, were abundant in Malta and some of the neighbouring islands during the Pleistocene period; their remains occurring in the caverns and the rock-fissures. These elephants, many of which were not larger than a donkey, appear to have been closely related to the living African species, and were doubtless dwarfed in size from the small area of the islands they inhabited.

Southern Elephant. The southern elephant (*E. meridionalis*), from the upper Pliocene rocks of Italy and France, and also found in the forest-bed on the coast of Norfolk, and at Dewlish in Dorsetshire, was the largest of all the European species, its height at the shoulder having been estimated at upwards of 15 feet. The molar teeth of this giant have very wide crowns, with the plates very broad and widely separated from one another, and somewhat less numerous than in the African species. The flat-headed elephant (*E. planifrons*) from the Pliocene rocks of the Siwalik Hills, was an allied Indian species, distinguished from all the other true elephants by the circumstance that two of the milk-molar teeth were vertically replaced by premolars; this elephant thus having eight more teeth than any other species, and thereby showing evident traces of closer kinship with the mastodons.

Stegodont Elephants. The so-called stegodont elephants (so named from the roof-like form assumed by the ridges of their molar teeth) of India and other parts of South-Eastern Asia, form an exceedingly interesting group, which almost completely connects the true elephants with the under-mentioned mastodons. A molar tooth of one of the species of this group is represented on p. 526; this tooth, as already mentioned, being characterised by the small number of its ridges (in this instance six), which are very low and wide, with the shallow intervening valleys devoid of cement. In other species of the group the ridges were, however, somewhat more numerous and more elevated, while the valleys were partially filled with cement; and these serve to connect the figured Clift's elephant with species like the southern elephant. It will be observed that the tooth of Clift's elephant, represented on p. 526, agrees with existing species in having the transverse ridges undivided by any distinct longitudinal cleft. One of the stegodont elephants (*E. ganesa*) is remarkable for the enormous size of its tusks, those in a skull from the Siwalik Hills, preserved in the British Museum, measuring upwards of 12 feet 9 inches in length, with a maximum girth of 26 inches. Representatives of this group also occur in China, Japan, and Java.

THE MASTODONS.

Genus *Mastodon*.

The above-mentioned stegodont elephants so closely connect the genus *Elephas* with the extinct animals known as mastodons, that the division between the two genera is a somewhat arbitrary one. It is noteworthy that the species of mastodon most nearly related to the stegodont elephants are found in the same regions as



THE LAST LEFT UPPER MOLAR TEETH OF TWO SPECIES OF INDIAN MASTODONS.

The upper figure ($\frac{2}{3}$ nat. size) belongs to *M. latidens*; and the lower ($\frac{1}{2}$ nat. size) to *M. caulleyi*. In the specimen represented in the upper figure the first two ridges are partially worn, while in the lower one they are intact.

the latter, from which we may infer that the evolution of the elephants from the mastodons took place in South-Eastern Asia.

Mastodons are distinguished by their molar teeth, as shown in the accompanying figure and the one on p. 557, having comparatively few transverse ridges, which are low, and more or less completely divided by a longitudinal cleft into inner and outer columns. These ridges are separated by valleys in which there is little or no cement; and when worn down by use they exhibit more or less trefoil-shaped surfaces of ivory, quite different from the elongated ellipses formed in those of the

true elephants. In the third, fourth, and fifth molar teeth of the stegodont elephants, the number of transverse ridges is usually more than six, but in the mastodons it is generally either four (as shown in the figure below) or three, although occasionally there may be as many as five. Moreover, the sixth or last molar generally has only four or five such ridges, in place of from nine to eleven found in the stegodont elephants. In all these respects the mastodons exhibit a less specialised type of structure than that existing in the elephants, and thereby approximate to ordinary Ungulates. This simpler dental structure is further evidenced by the



TWO SPECIMENS OF MOLAR TEETH OF INDIAN MASTODONS (nat size).

Both teeth are unworn; and while the upper belongs to *M. cautleyi*, the lower belongs to *M. perimensis*.

circumstance that portions of three molar teeth may be in use at the same time, whereas in elephants only two such teeth are ever present contemporaneously on one side of the jaw. Then, again, nearly all the mastodons had premolar teeth vertically replacing their milk-molars, in the same manner as in other Ungulates.

Another peculiarity of some, although by no means all mastodons, is the presence of a pair of larger or smaller tusks in the lower as well as in the upper jaw; the extremity of the lower jaw in such species being prolonged into a spout-like projection.

There are a larger number of species of mastodon, ranging over a great part of Europe, South-Eastern Asia, and the whole of America; the earliest representatives of the group occurring in Europe in the middle division of the Miocene period. And it is noteworthy that all these earlier species had but three transverse ridges in the third, fourth, and fifth molar teeth, thus approximating the closest to other Ungulates.

One of the best known species is the North American mastodon (*Mastodon americanus*), of which teeth and bones, and sometimes entire skeletons, are found in enormous quantities in the peat and lacustrine deposits of Ohio and Missouri. This animal had enormous tusks in the upper jaw, but either none or mere rudiments in the lower jaw; and its molar teeth, with the exception of the last, had only three ridges, in which the longitudinal cleft was but slightly marked. Some of the teeth are so fresh-looking as to appear almost like those of recent elephants, and it seems that this mastodon lived on till within the human period. In height the skeleton stood about 12 feet at the shoulder.

In the Old World mastodons disappeared at an earlier date, none being known to have survived the close of the Pliocene period. Remains of several species occur in the Miocene and Pliocene deposits of the Continent, while detached teeth are occasionally found in the shelly deposits on the coast of Essex, Suffolk, and Norfolk, locally known as crags. In Northern India there were an extraordinary number of species of these animals; and among these the broad-toothed mastodon (*M. latidens*), ranging from India through Burma to Borneo, is the one approaching most closely to the elephants. In some of these Indian mastodons, as in one of those from the English crags, the inner and outer columns of the ridges of the molar teeth are completely separated from one another, and are arranged somewhat alternately; and from the nipple-like form assumed by these columns in the species in question, the generic name of *Mastodon* takes its origin.

THE DINOHERE.

Family *DINOTHERIIDÆ*.

A remarkable animal known as the dinothere (*Dinotherium giganteum*), the remains of which are found in the Miocene and Pliocene rocks of Europe and India, presents us with the most generalised type of Proboscidian yet known. In this animal, which must have been fully as large as an elephant, there appear to have been no upper tusks, but the extremity of the lower jaw was sharply bent down, and terminated in a pair of very massive and somewhat curved tusks. As in the elephants and mastodons, there were no canine teeth, and the cheek-teeth carried transverse ridges. The whole of the permanent series of cheek-teeth were, however, in use at the same time, as in ordinary Ungulates, and their ridges were low and simple, and either two or three in number. Very little else is known of the skeleton of this strange animal, and there have been many conjectures as to the use of the downwardly-curved lower tusks. Possibly the creature may have been more or less aquatic in its habits, and have used these weapons to drag up water-plants from the beds and banks of lakes or rivers. On the other hand, it may

equally well have been purely terrestrial, and have used its tusks, after the manner of the African elephant, in turning up the soil in search of roots and tubers.

With this animal, an illustration of whose skull is given below, our present knowledge of the Proboscidiæ and their ancestors comes to an abrupt termination.

THE SHORT-FOOTED UNGULATES.

SUBORDER Amblypoda.

There are several extinct groups of Ungulates differing so markedly from the living forms that they cannot be included in any of the groups into which the latter are divided, and consequently have to be classed in groups by themselves.

The name of Short-footed Ungulates is applied to one of these groups which is confined to the Eocene division of the Tertiary period, and is more developed in the United States than in Europe. It is represented in both continents by the coryphodons of the lower and middle Eocene beds, and in America by the Uintatheres of the upper Eocene. In these animals the feet, as shown in the figure on p. 152, were very short, and were each provided with five toes, the mode of walking being partly plantigrade. The molar teeth were of the type as shown in figure on the next page, having short crowns and the ridges arranged in a



SKULL OF DINTHERE (greatly reduced).

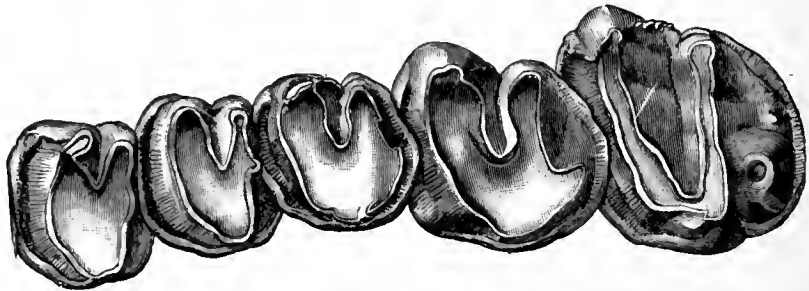
V-shape in those of the upper jaw. The two bones in the fore-arm, as well as those in the lower leg, were quite distinct from one another.

The coryphodons were animals which may be compared in size to a bear, and possessed the full typical number of forty-four teeth, with the tusks (canines) well developed. They had no horn-like processes to the skull. In the fore-feet (see p. 152) only the terminal bones of the toes touched the ground, but in the hind ones the whole sole was applied to the ground, in the same manner as in a bear.

The American Uintatheres, on the other hand, were much larger animals, rivalling the Indian rhinoceros in bulk. Their skulls were provided with three pairs of bony processes, which during life were probably covered with horn; and the upper tusks were developed into enormous sabre-like teeth, protected by a descending flange on each side of the front of the lower jaw. There were no incisor teeth in the upper jaw, and the first premolar tooth was wanting in both jaws,

the total number of teeth being thirty-four. Both feet resembled the fore-feet of the coryphodons in general structure, and the bones of the limbs approximate to those of the elephants. The brain was marvellously small in proportion to the size of the skull and body, indicating that these animals must have been of a stupid and sluggish nature. The uintatheres are evidently a specialised development of the coryphodon stock, which died out with the appearance of the former.

Professor Cope, who considered that the hind-feet of the coryphodon were of the same type as the front pair, remarks that the movements of this animal "doubtless resembled those of the elephant in its shuffling and ambling gait, and may have been even more awkward from the inflexibility of the ankle. But in compensation for the probable lack of speed, these animals were most formidably armed with tusks. These weapons, particularly those of the upper jaw, were more formidable than those of the Carnivora, and generally more robust." In length, one of the American species was probably about 6 feet.



THE LEFT UPPER CHEEK-TEETH OF THE UINTATHERE ($\frac{2}{3}$ nat. size). (From Marsh.)

Although the uintatheres have only been known to science for rather more than twenty years, their skulls and bones long ago attracted the attention of the wandering Indians, and such squatters and trappers whose business led them into the district known as the "Bad Lands." On returning to civilisation, these pioneers brought news of the skeletons of marvellous monsters staring at them from the rockbound cañons; and at length these attracted the attention of the late Professor Leidy, to whom belongs the honour of having made known these strange creatures to a wondering world. Describing the region where these remains occur, Professor Marsh writes that bare, treeless wastes of naked stone rise here and there into terraced ledges and strange tower-like prominences, or sink into hollows where the water gathers in salt or bitter pools. Under the cloudless sky, and in the clear, dry atmosphere, the extraordinary colouring of the rocks forms, perhaps, the most striking feature of the weird landscape.

THE MACRAUCHENIA AND ITS ALLIES.

SUBORDER Litopterna.

South America was the home of numerous extinct Ungulates, quite unlike those found in any other part of the world, and which, while allied in some respects to the Odd-toed group, appear to represent three distinct suborders. Among these,

not the least remarkable was the so-called *Macrauchenia*, the typical representative of the suborder Litopterna. The members of this group are characterised by having cheek-teeth approximating in structure to those of the European palæotheres (p. 515), the upper molars having their outer wall divided into two distinct lobes. Although the long toes were arranged in the same manner as in the Odd-toed group of Ungulates, and were never more than three in number, the structure of both the wrist and ankle-joints were different. Thus, in place of the component bones of these joints alternating with one another, they were arranged directly one above another, after the so-called linear type characterising the modern elephants (see p. 528). The huckle-bone, or astragalus, of the ankle resembles that of the Odd-toed group in being grooved superiorly; but the heel-bone, or calcaneum, differed in having a small surface for the articulation of the fibula, or smaller bone of the leg, as in the Even-toed group. The long vertebrae of the neck, although showing the same flat terminal ends characterising the allied extinct South American groups, are peculiar in regard to the position of the canal for the great artery of the neck, and in this respect agree with the camels and llamas alone among living Ungulates. The thigh-bone, or femur, has a small third trochanter representing the larger one characteristic of the Odd-toed group. In build, the members of the present group were tall, slender Ungulates, with long legs, feet, and neck; and thus very different in appearance from the under-mentioned toxodonts, which were short-limbed, short-necked, and heavily-built creatures.

The Litopterna are divisible into two families, of which the first (*Macraucheniiidae*) is represented by the macrauchenia and certain allied forms, and is characterised by the presence of forty-four teeth, forming an uninterrupted series in the jaws. *Macrauchenia* itself, which was discovered by Darwin in the superficial deposits of Patagonia, was an animal somewhat larger than a horse, presenting the remarkable peculiarity of having the aperture of the nostrils in the skull situated in the middle of the forehead; although during life it is probable that they terminated in a short trunk. In the lower, or Miocene Tertiaries of Patagonia the family was represented by smaller and less specialised forms (such as *Oxyodontotherium*), in which the nostrils were more normal in position, and the crowns of the molar teeth lower and simpler.

In the second family, or *Proterotheriidae*, represented principally in the lower Patagonian Tertiary deposits, the teeth were reduced in number, and formed an interrupted series, a pair in both the upper and lower jaw being much longer than the rest. In these proterotheres the molar teeth had a considerable resemblance to those of the palæotheres; but the feet were of the general type of those of the three-toed horses, or hipparions, and in some cases it appears that only the middle toe was functionally developed.

THE ASTRAPOTHERES AND THEIR KIN.

SUBORDER *Astrapotheria*.

In this second South American group, represented only in the Miocene deposits of Patagonia, all the species are of large size, and possess rooted cheek-teeth of a

rhinocerotie type, and lacking the marked curvature of the crown characterising those of the toxodonts. The vertebræ of the neck are comparatively short, with flattened articular surfaces, and the lateral canal piercing the transverse process in the ordinary manner. The wrist and ankle-joints were probably of the linear type; the calcaneum articulated largely with the fibula; and the astragalus was quite flat, and furnished with a large head for articulation with the navicular bone. The femur, when known, had a large third trochanter.

In both families the upper cheek-teeth were of a rhinocerotie type of structure, having a continuous external wall undivided into lobes. The group is widely distinguished from the Amblypoda by the structure of the cheek-teeth, and not improbably by the number of digits having been three in place of five. It is, however, decidedly the most generalised of the three South American extinct suborders, as is especially shown by the flattened astragalus. The remarkable



PALATE OF THE HOMALODONTOTHERE, WANTING SOME OF THE FRONT TEETH (much reduced).

similarity of the molars of *Astrapotherium* to those of rhinoceroses must probably be considered as largely due to parallelism, since the structure of the ankle in the allied *Homalodontotherium* indicates that the group diverged from the common ancestor before the modern Odd-toed Ungulates had acquired their characteristic foot-structure.

In the homalodontotheres, representing the first family, the teeth, as shown in the accompanying figure, comprise the full number of $i\frac{3}{3}$, $c\frac{1}{1}$, $p\frac{4}{4}$, $m\frac{3}{3}$, and have no gap; the canines being rooted and of relatively small size, and the molars with comparatively short crowns. The upper pre-

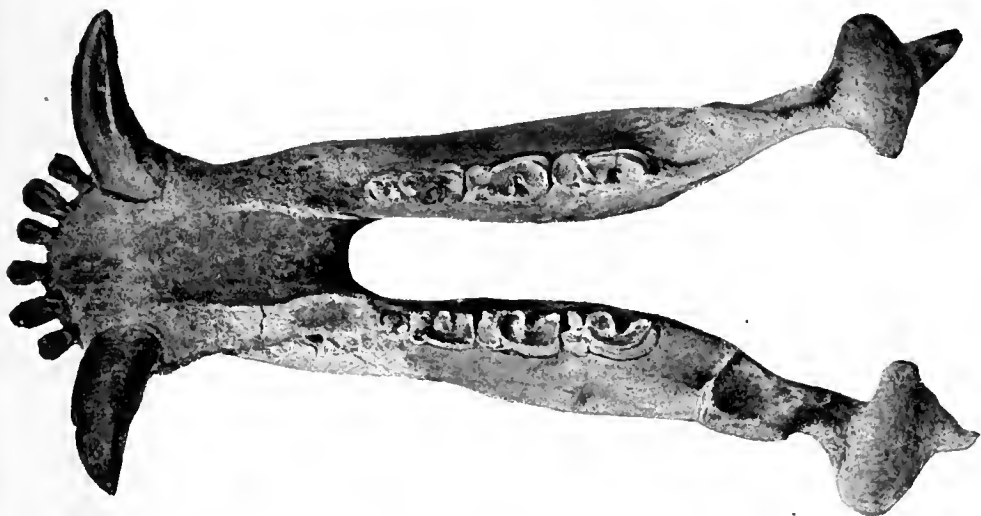
molars are nearly as complex as the molars; and the third upper molar is not very markedly different from the two preceding teeth. The lower molars are in the form of double crescents, of which the anterior develops a loop like that found in the horses. It is stated that the toes terminated in claws. The one known species of the genus was an animal of the approximate size of the Sumatran rhinoceros.

The gigantic astrapothere, which alone represents the second family, differs from the last genus by the more specialised and reduced dentition, the enlarged teeth of each jaw taking the form of permanently growing tusks, which are worn

in nearly the same manner as those of the pigs. The molars are more distinctly rhinocerotie in structure, those of the upper jaw having taller crowns than those of the homalodontothere, with a large posterior valley, and a well-developed projection in the middle valley. The last of the series has the same triangular form as in the majority of species of rhinoceros; while the premolars are simpler than the molars. In the lower jaw the molars form nearly simple crescents, very similar to those of rhinoceroses, but the hinder crescent of the third of the series is more elongated.

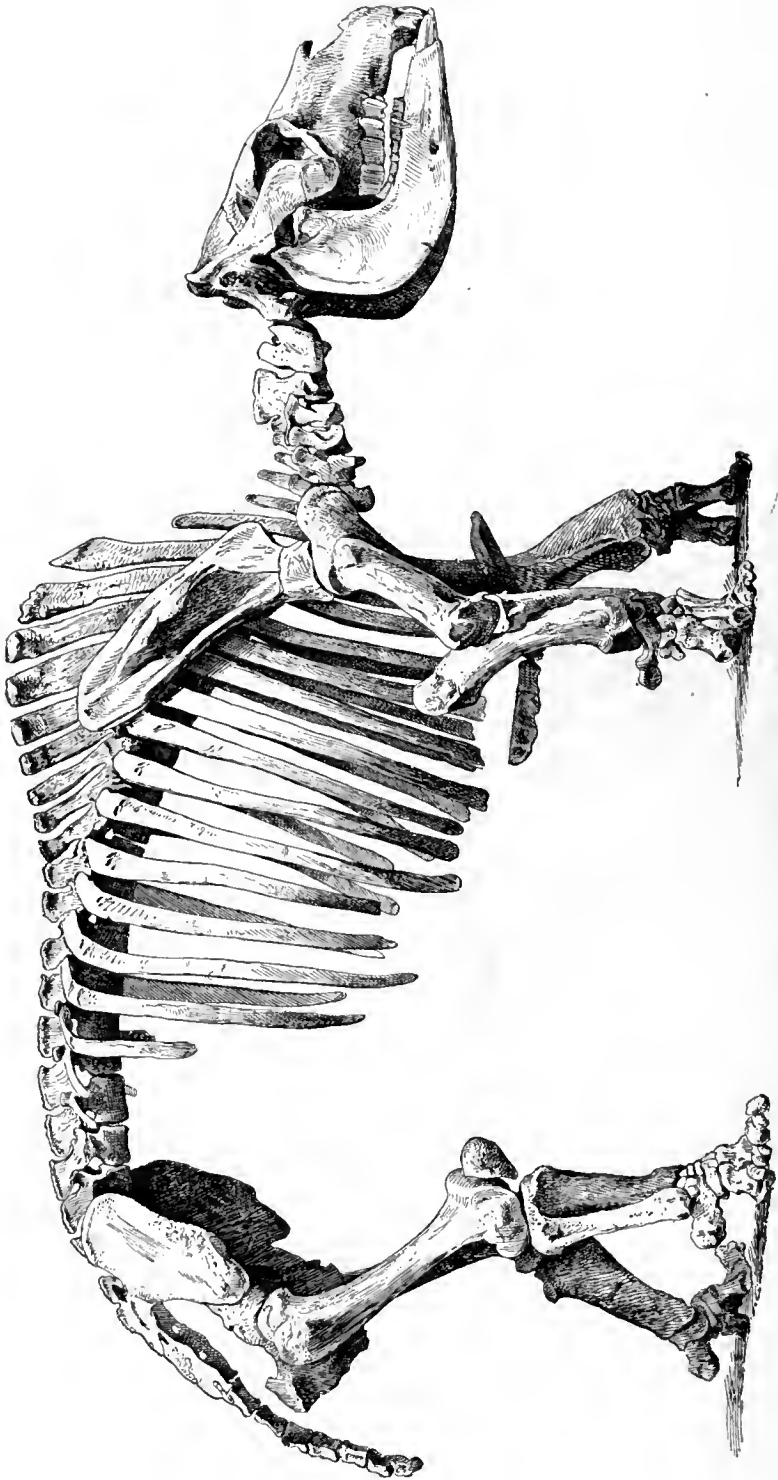
The dentition may apparently be represented by the formula, $i \frac{3}{3}, c \frac{0}{1}, p \frac{2}{1}, m \frac{3}{3}$; the premolars being separated from the incisors or canines by a long gap.

The front of the apex of the upper tusk is worn to an oblique facet by the attrition of the lower canine. In the lower jaw the tusk is considerably smaller



LOWER JAW OF THE ASTRAPOTHERE (much reduced).

than in the upper jaw, but is still triangular in section, although with the sharp edge in front. The inner surface is concave anteriorly and convex posteriorly; while the outer one is wholly convex, and passes imperceptibly into the small hinder surface. The extremity of the latter is worn into a long oblique facet, in the same manner as in the corresponding tooth of a peccary. The six lower incisors are inclined forwards, and arranged in a circle so as to fill up the interval between the tusks. Their crowns, which, vary in shape in the two species of the genus, are short and spatulate, with the upper surface slightly concave, and the lower one convex; a deep longitudinal groove traversing the middle of each of these two surfaces, and uniting in a notch in the middle of the unworn crown. The lower cheek-teeth call for no special remark, as they are very similar to those of the rhinoceroses. In the lower jaw, the tusks certainly correspond to the canines; and it would appear at first sight that the same would hold good with those of the upper jaw, but from the analogy of the proterothere it is more probable that the latter really belong to the incisor series.



SKELETON OF TOXODON (greatly reduced).

THE TOXODONTS.

SUBORDER *Toxodontia*.

The toxodonts may be defined as a group of more or less aberrant Ungulates with tall-crowned and curved cheek-teeth, some or all of which grow from persistent pulps, either permanently or during life; while at least one pair of incisors in each jaw are rootless, and the third upper incisor, when present, is placed in the line of the cheek-teeth. The vertebrae of the neck are short, with flattened articular faces to the bodies, and the vertebral artery piercing the transverse process in the ordinary manner. The wrist (when known) is of the alternating type, while the ankle-joint is formed on the linear plan. The astragalus is slightly grooved on its superior face, and inferiorly is like that of the Odd-toed group, having no head for the navicular; but the calcaneum, which is truncated inferiorly, has a large articular surface for the fibula, as in the Even-toed section. The number of toes varies from five to three; the middle one being larger than either of the others, and symmetrical in itself. The femur may or may not have a third trochanter. The number of trunk-vertebrae in the typical genus is twenty, or intermediate between that of the Even and Odd-toed groups. In form the cheek-teeth of the less specialised forms approximate to the Odd-toed plan of structure; and in all the genera the enamel is most developed on, or even confined to, the outer sides of the cheek-teeth, although there may be vertical bands on some of the other surfaces. More specialised in the structure of the feet and teeth than the last group, phylogenetically the toxodonts may apparently be regarded as related to the Odd-toed Ungulates, but as retaining certain features now common to the Even-toed group, which have probably been inherited from common ancestors.

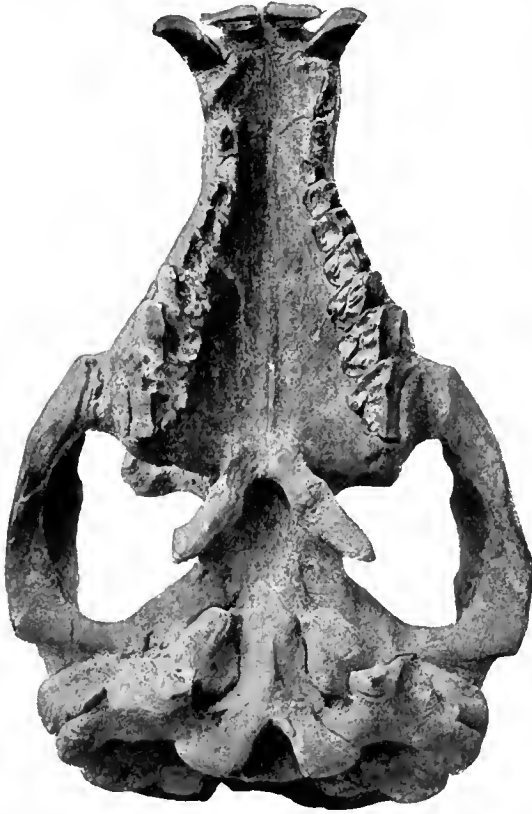
While, as aforesaid, the more generalised members of the suborder approximate in the structure of their teeth and feet to the Odd-toed group, the specialised forms assume a more or less Rodent-like type of dentition and limb-structure, which must probably be regarded as an instance of parallelism. It may be added that, from the retention of clavicles, these Rodent-like types must be derived from some form less specialised than toxodon, in which those bones have disappeared.

The toxodon was of the size of a large rhinoceros, and characterised by the long and curved crowns of its molar teeth, which continued to grow throughout life. There were only two pairs of incisor teeth and no tusks in the upper jaw, although in the lower jaw the full number of these teeth were developed. The feet were furnished with three toes.

This genus occurs in the superficial deposits of Argentina, but is replaced in the Miocene Tertiaries of Patagonia by certain allied forms known as nesodonts, which may be briefly defined as including toxodonts of medium or small size, in which the limbs, and probably also the neck, were relatively longer and more slender than in the typical genus; while all the teeth, with the exception of the second upper and third lower incisors developed roots in the adult state, and the upper molars were of a type approaching that of the Odd-toed group, with a distinct posterior valley, and the middle column forming a distinct lobe projecting

into the median valley. The second upper and the third lower incisors formed a pair of permanently growing tusks, which were, however, not fully developed till late in life.

Even more strange than the toxodon was the smaller tybothere of the same region, which represents a remarkable approximation in the characters of its skull and teeth to the Rodents. While the molars were not unlike those of the toxodon, the upper incisors were reduced to a single chisel-shaped pair, and there were no tusks in either jaw. The lower jaw carried one large pair of chisel-like incisor teeth, behind which there came a much smaller second pair. The tybothere differed from all living Ungulates, and thereby again resembled Rodents, in having collar-bones (clavicles).



UNDER-SURFACE OF SKULL OF THE NESODON ($\frac{1}{4}$ nat. size).

Finally, certain animals from the Eocene of North America, known as tillodonts, seem to combine the characters of the modern Ungulates, Carnivores, and Rodents, and thus almost defy classification.

The occurrence of all these remarkable Ungulates, so utterly different from those of all other parts of the world, indicates that during the Mioene period South America, with its many peculiar types of Edentates, must have been completely cut off from the northern half of the continent. During the

later Pleistocene period, the two areas must, however, have become connected, since at that epoch we first meet with horses, deer, llamas, and other northern types in South America; while some southern forms obtained an entrance into North America.

CHAPTER XXVIII.

MANATIS AND DUGONGS,—Order SIRENIA.

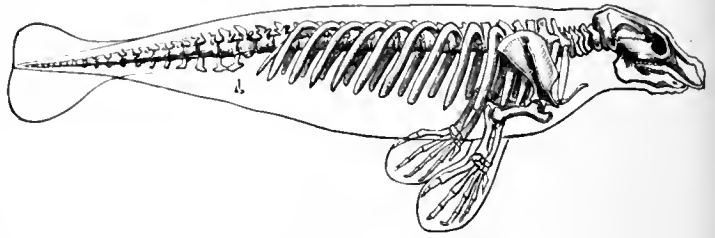
THE purely aquatic mammals known as manatis and dugongs, together with the northern sea-cow, which has become extinct within the last century and a half, constitute an order by themselves, and may be collectively known as Sirenians. Although they are as well fitted for an aquatic life as the Cetaceans, these animals have no sort of relationship with the members of that order, and have evidently been derived quite independently from terrestrial mammals. Such resemblances as do exist between Sirenians and Cetaceans are entirely of an adaptive nature, and have been produced merely by the two groups of animals leading a somewhat similar mode of life.

Characteristics. Although the existing Sirenians resemble the Cetaceans in having their fore-limbs converted into flippers, and having lost all traces of the hind-limbs, while the tail is converted into a horizontally-expanded rudder-like organ, comparable to the flukes of the whales and dolphins, their general conformation is very different. In the first place, although the body is somewhat cetacean-like, without any well-defined neck and with no distinction between trunk and tail, it is markedly depressed, instead of being more or less compressed from side to side. Then, again, the head departs but little from the ordinary mammalian type, being comparatively small in proportion to the body, with the summit rounded, and the nostrils, which are double, and capable of being closed at will by valve-like flaps, placed above the extremity of the abruptly-truncated muzzle. The back-fin, so commonly present in the Cetaceans, is totally wanting. In the flippers, although the whole of the toes are enclosed in a paddle-shaped mass of integument, traces of nails are still in some cases retained. The eyes are small, with imperfectly-developed lids, and the minute aperture of the ear is unprovided with any external conch. The mouth is small, with thick, fleshy lips, upon which grow a number of bristly hairs, which persist throughout life. The skin is thick, and either finely wrinkled or rugged and bark-like, sometimes with fine hairs thinly distributed upon it. The female has a single pair of teats placed on the breast. The teeth are very variable, being totally wanting in the northern sea-cow, while in the other two living genera they consist of incisors and cheek-teeth. The structure of the cheek-teeth is, however, very different in the two latter, and in one of them their number is much greater than among less aberrant mammals. The living forms have been recently discovered to possess rudimental milk-teeth, and in some extinct species such teeth were well developed. Certain extinct members of the order were, moreover, furnished with a complete set of teeth, comparable to those of ordinary mammals. All the recent

forms have horny plates on the palate and on the opposing surface of the lower jaw.

In the skeleton, the bones are distinguished by their solid and dense structure; this being especially noticeable in those of the skull and in the ribs. The skull is depressed, and has a more or less distinctly deflected beak-like snout, much flattened from side to side. It is further characterised by the very large size of the aperture of the cavity of the nose, which is somewhat pear-shaped, and placed relatively further back than usual. In the living forms the nasal bones were either rudimentary or totally absent; but in some of the fossil species they were better developed, and partially roofed over the nasal cavity in the ordinary manner. This abortion of the nasal bones in both the Sirenians and Cetaceans is doubtless due to the necessity for a large nasal aperture in the skull, owing to the peculiarities in the respiration of these animals. The vertebræ are peculiar in that during

the young state they do not show separate plate-like ossifications at each end of their bodies, like those developed in other mammals. Rudiments of these so-called epiphyses have, however, been shown to



SKELETON OF MANATI.

exist in the extremely young state; and they were more fully developed in certain extinct forms. As in Cetaceans, none of the vertebræ in the hinder region of the trunk unite to form a sacrum; and it is evident that a solid immovable structure in this part of the backbone would be not only a serious disadvantage to a swimming animal, but likewise of no possible use to one which has no hind-limbs to support. Sirenians resemble Ungulates in having no collar-bones. In the fore-limb the upper bone, or humerus, is of considerable length, and differs from that of the Cetaceans in having distinct pulley-like surfaces at its lower end for the articulation of the bones of the fore-arm (radius and ulna), thus permitting of a certain amount of free motion at the elbow-joint. The two bones of the fore-arm are, however, generally united at the lower end. The number of the digits is five, and none of these contains more than the ordinary number of three joints, in addition to the metacarpus. None of the recent Sirenians shows any trace of the hind-limb, although the pelvis is represented by a pair of splint-like bones; but in some fossil forms there was a rudimentary thigh-bone, or femur.

There are several peculiarities connected with the soft internal parts; but it will suffice to mention here that the lungs are extremely long and narrow, extending beneath the backbone nearly as far back as the last rib. To permit of this backward extension, the midriff, or diaphragm, is placed very obliquely. The larger arteries of the body form peculiar net-like expansions in certain regions, which render the animals able to remain beneath the surface of the water for a longer period than would otherwise be possible, as partly oxygenated blood can be retained for some time in these structures before it is passed through the heart.

Mode of Life. Although the manatis and dugongs never leave the water, and are as well adapted for an aquatic life as the Cetaceans, yet they cannot swim in the rapid manner characteristic of many of the latter, and are never found inhabiting the open sea. On the contrary, they frequent shallow seas and bays, lagoons, estuaries, and large rivers. As regards their food, these animals are entirely herbivorous; browsing upon sea-weeds or other aquatic plants growing beneath the surface of the water. They are slow and sluggish in their movements, while in disposition they are harmless and inoffensive, and appear to be endowed with but a comparatively small amount of intelligence.

Both dugongs and manatis produce but a single offspring at a birth, which is attended with assiduous care by its parent. When suckling, the females raise their heads and breasts above the water, and exhibit the young clinging to them, and partially supported by their flippers; and there can be little doubt but that this habit has given origin to the legendary mermaid. In describing the dugong, Sir Emerson Tennent wrote as follows concerning this point:—"The rude approach to the human outline observed in the shape of the head of this creature, and the attitude of the mother when suckling her young, clasping it to her breast with one flipper, while swimming with the other, holding the heads of both above water; and when disturbed, suddenly diving and displaying her fish-like tail,—these, together with her habitual demonstrations of strong maternal affection, probably gave rise to the fable of the mermaid; and thus that earliest invention of mythical physiology may be traced to the Arab seamen and the Greeks, who had watched the movements of the dugong in the waters of Manaar. Megasthenes records the existence of a creature in the ocean near Taprobane [Ceylon], with the aspect of a woman; and Ælian, adopting and enlarging upon his information, peoples the seas of Ceylon with fishes having the heads of lions, panthers, and rams, and, stranger still, Cetaceans in the form of satyrs. Statements such as these must have had their origin in the hairs which are set round the mouth of the dugong, somewhat resembling a beard, which Ælian and Megasthenes both particularise from their resemblance to the hairs of a woman." The belief in the existence of mermaids was firmly credited by the early Portugese and Dutch voyagers to the East.

Distribution. The living members of the order, which generally associate in small herds, frequent the coasts and larger rivers on both sides of the Atlantic, and also those of the Red Sea, the Indian Ocean, parts of the Bay of Bengal, and Australia. The northern sea-cow was, however, an inhabitant of the cold regions of Behring Sea; and during the Tertiary period Sirenians were distributed over the greater part of the globe. The group is, therefore, evidently a waning one. From their herbivorous habits and the structure of their molar teeth the suggestion naturally arises that the Sirenians are connected with the Ungulates; and the resemblances of their teeth are nearer to the Even-toed than to the Odd-toed section of that order. The retention of five toes by the Sirenians seems, however, to indicate that if they are really connected with the Ungulates, they must have diverged from that group at a very early period of its existence.

Classification. It has been very generally considered that each of the three genera of Sirenians that have existed during the historic period is entitled to constitute a family by itself. The whole are, however, so nearly allied,

and are so closely connected by fossil forms, that it seems preferable to follow Mr. Blanford in regarding them as members of a single family—the *Halicoridae*.

THE MANATIS.

Genus *Manatus*.

The manatis—so named from the hand-like use of the flippers when nursing the young—are characterised by the nostrils being situated at the apex of the



AMERICAN MANATI ($\frac{1}{2}$ nat. size).

muzzle, by the rounded margin of the expanded tail, and the usual presence of three minute rudimentary nails on each of the flippers. In the skull, the beak and extremity of the lower jaw are comparatively small, and but very slightly bent downwards. The incisor teeth are rudimentary, being concealed beneath the horny plates of the mouth, and disappearing before the animal becomes adult. The cheek-teeth, of which eleven are developed on each side of the jaws, have squared crowns, with transverse ridges, thus presenting some resemblance to the lower teeth of the tapir. Generally there are seldom more than six of these teeth in use at the same time on one side of each jaw; the front ones falling out before those further back

have come into use. In the skeleton the manatis present the remarkable peculiarity of having only six vertebræ in the neck; and are thereby almost unique among mammals.

Manatis, when full grown, attain a length of about 8 feet. Their dark, greyish coloured skin is marked by a number of fine wrinkles; and, at least in the young condition, is covered with a number of very fine, sparsely-distributed hairs.

One of the most peculiar features connected with the manatis is to be found in the conformation of the mouth. On this point the late Professor Garrod observes that "the upper lip is prehensile; in other words, the animal is able, by its unaided means, to introduce food placed before it into the mouth without the assistance of the comparatively insignificant lower lip." The front of the muzzle of the manati is of a triangular form, with the apex, in which are situated the nostrils, upwards. The lower border of this triangle is bounded by two rounded fleshy pads, forming the angles of the upper lip. These lip-pads can be either approximated to one another, or widely separated, at the will of their owner. "When the animal," writes Professor Garrod, "is on the point of seizing, say a leaf of lettuce, the pads are diverged transversely in such a way as to make the median gap of considerable breadth. Directly the leaf is within grasp, the lip-pads are approximated, the leaf is firmly seized between their contiguous bristly surfaces, and then drawn inwards by a backward movement of the lower margin of the lip as a whole. The appearance produced by the movements of this peculiar organ is very much the same as that of the mouth in the silkworm and other caterpillars whilst devouring a leaf, the jaws in these insects diverging and converging laterally, in a very similar manner during mastication." In regard to the mechanism for closing the nostrils during submersion, the same writer adds that "these circular orifices have each a flap-valve, which forms the floor or inferior wall of the nasal tubes when the animal is breathing, but which rises and completely occludes it when closed."

Distribution and Number of Species. Manatis are found in the rivers and on the coasts of the two sides of the tropical portions of the Atlantic; but are mainly fluvial, ascending the larger rivers, such as the Amazon, almost to their sources. There appear to be three well-defined species, namely, the American manati (*M. americanus*), the African manati (*M. senegalensis*), readily distinguished from the former by the characters of the skull, and the nailless manati (*M. inunguis*), from the Amazon and Orinoco.

Habits. Owing to the constant persecution for the sake of their oil and hides, manatis have been of late years much diminished in numbers, and in most accessible districts they are now becoming comparatively scarce animals. Their general habits are those noticed under the head of the order; but some more minute observations, which have been gathered from captive specimens, may be noticed in detail. The first living manati brought to England was received in the Zoological Gardens early in August 1875, but did not long survive; and a second specimen was obtained in March 1889. A third lived in the Brighton Aquarium for upwards of sixteen months. All these animals were fed chiefly upon lettuce, although they would also eat other vegetables. The following observations were made by Professor Garrod on the one first acquired by the Zoological Society:—"Looking at the living animal generally, the most striking peculiarity was the

sluggishness of its movements, when crossing its pond there was none of the lateral movement of the body so characteristic of the seals. All flexions were up and down, the whole trunk bending a little in that direction, the base of the tail doing so freely at a clearly-marked transverse fold-line in that region. An opportunity occurred for seeing it out of water, when its pond was drained dry for a short time. From my observations on this occasion, it was perfectly evident that the manati is purely aquatic in habits, and that it never willingly quits the water. When on land, it seemed perfectly unable to advance or recede, the only movements it performed being that from its belly to its back, and *vice versâ*. The power of moving the slightly exerted elbow was considerable, whilst that of the wrist was small but apparent. It used its limbs much more freely than do the seals, sometimes employing the extreme margins of the paddles to assist in introducing food into its mouth, at others employing them in progression along the bottom of the pond, during which time the swimming tail could not be brought into play to any extent."

Beyond the fact that only a single young is produced at a time, there appears to be no accurate observations as to the breeding-habits of the manati; neither are we acquainted with the length of time these animals can remain submerged.

The flesh of the manati, which is very light in colour, is eaten by the natives of the Amazon region, and is compared by Bates to pork. The fat is reported, however, to have a disagreeable flavour.

THE DUGONG.

Genus *Halicore*.

The dugong, or as it should properly be termed, from its Malayan name, *duyong*, is a very different animal, both externally and as regards the structure of its skull and teeth, from the manati. Externally, it is characterised by the nostrils being situated on the upper part of the muzzle, by the tail being crescent-shaped and concave posteriorly, and by the total absence of any trace of nails on the flippers. The skull is characterised by the great thickness and massiveness of the beak and the extremity of the lower jaw, both of which are sharply bent down, so as to form almost a right angle with the long axis of the skull. The teeth grow throughout life; and in the adult state comprise a pair of incisors in the upper jaw, and five molars on each side of both jaws. In the females, the incisors are small and do not pierce the gum, but in the males they assume the form of rather large and nearly straight tusks, which are partially coated with enamel, and are directed downwards. The molars are cylindrical in form, the last in each jaw being more complex than the others, and looking as if it were composed of two cylinders joined together. These teeth have no enamel; and, as in the manati, some of the front ones are shed before those behind come into use. There can be little doubt but that the molar teeth of the dugong present one step in the process of degeneration which has resulted in their complete disappearance in the northern sea-cow. In colour, the dugong is either uniformly bluish grey, or the under-parts may have a more or less distinct whitish tinge. The normal length attained by these animals varies from

5 to 7 feet, but they occasionally measure from 8 to 9 feet. In a specimen of 8½ feet in length, the maximum girth was 6 feet.

Distribution. Dugongs are found on the shores of the Indian Ocean, for about fifteen degrees on each side of the Equator, from East Africa to Australia, and likewise around the Red Sea. They are not uncommon on parts of the coasts of Ceylon, and around the Andaman and Nicobar Islands. Although it has been considered that the dugong of the Red Sea, and also the one found on the



THE DUGONG ($\frac{1}{3}$ nat. size).

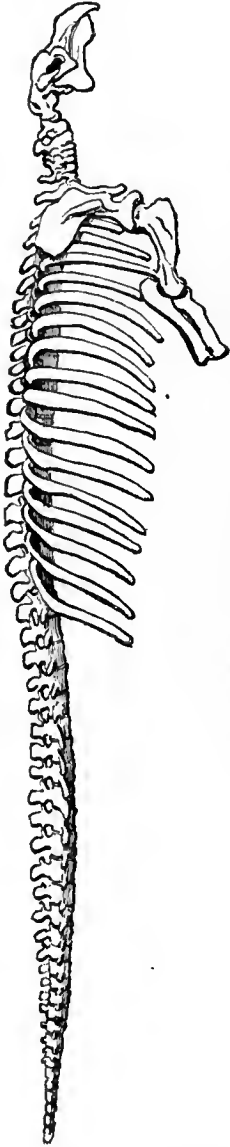
Australian coasts, are specifically distinct from the Indian dugong (*Halicore dugong*), this is extremely doubtful.

Habits. Except that it is a marine animal, never ascending rivers, and feeding chiefly upon seaweed, the dugong appears to be very similar in its general mode of life to the manati. Formerly, these animals are reported to have been found in large herds, comprising several hundreds of individuals, and to have been so fearless of man that they would allow themselves to be touched with the hand. Now, however, they are only to be met with in twos or threes, or small parties; and they have become very shy and wary. Dugong-fishing is practised as a regular industry on the Australian coast; the clear, limpid oil obtained from these animals bearing a high value. The flesh of the dugong is described as being of excellent quality and flavour, by those who have tried it. The natives of Torres Straits, according to the late Professor Moseley, are in the habit of using dugong skulls and ribs for the decoration of their huts.

THE NORTHERN SEA-COW.

Genus *Rhytina*.

On his return in 1741 from a voyage of discovery to Alaska, the navigator Behring had the misfortune to be shipwrecked on the island which now bears his name; that island, together with the adjacent Copper Island, constituting the Commander group, which lie in Behring Sea, at a distance of about one hundred miles from the coast of Kamshatka. At the time of their involuntary sojourn, Behring and his companions found the shores of these islands inhabited by a hitherto unknown animal, evidently allied to the manati, but of much greater dimensions. This creature was the northern sea-cow (*Rhytina stelleri*), then found in vast numbers on the islands in question, but which within a period of thirty years from that date appears to have been totally exterminated by the hand of man. Indeed, had it not been for the fortunate circumstance that Behring was accompanied by the naturalist Steller, we should probably never even have heard of the very existence of this animal, except through some slight mention in the accounts of certain contemporary voyagers. Unfortunately, no skins and only some imperfect skeletons of the animal appear to have been preserved by the survivors of Behring's party; but of late years, a considerable number of more or less imperfect skeletons have been reclaimed from the frozen soil of the Commander Islands.



SKELETON OF THE NORTHERN SEA-COW.

This gigantic Sirenian differed from all its allies in having no teeth, the functions of which were performed by the horny plates covering the palate and opposing surface of the lower jaw. The head was very small in proportion to the body; and the extremities of the jaws were somewhat bent downwards. The tail was forked, after the manner of that of the dugong. The flippers were very small and truncated, and were covered with bristly hairs. Steller expressly states that there were no bones in the hand; and it is certain that none have hitherto been found. The skin was naked, and covered with a thick, rugged epidermis, which was compared to the bark of a tree; in places this epidermis was an inch in thickness, and so tough that it required the use of an axe to cut it. The skin, according to Steller's description, was dark brown in colour, sometimes marked with streaks or spots of white. A drawing of the animal left by Waxell, the navigator of Behring's party, represents it, however, as being marked with alternate dark and light transverse stripes. The skeleton herewith figured measures $19\frac{1}{2}$ feet in length, which would indicate a length of about 20 feet in the

living state; but Steller states that the animal sometimes attained a length of from 25 to 30 feet. The girth of the body was 19 or 20 feet; and the estimated weight 8000 lbs.

Distribution and Habits. With the exception of a single rib from Altu, no remains of the northern sea-cow have been obtained elsewhere than on Barren and Copper Islands. It is, however, almost impossible to believe that such a large animal could always have had such a restricted distribution; and it is hence probable that, when discovered, this Sirenian was already on the wane, and that the Commander Islands were its last resorts from a more extended distribution. Not the least remarkable circumstance connected with this animal is that, although closely allied to the typical dugong, it should have inhabited such a cold and northerly region.

At the time of its discovery by Behring's party, the northern sea-cow was abundant in the bays and river-mouths of the Commander Islands, where it lived in herds of considerable size. It fed chiefly on seaweeds, and more especially on the tangle which grows so abundantly in the northern seas. It was described as a stupid, sluggish, and comparatively helpless animal, which was unable to dive, and was not unfrequently washed ashore by the waves. From its inability to dive, it was compelled to obtain its food in shallow water; and from being often unable to approach the shore during the storms of winter, the animal was generally in poor condition by the spring.

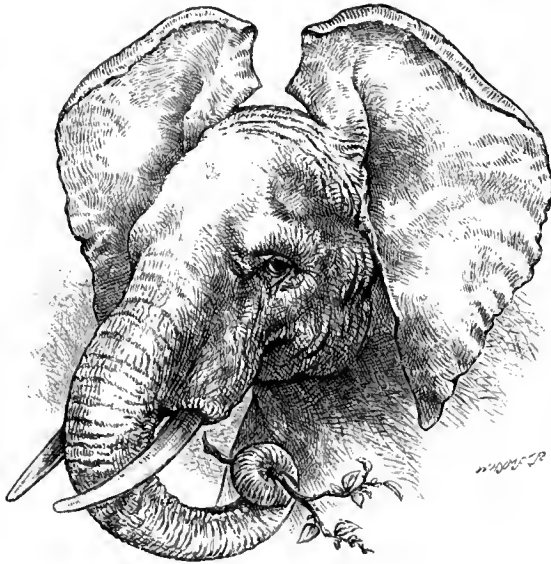
Extermination. Within nine years of its discovery, the northern sea-cow was exterminated on Copper Island; while on Behring Island it had become very scarce by 1763, and the last of its race appears to have been killed in the year 1767 or 1768. It was long thought that the creature was practically exterminated by Behring's party during their sojourn of ten months on the island named after their leader. This, however, was not the case, as they killed but very few. Soon after the return of Behring's crew to Kamschatka several expeditions were fitted out for the purpose of wintering on the Commander Islands and hunting fur-bearing animals; the sea-cows offering the inducement of an abundant supply of fresh food. Ships sailing to Alaska were also in the habit of touching at these islands to take in a supply of salted sea-cow meat. With such stupid and helpless habits as characterised the animal, it is no wonder that its complete extirpation was soon accomplished. Generally the sea-cow was harpooned from a boat; but by approaching stealthily hunters were also enabled to kill them with lances as they lay asleep near the shore.

TERTIARY SIRENIANS.

Throughout a large portion of the Tertiary period various species of extinct Sirenians were common in Europe, and they have also been sparingly met with in England. The best known of these was the halithere (*Halitherium*), which forms in some respects a kind of connecting link between the manati and the dugong. It resembled the latter in having the extremities of the jaws deflected, and in the presence of a pair of tusks in the upper jaw; but its molar teeth were more like those of the manati, although with a pattern recalling that obtaining on the crowns

of those of the hippopotamus. The most interesting points about this animal are the evidences it affords of being a more generalised type than either of its existing allies. Thus the premolar teeth had milk-predecessors, the skull was furnished with distinct nasal bones, and there was a rudimentary hind-limb.

There is, however, another extinct member of the order, which, although unfortunately known only by the skull, presents indications of a still closer affinity with ordinary mammals. This is the *Prorastoma*, of which the remains have been found in strata, probably belonging to the upper portion of the Eocene period in Jamaica and Italy. This creature had three pairs of incisors, and a pair of canines, as well as seven or eight pairs of cheek-teeth in each, and thus approximated very closely to the ordinary mammalian type; the front and premolar teeth doubtless having milk-predecessors. Although, therefore, we have not at present actually succeeded in tracing the origin of the Sirenians into terrestrial mammals, yet we have been able to go such a long way in this direction as to leave no doubt that they have been so derived by some evolutionary process.



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