SUB-ORDER SIMPLICIDENTATA.

SIMPLE-TOOTHED RODENTS.

These, as I before observed, are those of the order which never have more than two incisors in the upper jaw, and the enamel on these is restricted to the front of the tooth. They have also a well-developed bony palate, which in the Duplicidentata is imperfect, forming in fact but a narrow bridge from one jaw to the other. In the latter also the fibula, which is anchylosed to the end of the tibia, articulates with the calcaneum or heel-bone, which is not the case with the simple-toothed rodents.

We now come to the subdivisions of the Simplicidentata. The order GLIRES has always been a puzzling one to naturalists, from the immense variety of forms, with their intricate affinities, and there is not much help to be gained from extinct forms, for such as have been found are mostly referable to existing families. The classification which I have adopted is, as I said before, that elaborated by Mr. E. R. Alston, F.G.S., F.Z.S., and reported in the 'Proceedings' of the Zoological Society for 1876. I said that he had founded it on Professor Gervais' scheme, but I see that the groundwork of the system was laid down in 1839 by Mr. G. R. Waterhouse, then curator of the Zoological Society, and it was afterwards, in 1848, taken up by Professor Gervais, and subsequently added to by Professor Brandt in 1855, and Lilljeborg in 1866. About ten years later Mr. Alston, working on the data supplied by the above, and also by Milne-Edwards, Gray, Günther, Leidy, Coues, and Dr. Peters, produced a complete system of classification, which seems to be all that is to be desired.

We have already divided the rodents into two sub-orders, to which, however, Mr. Alston adds a third, viz., *Hebetidentati*, or Blunt-toothed Rodents, which contains only the *Mesotherium*, a fossil form. We have now to subdivide the two. The Double-toothed Rodents are easily disposed of in two families—*Leporidæ* and *Lagomyidæ*. The Simple-toothed Rodents are more numerous, and consist of about eighteen families arranged under three sections, which are *Sciuromorpha*, or Squirrel-like Rodents, *Myomorpha* or Rat-like Rodents, and *Hystricomorpha*, or Porcupine-like Rodents. It would perhaps render it clear to the reader were I to tabulate the differences chiefly noticeable in these three sections:—

SECTION I.—SCIUROMORPHA, OR SQUIRREL-LIKE RODENTS.

Molar dentition $\frac{4-4}{4-4}$ or $\frac{5-5}{4-4}$. In the latter case the foremost upper molar is small; the fibula is distinct, and never united, except in some

cases where it is attached to the extremity of the tibia; the zygomatic arch is formed chiefly by the malar, which is not supported beneath by a continuation of the zygomatic process of the maxillary; collar-bones perfect; upper lip cleft; the muffle small and naked; tail cylindrical and hairy (except in *Castoridæ*). Five families.

SECTION II.—MYOMORPHA, OR RAT-LIKE RODENTS.

Molar dentition from $\frac{3-3}{3-3}$ to $\frac{6-6}{6-6}$, the former being the usual number; the tibia and fibula are united for at least a third of their length. The zygomatic arch is slender, and the malar process rarely extends so far forward as in the preceding section, and is generally supported below by a continuation of the maxillary zygomatic process; collar bones are perfect (except in *Lophiomyidæ*); upper lip and muffle as in the last; tail cylindrical, sometimes hairy, but commonly covered with scales arranged in rings. Seven families.

SECTION III.—HYSTRICOMORPHA, OR PORCUPINE-LIKE RODENTS.

With one exception (*Ctenodactylus*) have four molars in each upper and lower jaw; the tibia and fibula are distinct in young and old; the zygomatic arch is stout, and the malar does not advance far forward, nor is it supported by the maxillary zygomatic process; collar-bones perfect in some; the upper lip is rarely cleft; the muffle clad with fine hair; tail hairy, sub-naked or scaly.

SECTION I.—SCIUROMORPHA.

Contains the following families, those that are not Indian being in *italics*:—

(1) *Anomaluridæ*; (2) Sciuridæ; (3) *Ischyromyidæ*, a fossil genus; (4) *Haplodontidæ*; (5) *Castoridæ*.

The Anomalures are African animals resembling our flying squirrels, to which they were at first thought to belong, but were separated and named by Mr. Waterhouse, the chief peculiarity being the tail, which is long and well covered with hair, though not bushy as in the squirrels, and which has, at its basal portion, a double series of projecting horny scales, which probably help it in climbing trees. There are several other peculiarities, which I need not dwell on here, which have justified its separation from the true squirrels. The flying membrane, which is quite as large as that of the flying squirrels, extends from the elbow to the heel instead of from the wrist, and it is held out by a strong cartilaginous spur starting from the elbow.

Of the Sciuridæ we have many examples in India, which will be noticed further on.

The *Ischyromyidæ* is founded on a single North American fossil genus (*Ischyromys typus*), which is nearly allied to the Sciuridæ, but also shows some affinity to the beavers.

The *Haplodontidæ* is also an American family, founded on one genus, but an existing and not a fossil animal. The *Haplodon rufus* is a small burrowing rodent, valued by the Indians both for its flesh and its skin, of which from twenty to thirty are sewn together to form a robe; the teeth are rootless, simple, and prismatic, the surface of each being surrounded by a mere border of enamel.

The *Castoridæ* is the beaver family, which is also unknown in India. Unlike as this animal is externally to the squirrels, its anatomy warrants its position in the Sciuromorpha, otherwise one would feel inclined to include it in the next section.

We see that of the five families, of which this section is composed, only the second has its representatives in India.

SCIURIDÆ—THE SQUIRRELS.

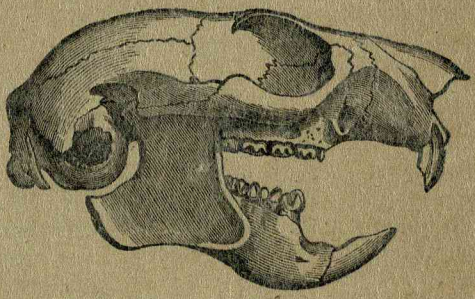
This family contains the true squirrels, including the flying ones, and the marmots. The distinctive characteristics of the former are as follows: The gnawing teeth are smooth, compressed. The grinding teeth are $\frac{5-5}{4-4}$ or $\frac{4-4}{4-4}$; in the former case the first upper premolar is small, and sometimes deciduous; they are tubercular, at least in youth, and rooted. Skull with distinct post-orbital processes; infra-orbital opening small, usually placed in front of the maxillary zygomatic process; palate broad and flat; twelve or thirteen pairs of ribs; tail cylindrical and bushy; feet either pentadactylous or with a tubercle in place of a thumb on the fore-feet. Mostly quite arboreal.

GÆNUS SCIURUS.

Pre-molars, $\frac{2-2}{1-1}$; molars, $\frac{3-3}{3-3}$; gnawing teeth smooth, orange-coloured, or brown; no cheek pouches; mammæ three or four pairs; first upper pre-molar soon lost in many cases; limbs free; form agile; tail long and very bushy.

Jerdon states that "there are three well marked groups in India distinguished by size, coloration and habits," by which he means the large forest squirrels, the medium size grizzled ones, and the little striped squirrels, to which however I must add one more form, which is found out of the geographical limits assigned to his work—the

Rhinosciurus, or long-snouted squirrel, an animal singularly like a Tupaia. The squirrels, as a whole, form a natural and well-defined group, with a remarkable uniformity of dentition and skull, but of infinite variation in colour. In fact, it is most puzzling and misleading to find so great a diversity of pelage as is exhibited by a single species. I was shown by a friend a few months ago a fine range of colours in skins of a single species from Burmah—*S. caniceps*. I cannot attempt to describe them from memory, but the diversity was so marked that I believe they would have been taken by unscientific observers for so many different species. Now in domesticated animals there is great variation in colouring, but not in the majority of wild species. What the causes are that operate in the painting of the skin of an animal no one can say, any more than one can say how particular spots are arranged on the petal of a flower or the wing of a butterfly. That specific liveries have been designed by an all-wise Creator for purposes of recognition I have no doubt, as well as for purposes of deception and protection—in the former case to keep certain breeds pure, and in the latter to protect animals from attack by enabling them better to hide themselves, as we see in the case of those birds and quadrupeds which inhabit exposed cold countries turning white in winter, and in the mottled skin of the Galeopithicus, which is hardly discernible from the rough bark of the tree to which it clings. I have hardly ever noticed such varied hues in any wild animals, although the *Viverridæ* are somewhat erratic in colouring, as in the Indian squirrels, and it is doubtful whether several recorded species are not so nearly allied as to be in fact properly but one and the same. There is much in common in at least five species of Burmese squirrels, and it is open to question whether *S. caniceps* and *S. Blanfordii* are not the same. Dr. Anderson writes: "I have examined a very extensive series of squirrels belonging to the various forms above described, viz., *S. pygerythrus*, *S. caniceps*, *S. Phayrei* and *S. Blanfordii*, and of others which appears to indicate at least, if not to prove, that all of them are in some way related to each other." In another place he says: "The skull of an adult male, *S. caniceps*, which had the bright red golden colour of the back well developed, presents so strong a resemblance to the skull of *S. Blanfordii*, that it is



Skull of *Pteromys* (Flying Squirrel).

extremely difficult to seize on any point wherein they differ." After comparison of the above with skulls of *S. griseimanus* and *S. Phayrei*, he adds: "such facts taken in conjunction with those mentioned under *S. Blanfordii*, suggest that there is a very intimate connection between all of these forms, if they do not ultimately prove to be identical" ('Anat. and Zool. Researches,' pp. 229, 231).

Blyth also, speaking of the larger squirrels, says: "It is difficult to conceive of the whole series as other than permanent varieties of one species; and the same remark applies to the races of *Pteromys*, and at least to some of those of *Sciuropterus*, as also to various named *Sciuri*" ('Cat. Mam.,' p. 98).

The large forest squirrels come first on our list. They inhabit lofty tree jungle, making their nests on the tops of the tallest trees. They are most active in their habits, and are strictly arboreal, being awkward on the ground. When kept as pets they become very tame, though some are crotchety tempered, and bite severely.

No. 273. SCIURUS INDICUS.

(*Sciurus Malabaricus and S. Elphinstonei in Jerdon, Nos.* 148 *and* 150.)

The Bombay Squirrel of Pennant.

NATIVE NAMES.—*Jangli-gilheri*, Hindi; *Shekra*, Mahrathi; *Kes-annalu*, Canarese of the Halapyks.

HABITAT.—The dense forests of the Western Ghâts, but extending easterly as far as Midnapore and Cuttack.

DESCRIPTION.—Upper surface of body dark maroon red, lower part of back and rump and upper portions of limbs and the whole of the tail black, the latter ending in a broad brownish-yellow tip; the outside of the hind-legs and half-way down the outside of the fore-legs a uniform rich maroon red; the under parts from chin to vent, inside of limbs, lower part of fore-legs, the inter-aural region and the cheeks bright orange yellow; forehead and nose reddish-brown, with white hairs interspersed; ears small and tufted; a narrow maroon line from the anterior angle of the ear extends downwards to the side of the neck, with a yellow line behind it; whiskers and bristles black.

Dr. Anderson also remarks on the skull of this species that it is considerably smaller than that of *S. maximus*, and has a narrower and less concave inter-orbital space; the nasals are also broader posteriorly, and less dilated anteriorly, the upper dental line being also shorter.

SIZE.—Head and body, 20 inches; tail, 15¼ inches.

Jerdon's description of this animal is taken *verbatim* from Sykes, who named it after the Honourable Mountstuart Elphinstone, under the

impression that it was a new species, but it is apparently the same as *S. Indicus* of Erxleben and *S. Malabaricus* of Schinz.

No. 274. SCIURUS MAXIMUS.

The Central Indian Red Squirrel (*Jerdon's No.* 149).

NATIVE NAMES.— *Kat-berral*, Bengali; *Karat*, Hindi; *Rasu* and *Ratuphar* at Monghyr, according to Hamilton; *Kondeng* of the Coles; *Per-warsti*, Gondi; *Bet-udata*, Telegu; *Shekra*, Mahrathi.

Sciurus maximus.

HABITAT.—Malabar coast, Central India, and, according to Dr. F. B. Hamilton, the hills about Monghyr, whence doubtless the Calcutta market is supplied. Hodgson records it from the Himalayan Terai.

DESCRIPTION.—"The upper surface and the sides of the neck, the shoulders, and the outside of the fore-limbs, the lumbar and sacral regions, the outside of the thighs and the tail are black, the black of the hind-quarters being prolonged forwards along the mesial line towards the black of the shoulders; a large dark maroon spot on the vertex, separated from the maroon of the nape by yellowish inter-aural area, which extends downwards and forwards to the cheeks; a maroon-coloured line passes downward from the front of the ear, with a yellow area behind it. The sides of the face and muzzle are pale yellowish, the latter being flesh-coloured; the other portions of the trunk and the lower half of the tibial portion of the hind limbs are maroon. The tail is either black or maroon black, sometimes tipped with yellowish brown. The whole of the under-parts and inside of the limbs and the hands and feet are rich yellowish; the ears strongly maroon and tufted" (*Dr. Anderson*). Jerdon's description of this animal is very meagre and doubtful.

SIZE.—About the same as the last.

This squirrel was tolerably common in the forests of Seonee, and we had one or two in confinement. One belonging to my brother-in-law was so tame as to allow of any amount of bullying by his children, who used to pull it about as though it were a puppy or kitten, but I have known others to bite severely and resent any freedom.

No. 275. SCIURUS MACROURUS.

The Long-tailed Forest Squirrel (*Jerdon's No.* 152).

NATIVE NAMES.—*Rookeeah* or *Dandoleyna*, Singhalese.

HABITAT.—Ceylon, Southern India, i.e. Malabar, Travancore, Mysore, Neilgherries.

DESCRIPTION.—"Fur of the upper parts coarse and slightly waved; above, the colour varies from maroon-black to rufous brown; hairs sometimes grizzled and tipped white or pale yellow, particularly on the croup, sides, and upper parts of limbs; crown of the head darker in most specimens than other parts; cheeks, under-parts, and lower two-thirds of limbs of a fulvous white; occiput of a deeper fulvous, sometimes yellow or ferruginous brown; an indistinct dark spot on the cheek, which is sometimes absent; two-thirds or more of the basal portion of the tail black or brown; the rest grizzled grey or fulvous. In some the hairs of the whole tail are tipped white, and in others grizzled white throughout. In the young there is very little of brown or black; the whole tail is more or less formed of grey hairs, and the terminal third is nearly white. Grey is also the prevailing colour on the posterior half of the body; toes in all black or blackish brown; ears hairy, only slightly tufted in adults."—*Kellaart.*

SIZE.—Head and body, 13½ inches; tail, 11 inches.

This squirrel also varies greatly in colouring, and has led several naturalists astray. Kellaart, in his 'Prodromus Faunæ Zeylanicæ,' says he has seen them in a transition state from dark brown to grizzled grey.

No. 276. SCIURUS GIGANTEUS.

The Black Hill Squirrel (*Sciurus macrouroides in Jerdon, No.* 151).

NATIVE NAMES.—*Shingsham*, Bhotia; *Le-hyuk*, Lepcha; *Jelarang*, Javanese; *Chingkrawah-etam*, Malay; *Leng-thet*, in Arakan; *Sheu*, in Tenasserim.

HABITAT.—North-west Himalayas to Assam, the Garo hills, Sylhet, and Cachar, spreading from Northern Assam across to Yunnan, and through Arakan and Tenasserim on to the Malayan peninsula and Borneo.

DESCRIPTION.—"This species has well-tufted ears; the upper surface is either wholly black or reddish-brown, without any trace of white; the tail is generally jet black, also the outside of the fore and hind limbs, and the upper surface of the feet; an elongated black spot is almost invariably found below the eye from beyond the moustache, and the eye is encircled with black. There are generally two black spots on the under surface of the chin; the under parts and the inside of the limbs vary from pale yellowish-white to a rich rufous orange; the basal portion of the hairs of the under-parts is dark brown or black, and the ventral area has frequently a dull hue where the yellow tips are sparse; the coats of these squirrels are generally sleek, glossy and deep black, and while in this condition the under surface is most brilliant, especially at its line of junction with the black, along the sides of the body and limbs, tending to form a kind of bright band.

"In some the upper parts have a brownish hue, but this is not characteristic of any particular locality, as two individuals, one from Nepal and the other from Borneo, are equally brown. While the fur is of this colour it is long and coarse, and the under-parts are less brilliant. These phases are probably seasonal, and connected with the breeding period."—*Anderson.*

SIZE.—Head and body, about 15 inches; tail, about 16 inches.

The next group consists of squirrels of medium size with grizzled fur, as Jerdon remarks of the two species he mentions; but with the rich fields of Burmah and Assam we can swell our list to over a dozen. It is doubtful whether one or two of the named species are not varieties of one and the same, so nearly are they allied, but this remains to be proved.

No. 277. SCIURUS LOKRIAH.

The Orange-bellied Grey Squirrel (*Jerdon's No.* 153).

NATIVE NAMES.—*Lokriah*, Nepalese; *Zhamo*, Bhotia, *Killi*, or *Kallitingdong*, Lepcha (*Jerdon*).

HABITAT.—Nepal, Sikim, Assam (Khasia Hills), and Burmah (Arakan).

DESCRIPTION.—A deep ferruginous olive-brown, the hairs tipped with orange, soft and silky; the under-parts from chin to vent and the outside of the thighs a rich orange; the tail is shorter than that of the next species, concolorous with the body above, but the banding of the hair is coarser, the apical black band being very broad, tipped with orange or white, generally the latter, the general hue being blackish washed with orange or white. In some the general hue is orange brown with obscure annuli; the arrangement of the hair is distichous or in two rows.

SIZE.—Head and body, about 8 inches; tail, 6½ to 8 inches, including hair.

There is some confusion between this and the next species, *S. lokroides*, and the distinctive characteristics quoted by Jerdon and others, founded on colouring alone, are not to be depended upon, for colouring varies, but there is considerable difference in the skulls of the two, *S. lokriah* having a smaller skull, with distinct peculiarities. The inter-orbital portion of the skull is narrower anteriorly and posteriorly, and the muzzle is narrow at the base, and of nearly equal breadth throughout. The nasals are long and narrow, and reach further back than in *S. lokroides*. These points, which are brought forward by Dr. Anderson, are sufficient to indicate that they are quite distinct species. As regards colouring *S. lokriah* has normally red thighs, but even this is absent at times. Dr. Anderson says: "It is much more richly coloured than *S. lokroides*, with no rufous even on the thighs, and with generally a tuft of pure white hair behind the ear, by which it can be recognised, as it occurs in twenty instances out of twenty-five, and even when absent the hairs in that locality have a paler colour. As this whitish tuft lies backwards, it is only seen when the ear is carefully examined."

No. 278. SCIURUS LOKROIDES.

The Hoary-bellied Grey Squirrel (*Jerdon's No.* 154).

HABITAT.—In the lower ranges of the South-eastern Himalayas, Nepal, Sikim, Assam, Tipperah and Arakan.

DESCRIPTION.—This is a most difficult species to describe. Dr. Anderson writes: "I have before me sixty-two examples of various

squirrels which have been referred to *S. lokroides*, *S. Assamensis* and *S. Blythii* by Hodgson, M'Clelland and Tytler, also the types of *S. similis* (Gray), which were forwarded to the British Museum as *S. lokroides* by Hodgson. After a careful consideration of these materials, they appear to me to be referable to one species. Hodgson, who first described it, referred to it all those Himalayan squirrels slightly larger than *S. lokriah*, and which had the ventral surface either pale whitish or slightly washed with rufous, the sides also being sometimes suffused with this tinge especially on the anterior half of the thigh, which in many is bright orange red; but this colour is variable, and many squirrels have this portion of the body white, of which *S. Blythii* is an example; and others similar to it are before me from Bhutan and Assam which do not differ from *S. lokroides* except in the presence of this white area, which is evidently only a variation on the red area, and probably a seasonal change, as many show merely a faint rufous tinge in the inguinal region, that colour being entirely absent on the outside of the thigh.

It is, however, worthy of note that those squirrels which have a rufous tinge in the inguinal region rarely, if ever, have the outside of the thigh bright red, and that the squirrels distinguished by white on their thighs are from Bhutan, Assam, and the Garo hills. But I do not see that these latter differ in any other respect from the squirrels sent by Hodgson as specimens of *S. lokroides*, with and without red thighs. Moreover, one of Hodgson's specimens of *S. lokroides* shows a tendency in the thigh to become white" ('Anat. and Zool. Researches,' pp. 247, 248).

The difficulty in laying down precise rules for colouring is here evident, but in general I may say that the upper parts are rufescent olive brown, the hair being grizzled or banded black and yellow, commencing with greyish-black at the base, then yellow, black, yellow with a dark brown or black tip; the lower parts are rufous hoary or grey, tinged with rufous, or the latter shade may be restricted to the groin or inguinal parts. The fur is coarser and more broadly ringed than in *S. lokriah*, and the ventral surface is never tinged with orange, as in that species: the tail is concolorous with the back; the hair more coarsely annulated; there is no white tuft behind the ears, as in the last species.

SIZE.—About the same as the last, or Dr. Anderson says: "In the form referable to *S. Blythii*, a white spot occurs on the inguinal region of the thigh in the position in which the rufous of the so-called red-legged squirrels is developed. The groin in some of these squirrels shows also a decided rufous tinge, while the remainder of the belly is sullied grey white. If these forms were without the white thigh-spot, they would exactly conform to the type of *S. Assamensis*. A squirrel in the British Museum, labelled *S. Tytleri* (Verreau, 'Indes Orientales'), agrees with *S. Blythii*" ('A. and Z. Res.', p. 249).

Blyth has seen a squirrel of this species renewing its coat, and

assuming a variegated appearance during its transition to the breeding dress.

A jet-black squirrel of the same proportion occurs in Sylhet and Cachar, which Dr. Anderson is inclined to think belongs also to this species.

We may, therefore, regard the following as being the same as *S. lokroides*, viz., *S. Assamensis*, *S. Blythii*, *S. similis*, and the black one, which has apparently not been named.

Jerdon states that these squirrels are mostly seen in the autumn when the chestnuts, of which they are very fond, ripen.

No. 279. SCIURUS PYGERYTHRUS.

HABITAT.—Burmah (Lower Pegu, and common in the neighbourhood of Rangoon).

DESCRIPTION.—Upper parts dark olive grey; basal third of the tail concolorous with the back, its latter two-thirds ringed olive-yellow and black; the tip black; feet olive grey, sometimes washed with yellowish; under surface and inside of limbs orange yellow, which extends also along the middle of the under part of the tail. Paler varieties occur. The skull of this species is smaller than those of *S. caniceps*, *S. Phayrei* and *S. Blanfordii*.

No. 280. SCIURUS CANICEPS.

The Golden-backed Squirrel.

HABITAT.—Burmah (Upper Tenasserim and Tavoy).

DESCRIPTION.—General colour grey or fulvous above; limbs outside grizzled grey; feet yellowish-grey; in some cases the nape, shoulders, and upper parts of back are vivid light ferruginous or golden fulvous, sometimes extending downwards on to the base of the tail. Some have only a trace of this colouring, others none at all. There is infinite variety of colouring in this species, as I observed in my remarks on the genus, and it is closely allied to the next three, if they do not ultimately prove to be the same.

"Out of a large series of specimens referable to *S. caniceps*, the males illustrate three phases of colouring, associated with a difference in the character of the fur. The first is a grey, the second a yellowish, and the third a phase in which the back becomes brilliant yellowish-red."—*Anderson.*

No. 281. SCIURUS PHAYREI.

The Laterally-banded or Phayre's Squirrel.

HABITAT.—Burmah. Common in Martaban; has also been obtained at Tounghu.

DESCRIPTION.—Upper parts dark olive grey; lower parts rich orange-red; the same colour being more or less continued along the under surface of the tail; the orange colour extends over the inside of the limbs, the front of the thigh and on the feet; the fore-limbs are dusky outside, with pale rufous yellow feet. Its chief distinguishing mark is a brown well-defined dark band on the flanks between the colour of the upper and lower parts.

No. 282. SCIURUS BLANFORDII.

Blanford's Squirrel.

HABITAT.—Upper Burmah.

DESCRIPTION.—Pale grey above, finely punctulated with black and grey; tail concolorous, with a black tip; under parts pale orange yellow; hands and feet yellow. Dr. Anderson shot a female at Pudeepyo, in the beginning of January, which had a distinct tendency to the formation of a dusky lateral stripe, as in the last species; the under-parts also were much more rich orange than in the type of this species. In the grey phase of *S. caniceps* that species is so like *S. Blanfordii* in the colouring of the upper parts and feet that it is almost impossible to distinguish them, but, according to Dr. Anderson, "on examining the under parts it is found that in these phases of *S. caniceps* they are grey, whereas in *S. Blanfordii* they are a beautiful rich orange, and the feet are yellow."

Before proceeding to the next species, which is a better marked one, I will quote one more passage from Dr. Anderson's careful comparison of the four preceding squirrels. "*S. Phayrei* corresponds in the colour of the upper fur to the yellow phase of *S. caniceps*, and the tail is the same as in it, having a black tip, which is the character also that that appendage has in *S. pygerythrus*. In some examples of *S. Phayrei* the dusky or blackish is not confined to the lateral line, but extends over the outside of the fore-limbs, the feet being always yellow in squirrels presenting these characters. Some specimens of *S. pygerythrus* show a distinct tendency to have yellow feet, and further research will probably prove *S. Phayrei* to be only a variety of *S. pygerythrus*. When Blyth first encountered this form, he simply regarded it as a variety of *S. pygerythrus*, and I believe his first opinion will be ultimately found to be more in accordance with the real interpretation of the facts than the conclusion he afterwards adopted. In the Paris Museum there is an example of *S. Blanfordii* from Upper Burmah which distinctly shows a dark lateral streak, so that, taking into consideration the other examples to which I have already referred, there seems to be a presumption that it and *S. Phayrei* are one and the same species, and that they are pro-

barely identical with *S. pygerythrus*; moreover, my impression is that a more extensive series will establish their identity with *S. caniceps*. This view of the question is also supported by a small series of these squirrels in the Leyden Museum from Tounghu in Upper Burmah, presented by the Marquis of Tweeddale. From the characters manifested by these squirrels, and the circumstances that they were all shot in one locality, they are of great interest. One is an adult, and in its upper parts it exactly resembles *S. Blanfordii*, also in its yellow feet and black tip to its tail, but, like *S. Phayrei*, it has a broad blackish-brown lateral stripe. The others are smaller, and resemble the foregoing specimens in all their characters, except that they have no dark lateral streak, and that the feet of two are concolorous with the upper parts, while in the remaining squirrel the feet appear to be changing to yellow, as in the adult. The two former of these, therefore, conform to the type of *S. pygerythrus*, but the fur of the upper parts is greyer and not so richly coloured as in it, but the annulation of the fur has the same character in both. The remaining specimen in its features is distinctly referable to *S. Blanfordii* ('Anat. and Zool. Researches,' p. 232).

No. 283. SCIURUS ATRODORSALIS.

The Black-backed Squirrel.

HABITAT.—Burmah and the Malayan countries. Common in Martaban.

DESCRIPTION.—There are two phases of colouring, in which both old and young of this species are found: with the black on the back, and again without it. In the latter case the upper parts and feet are a yellowish-rufous. The upper surface of the head, as far back as to include the ears, orange red; under parts and inside of limbs more or less chestnut; under surface of neck orange yellow, with a centre line of the same on the chest; tail variable—in the young it has seven alternate orange and black bands, the orange being terminal; but the adults have sometimes only five bands, the apical one so broad as to make a rich orange tail with yellowish-white tipped hair. In those with black backs the colour of the upper fur is less fulvous, and the chestnut of the lower parts is darker; in some the tail has broad orange tipped hairs, whilst in others it is, with the exception of the base, wholly black, and not annulated. These differences in colouring are not sexual, nor due to age. The skull of *S. atrodorsalis* resembles that of *S. caniceps*, but is broader, with a somewhat shorter muzzle, has smaller teeth, and would appear to be, from comparisons made by Dr. Anderson, smaller.

No. 284. SCIURUS ERYTHRÆUS.

The Assam Red-bellied Squirrel.

HABITAT.—Assam, Garo hills, Munipur.

DESCRIPTION.—The upper parts glistening deep reddish-black, minutely grizzled with light fulvous or yellowish-brown, each hair having two annulations; under parts and inside of limbs dark reddish maroon; feet black; tail concolorous with the back from the basal third, then gradually less grizzled; the terminal half black; whiskers black. Pallas describes the black of the tail as passing upwards in a mesial line.

SIZE.—Head and body, about 9 to 10 inches; tail with hair, from 11 to 12 inches.

No. 285. SCIURUS GORDONI.

Gordon's Squirrel.

HABITAT.—Upper Burmah.

DESCRIPTION.—Dr. Anderson, who first named this species, describes it as follows: "*S. Gordoni* has the upper surface and a narrow line from between the fore-limbs along the middle of the body grizzled olive-brown or greyish, with a variable rufous tint; the annulations are not so fine as in *S. erythræus*. The chin and sides of the throat are paler grizzled than on the back and the lower part of the throat; the chest, belly, and inside of the limbs are either pale yellow or rich orange-yellow, or passing into pale chestnut in the Assam variety, in which the belly is rarely lineated. The ears are feebly pencilled; the tail has the same proportion as in *S. erythræus* and *S. castaneoventris* * but it is more persistently and uniformly concolorous with the body than in these species, and is finely ringed with black and yellow, the rings being most distinct on the latter fourth; the tip is generally washed with orange yellow" ('Anat. and Zool. Res.').

SIZE.—Head and body, 9 inches; tail, 7 inches.

No. 286. SCIURUS HIPPURUS.

The Chestnut-bellied Assam Squirrel.

HABITAT.—Assam; also in the Malayan peninsula.

DESCRIPTION.—Upper parts of the body, with base of tail yellowish-rufous, punctulated with yellow and black; the lower parts deep ruddy ferruginous or chestnut; feet, tail (which is bushy) and whiskers black.

Dr. Anderson, however, mentions several varieties. He writes: "The specimen in the British Museum referred by Dr. Gray to *S. rufogaster*, var. *Borneoensis* differs from Malayan specimens in having portions

* A Chinese species: Western China, Formosa and Hainau.—R. A. S.

the upper parts unannulated and of a deep rich chestnut, which embraces the upper surface of the base of the tail, and is concolorous with the chestnut of the under parts. This, however, is evidently not a persistent form, because I have seen a specimen from the same island in which the red portion of the upper parts is grizzled and much of the same tint as Malayan individuals, except in the mesial line of the neck and back, where the colour is rich red-brown extending along the dorsum of the tail for about three inches.

Müller and Schlegel mention a variety that I have not seen, and of which they state that the red colour of the under parts extends to the heel, the forefoot and the toes, while the colour of the upper parts passes into a uniform lustrous black. They also remark, however, that the back not unfrequently assumes a pale yellowish brown tint" ('Anat. and Zool. Res.' p. 242).

Horsfield remarks :—"This species is nearly allied to the *S. erythræus* of Pallas, but it varies in the depth of the colours both above and underneath."

"In the skull the orbit is rather large, and the muzzle is so contracted at its base that the extremity is but little narrower."—*Anderson.*

No. 287. SCIURUS SLADENI.

Sladen's Squirrel.

HABITAT.—Upper Burmah.

DESCRIPTION.—After Dr. Anderson ('Proc. Zool. Soc.' 1871, p. 139) who first obtained and named this species: "grizzled, rufous olive above, the annulations fine, and the fur of moderate length; the forehead, face, chin, throat, belly, inside of limbs, front of thighs, lower half of forelimbs, and the hind-feet rich chestnut red; tail rather bushy, as long as the body without the neck and head, concolorous with the upper surface of the body, but slightly more rufous, with a bright chestnut red tip."

SIZE.—Head and body, 10¼ inches; tail, including rufous tip, 8 inches.

This handsome squirrel is figured in the volume of plates belonging to Dr. Anderson's work on the Zoology of the Yunnan Expedition. Speaking of the skull he says: "The skull of *S. Sladeni* has a rather short muzzle, with considerable breadth across its base superiorly, and it is a shorter and broader skull than the skulls of squirrels referred to *S. Blanfordii*. Compared with the skull of the red-headed specimen of *S. erythræus* from Bhutan, there is a decided resemblance between the two, the chief distinction being the less breadth of the base of the muzzle of the latter, but the teeth of this specimen show it to be young, while the teeth of *S. Sladeni* are much worn by use."—'A. and Z. Res.' p. 243.

No. 288. SCIURUS FERRUGINEUS.

The Rusty-coloured Squirrel.

HABITAT.—From Assam to Burmah and Siam, and the adjacent islands of Pulo Condor and Sichang.

DESCRIPTION.—Colouring most diverse, no less than ten named species being referable to this one, viz., *S. Finlaysoni*, *S. ferrugineus*, *S. Keraudrenii*, *S. splendidus*, *S. cinnamomeus*, *S. Siamensis*, *S. splendens*, *S. Germani*, *S. Bocourtii*, *S. leucogaster*; some are rich red, one jet black, and another is white, but apparently most of the varieties come from Siam; the Assam and Burmah specimens being reddish, of which the following description is by Blyth, according to Horsfield's Catalogue, where it is entered as *S. Keraudrenii*: "Entirely of a deep rufo-ferruginous colour, rather darker above than below; the fur of the upper parts somewhat glistening; toes of all the feet blackish, as in the three preceding, and the extreme tip of the tail yellowish-white."

The following group consists of the striped squirrels, a smaller and more terrestrial species, allied to the ground squirrels (*Tamias*).

No. 289. SCIURUS PALMARUM.

The Common Indian Ground Squirrel (*Jerdon's No.* 155).

NATIVE NAMES.—*Gilehri*, Hindi; *Beral*, *Lakki*, Bengali; *Kharri*, Mahrathi; *Alalu*, Canarese; *Vodata*, Telegu; *Urta* of Waddurs (*Jerdon*).

HABITAT.—India generally, except in some parts of Malabar and North-eastern Bengal.

DESCRIPTION.—The upper parts are dusky greenish-grey, with five yellowish-white dorsal lines, the two outer ones being faint and indistinct; under parts whitish; the hairs of the tail are annulated with red and black; ears round. But the colouring varies; some are much darker than others; one I have is a deep ferruginous brown between the dorsal stripes.

SIZE.—Head and body, 6½ to 7 inches; tail, 5¼ to 6 inches.

This beautiful little animal is well known to almost all who have lived in India, and it is one of the most engaging and cheerful of all the frequenters of our Mofussil bungalows, although I have heard the poor little creature abused by some in unmeasured terms, as a nuisance on account of its piercing voice. I confess to liking even its shrill chatter; but then I am not easily put out by noise, and am rather like the deaf old King of Oude, who sits and reads in his cockatoo house, and looks up smilingly, as half a dozen of them give vent to extra diabolical shrieks, and pleasantly remarks: "Ah: the birds are singing a little this morning!" I am not

quite so bad as that; but as I now sit writing, I have a hill myna on one side of me imitating an ungreased cart-wheel and the agonies of an asthmatic *derzie*, and on the other side a small female of the rose-headed parrakeet, which has a most piercing selection of whistles and small talk, to say nothing of two small bipeds of five and seven, who cap all the rest for noise, till I sometimes wish I had the aural afflictions of the old king. I can, however, quite imagine the irritation the sharp chirrup-chirrup of this little squirrel would cause to an invalid, for there is something particularly ear-piercing about it; but their prettiness and familiarity make up in great measure for their noisiness. They are certainly a nuisance in a garden, and I rather doubt whether they are of any use, as McMaster says, "in destroying many insects, especially white ants, beetles, both in their perfect and larval state," &c. He adds: "They are said to destroy the eggs of small birds, but I have never observed this myself." I should also doubt this, were it not that the European squirrel is accused of the same thing. General McMaster, I think, got his idea from a quaint old book, which he quotes at times, Dr. John Fryer's 'Voyage to East India and Bombain,' who, writing on the nests of the weaver bird (*Ploceus baya*), says: "It ties it by so slender a Thread to the Bough of the Tree, that the Squirrel dare not venture his body, though his Mouth water at the eggs and Prey within." McMaster himself writes: "This familiar little pest is accused, but I believe unjustly, of robbing nests; were he guilty of this, it would in the breeding season cause much excitement among the small birds, in whose society he lives on terms of the most perfect friendship." There is much truth in this. Wood and others, however, state that the European squirrel has been detected in the act of carrying off a small bird out of a nest, and that it will devour eggs, insects, &c.

Jerdon relates the Indian legend that, when Hanuman was crossing the Ganges, it was bridged over by all the animals; one small gap remained, which was filled by this squirrel, and as Hanuman passed over he put his hand on the squirrel's back, on which the marks of his five fingers have since remained. It is not unlike the chipmunk of America (*Tamias striatus*), but these true ground squirrels have cheeks pouches and live in burrows. Our so-called palm squirrel (though it does not affect palms any more than other trees) builds a ragged sort of nest of any fibrous matter, without much attempt at concealment; and I have known it carry off bits of lace and strips of muslin and skeins of wool from a lady's work-box for its house-building purposes. The skins of this species nicely cured make very pretty slippers. They are very easily tamed, and often fall victims to their temerity, in venturing unknown into their owner's pockets, boxes, boots, &c. One I have now is very fond of a mess of parched rice and milk. It sleeps rolled up in a ball, not on its side, but with its head bent down between its legs.

No. 290. SCIURUS TRISTRIATUS.

The Three-striped Ground-Squirrel (*Jerdon's No.* 156).

NATIVE NAMES.—As in the last. *Leyna* in Singhalese.

HABITAT.—Ceylon and Southern India; on the Neilgherries. Has been found in Midnapur, and it is stated to range northward to the Himalayas.

DESCRIPTION.—Somewhat larger and darker than the last species, manifesting considerable variation in the colour of the dark lines of the back. In some the lines are rufous; in others dark brown or blackish throughout, or black only from the shoulder to the lumbar region. The general tints are rusty red on the head, greyish on the shoulders, blackish in the middle of the back, rusty on the haunches. Three well-defined yellow dorsal lines, not extending the whole length of the back; the tail rusty beneath, darker than *S. palmarum* on the sides.

SIZE.—Head and body, 7½ inches; tail, 7½ inches.

This squirrel is more shy than the last, and keeps to the woods, although occasionally it will approach houses. Dr. Jerdon says a pair frequented his house at Tellicherry, but they were less familiar than *S. palmarum*, and endeavoured to shun observation. Kellaart gives a careful description of it, but does not say anything about its habits, at which I wonder, for it is common there, and takes the place of our little Indian friend, though probably its more retiring disposition has prevented so much notice being taken of it. Were it in the habit of frequenting houses in the manner of its Indian cousin, I am sure Sir Emerson Tennent would have devoted a page to it, whereas he does not mention it at all. It had also escaped McMaster's notice, careful observer though he was. Waterhouse, in his description ('Proc. Zool. Soc.' 1839, p. 118), describes some differences in the skull of this and *S. palmarum*, but Dr. Anderson finds no difference whatever.

No. 291. SCIURUS LAYARDI.

Layard's Striped Ground-Squirrel (*Jerdon's No.* 157).

HABITAT.—Ceylon; in the highlands and the mountains of Travancore in Southern India.

DESCRIPTION.—Dark dingy olive, inclining more to ashy than fulvous, except on the head and flanks. Lower parts ferruginous, paler on the breast; middle of back very dark, with a narrow bright fulvous streak in the middle, reaching from between the shoulders to near the tail, and an obscure shorter stripe on either side, barely reaching to the croup; tail ferruginous along the centre, the hairs margined with black, with white tips; a narrower black band near the base of each hair; tip of tail

black, forming a pencil tuft three inches long. In some specimens the centre dorsal streak is bright orange, the two intervening bands being jet black. In those in which the streaks are pale, the intervening bands differ only from the surrounding fur in being darker, but are grizzled like it. There is a narrow rufous area round the eye; the whiskers are black; the under-parts and inside of limbs are bright reddish-chestnut, and this colour extends along the under-part of the tail. Jerdon calls this squirrel *the Travancore striped squirrel*, but I see no reason to retain this name, as it is not peculiar to Travancore, but was first found in Ceylon by Mr. E. Layard, after whom Blyth named it.

No. 292. SCIURUS SUBLINEATUS.

The Dusky-striped Ground-Squirrel (*Jerdon's No.* 158).

HABITAT.—The mountains of Ceylon and Southern India.

DESCRIPTION.—Smaller than the palm squirrel; fur soft, dense, grizzled olive brown; base of hairs dusky black; three pale and four dark lines on the back and croup, the lineation being obscure, and reaching only from the shoulder to the sacral region. Under-parts variable, but always dusky, never bright, from grey to dusky brown washed with rufous; tail concolorous with the upper part of the body and obscurely annulated.

SIZE.—Head and body, 5 to 6 inches; tail, 4½ to 6 inches.

Kellaart calls this *the Newara Elia ground-squirrel*, and Jerdon *the Neilgherry striped squirrel*, but, as it is not peculiar to either one or the other place, I think it better to adopt another popular name. It is common about Newara Elia and Dimboola, but it does not seem to descend lower than 3000 feet. In Southern India it is found in the Neilgherries, Wynaad and Coorg, but only at considerable elevations.

No. 293. SCIURUS MCCLELLANDI.

McClelland's Ground-Squirrel (*Jerdon's No.* 159).

NATIVE NAME.—*Kalli-gangdin*, Lepcha.

HABITAT.—"This species has a wide distribution, ranging from Nepal and Thibet to the east of China and Formosa, and through Assam and Cachar south-eastward to Tenasserim and Siam."—*Anderson.*

DESCRIPTION.—General hue olive brown, each hair having a blackish tip, a sub-apical yellow band, and a slaty black base. A pale yellowish band on the side of the nose, passing underneath the eye and ear along the side of the neck, and continued along the side of the back to the base of the tail; its upper margin has a dusky line; a narrow black line from between the shoulders over the vertebræ to the root of the tail;

tail grizzled dark above, fulvous beneath; whiskers black; limbs concolorous with the body: ears small, black edged, fulvous white within, and with white pencil tufts.

SIZE.—Head and body, 5 inches; tail, 4 inches.

Dr. Anderson obtained this species at Ponsee in Burmah, at an elevation of 3500 feet, and Dr. Jerdon, at Darjeeling, at from 4000 to 6000 feet. This species is synonymous with Blyth's *S. Barbei.*

No. 294. SCIURUS BERDMOREI.

Berdmore's Ground-Squirrel.

HABITAT.—Tenasserim and Martaban.

DESCRIPTION.—General colour brownish, with a distinct rufous tinge on the middle of the back. It is punctulated with yellowish on the head, sides of face and body and outside of limbs, and with rich rufous on the middle of the back. An obscure narrow black line along the middle of the back from between the shoulders, but only extending half way down the trunk. On the sides of the back a yellow line from shoulder to articulation of femur; this is margined below with a broad black band, and above by an obscure dusky line. There is a broad pale yellow linear area below the former of these two dark bands, the portion of the side below it being concolorous with the thighs and fore-limbs. The rufous area of the back is confined between the two uppermost yellow lines; ears are large; all under-parts white, slightly washed here and there with yellowish; the tail moderately bushy, all the hairs annulated with four alternative orange and black bands, the terminal black band being occasionally tipped with white, and being as broad as the three remaining bands, so that the tail has a decidedly black tint washed with whitish, the orange bands, however, appearing through the black.

SIZE.—Head and body, about $7\frac{3}{4}$ inches; tail without hair, 5 inches.

No. 295. SCIURUS QUINQUESTRIATUS.

The Stripe-bellied Squirrel.

HABITAT.—Kakhyen hills, on the Burmo-Chinese frontier.

DESCRIPTION.—"Above grizzled olive, brownish-grey, with a distinct rufous tint, deepest on the dorsal surface; annulation fine, as in the grizzled squirrels generally; chin and throat obscurely grizzled greyish, washed with reddish; a rufous grizzled blackish-brown band from the chest along the middle line of the belly to the vent; external of this, on either side, a broad pure white well-defined band from the side to the chest along the belly and prolonged along the inguinal region to the vent; a broad black band from the hollow of the axilla along the side

of the belly, expanding on the inside of the thighs, where it is faintly washed with greyish; inside of the fore-limbs blackish, washed with greyish; toes black, with rufous annulations. Tail nearly as long as the body and head, concolorous with body, but the black and rufous annulations much broader and more marked, assuming the form of indistinct rufous and black rings on the posterior third; tip of tail jet black, narrowly terminated with greyish."—*Dr. J. Anderson* in 'Proc. Zool. Soc.' 1871, p. 142.

SIZE.—Head and body, about 9½ inches; tail, 7¼ inches.

This curious squirrel was first discovered and named by Dr. Anderson, who states that it was common at Ponsee on the Kakhyen range of hills east of Bhamo, at an elevation of from 2000 to 3000 feet, and as yet it has only been found on those hills. There is a coloured plate of it in the 'Proceedings of the Zoological Society' for 1871.

The next animal forms a curious link in resemblance between the Tupaiidæ and the squirrels. I mentioned some time back that the first Tupaia was taken for a squirrel; and certainly, to look at this long-snouted squirrel, one might easily be misled into supposing it to be a Tupaia, till an examination of its dentition proved it to be a rodent. It is supposed to be a Malayan species, but I was shown not long ago a specimen in Mr. Hume's collection which I understood Mr. Davison to say he had procured in Burmah. It has been classed by Dr. Gray in a separate genus, *Rhinosciurus*.

No. 296. SCIURUS (RHINOSCIURUS) TUPAOIDES.

The Long-nosed Squirrel.

HABITAT.—The Malayan peninsula and Borneo, and I believe the Tenasserim provinces.

DESCRIPTION.—This animal differs from all other squirrels by the extreme length of its pointed muzzle, with which is associated a long and narrow skull. The coloration varies from light to dark, and almost blackish-brown; the tail is shorter than the body, moderately bushy, narrow at the base, but expanding towards the tip; the hairs are broadly banded with four alternate pale and dark brown bands, the last being the darkest and broadest, with a pale tip; the under-parts are white in some, rich orange yellow in others.

SIZE.—Head and body, 7¼ inches; tail reaches to the eye.

The Flying Squirrels next engage our attention. In several groups of animals of strictly arboreal habits, nature has gone beyond the ordinary limits of agility afforded by muscular limbs alone, and has supplemented those limbs with elastic membranes which act like a

parachute when the animal takes a leap into space, and gives it a gradual and easy descent. Amongst the lemurs the *Galeopithecus*, the *Pteromys* in the squirrels, and the *Anomalurus* in another family of rodents, are all thus provided with the apparatus necessary to enable them to float awhile in the air, for flying is scarcely the proper term for the letting-down easy principle of the mechanism in question.

The flying squirrels, with which we have now to deal, are in general details the same as ordinary squirrels, but the skin of the flanks is extended between the fore and hind limbs, which, when spread out, stretches it into a wide parachute, increased in front by means of a bony spur which projects from the wrist. These animals have been subdivided into the large round-tailed flying squirrels, *Pteromys*, and the small flat-tailed flying squirrels, *Sciuropterus*. The distinction was primarily made by F. Cuvier on the character of the teeth, as he considered *Sciuropterus* to have a less complex system of folds in the enamel of the molars, more like the ordinary squirrels than *Pteromys*; but modern research has proved that this is not a good ground for distinction. Dr. Anderson has lately examined the dentition in eleven species of *Pteromys* and *Sciuropterus*, and he says: "According to my observations the form of the enamel folds in youth are essentially similar, consisting of a series of tubercular folds which are marked with wavy lines in some, and are smooth in others, but in all there is a marked conformity to a common type. The seemingly more complex character of the folds appears to depend on the extent to which the tubercular ridges are worn by use." He also questions the propriety of the separation according to the distichous arrangement of the hairs of the tail. After a careful examination of the organ in nearly all the members of the series, he writes: "I have failed to detect that it is essentially distinctive of them—that is, that the distichous arrangement of the hairs is always associated with a diminutive species; but at the same time there can be no doubt that it is more prevalent among such." He then goes on to show that the tail is bushy in seventeen species, partially distichous in one, and wholly so in ten, and concludes by saying: "I am therefore disposed to regard the flying squirrels generally as constituting a well-defined generic group, the parallel of the genus *Sciurus*, which consists of an extensive series of specific forms distinguished by a remarkable uniformity of structure, both in their skulls and skeletons, and in the formations of their soft parts." There is a laudable tendency nowadays amongst mammalogists to reduce as far as possible the number of genera and species, and, acting on this principle, I will follow Dr. Anderson, and treat all the Indian flying squirrels under *Pteromys*.

GENUS PTEROMYS.

General anatomy that of the squirrel, except that the skin of the flanks is extended between the limbs in such a manner as to form a parachute when the fore and hind legs are stretched out in the act of springing from tree to tree.

No. 297. PTEROMYS ORAL.

Pteromys petaurista in Jerdon, No. 160.

The Brown Flying Squirrel.

NATIVE NAMES.—*Oral* of the Coles; *Pakya*, Maharathi; *Parachatea*, Malabarese; *Egala dandoleyna*, Singhalese.

HABITAT.—India, wherever there are large forests; Ceylon.

DESCRIPTION.—Upper parts dusky maroon black grizzled with white;

Pteromys oral.

this effect being due to the ends of the hairs being white, tipped with a small black point.

The muzzle and around the eyes, and the feet are black; the limbs and side membrane a lighter rufous maroon; the male has an irregular rufous patch on the sides of the neck, according to Elliot, which in the female is a pale fawn colour; the tail is rather longer than the body, and very bushy; its terminal two-thirds or three-fourths are black or blackish—sometimes (rarely) a little white at the extreme tip; the under-parts are dingy brownish-grey or nearly white. The female has six mammæ—two pectoral and four ventral.

SIZE.—Head and body, 20 inches; tail, 21 inches; breadth of expanse, 21 to 24.

This species is nocturnal in its habits as noticed by Mr. Baker ('Journ. As. Soc. Beng.' 1859, vol. xxviii. p. 287), Jerdon and others.

Mr. Baker says it makes a noise at night in the depths of the jungle which is alarming to strangers. On the other hand Tickell, who was one of the first to bring it to notice, says its voice is seldom heard, and it is a weak, low, soft monotone quickly repeated, so low that in the same room you require to listen attentively to distinguish it. "It is to the Coles a sound ominous of domestic affliction. When angry the oral seldom bites, but scratches with its fore-claws, grunting at the same time like a guinea-pig." "When taken young it becomes a most engaging pet. It can be reared on goat's or cow's milk,* and in about three weeks will begin to nibble fruit of any kind. During the day it sleeps much, either sitting with its back bent into a circle, and its head thrust down to its belly, or lying on its back with the legs and parachute extended—a position it is fond of in sultry weather. During the night time it is incessantly on the move."

Jerdon says of it: "It frequents the loftiest trees in the thickest parts of the forest, and is quite nocturnal in its habits, usually making its appearance when quite dusk. The natives discover its whereabouts by noting the droppings beneath the trees it frequents. It is said to keep in holes of trees during the day, and breeds in the same places. In the Wynaad many are killed, and a few captured alive by the Coorumbars, a jungle race of aborigines, who are usually employed to fell the forest trees in clearing for coffee; and I have had several sent to me alive, caught in this way, but could not keep them for any time. It lives chiefly on fruits of various kinds; also on bark, shoots, &c., and, Tickell says, occasionally on beetles and the larvæ of insects."

Jerdon says he had several times witnessed the flight of this species from tree to tree, and on one occasion he noted a flight of over sixty yards.

"Of course it was very close to the ground when it neared the tree, and the last few feet of its flight were slightly upwards, which I have also noticed at other times." I think Wallace has observed the same of the *Galeopithecus*. How this upward motion is accomplished more careful investigation will show; in all probability the depression or elevation of the tail may cause a deviation from a fixed course. According to Elliot it is very gentle, timid, and may be tamed, but from its delicacy is difficult to preserve. The fur is soft, beautiful and much valued. Jerdon gives the localities in which he has found it to be most

* I advise half water in the case of cow's milk, or one quarter water with buffalo milk.—R. A. S.

common: Malabar, Travancore (the Marquis of Tweeddale, according to Dr. Anderson, got a specimen from this locality of a much lighter colour than usual), the Bustar forests in Central India, Vindhian mountains near Mhow, the Northern Circars, and the Midnapore jungles.

No. 298. PTEROMYS CINERACEUS.

The Ashy Flying Squirrel.

NATIVE NAME.—*Shau-byau* in Arakan.

HABITAT.—Assam, Burmah, viz. Arakan, Pegu and Tenasserim provinces.

DESCRIPTION.—Very like the last, but with a greyish fur, and almost white tail, with a black tip.

The fur generally is a mixture of pale grey and brownish, the hairs of the head and back having a whitish subterminal band; the tail consists almost entirely of the greyish hairs; the parachute is reddish brown; the under-parts white. Blyth, however, mentions a specimen from Tenasserim which is unusually rufous, with the tail concolorous with the upper parts.

SIZE.—Same as the last.

It is open to question whether this is not identical with *Pteromys oral*, merely a local variety. Blyth so termed it; and from what Dr. Anderson has written on the subject, I gather that he, too, inclines to the same opinion, as he says: "The dimensions are the same as those of *P. oral*, Tickell, of which it will probably prove to be a local race."

No. 299. PTEROMYS YUNNANENSIS.

The Yunnan Flying Squirrel.

HABITAT.—Kananzan mountains; Burmo-Chinese frontier.

DESCRIPTION.—Dr. Anderson, who discovered and named this species, describes it as follows: "The general colour is a rich dark maroon chestnut on all the upper parts, the head and back in some being finely speckled with white, which is most marked in the young, but is always most profuse on the posterior half of the back, which in some individuals has almost a hoary tinge, from the extent to which the annulation of the hairs is carried.

"In the adult, the upper surface of the parachute is of the same colour as the back, and the hairs are not annulated, except along its margin; but in younger specimens they are partially so on the upper surface, as are also the hairs on the first three or six inches of the tail, which are concolorous with the back, but broadly tipped with black, while the remaining portion of the tail is rich glossy black; the sides of

the face, below the eye and ear, are yellowish-grey, mixed with chestnut, and the chin is dusky; the paws are rich black, also the margins of the limbs; the under surface is clad with a yellowish-white, rather woolly fur, which in some tends to a chestnut tint in the middle line, and to a darker tint of the same colour at the margin of the parachute.

"The basal portion of the fur of the upper parts is a dark greyish-brown, the hairs at their base being wavy; then follows a palish chestnut band, succeeded by a dark maroon chestnut, which either may or may not have a pure white sub-apical band, the tips of the hairs being glossy deep maroon chestnut, in some verging on black.

"The ears are large and rounded, and very sparsely covered with black hairs externally, with chestnut-coloured hairs on the anterior, and black on the posterior half of the dorsal surface.

"The hairs on the outer side of the tarsus form a rather long and dense brush; the tail is moderately bushy."—'Anat. and Zool. Res.,' p. 282.

SIZE.—Dr. Anderson only got skins of this beautiful squirrel, so accurate dimensions cannot be given, but the largest skin measured from muzzle to root of tail 24 inches, the tail being the same.

No. 300. PTEROMYS MELANOPTERUS.

The Black-flanked Flying Squirrel.

HABITAT.—Thibet.

DESCRIPTION.—The back and top of the head are greyish-yellowish, the hairs being leaden grey at the base, passing into yellow, the sub-terminal part being brown, with a minute dark point; the upper surface of the parachute is almost wholly black, with a greyish-white border; under surface yellow; the belly greyish-ashy; feet black; limbs and tail concolorous with the body, the latter very bushy.

SIZE.—Head and body, about 19¼ inches; tail, 17¼ inches.

I have included this species, although it does not belong to India proper; still it would be well if travellers and sportsmen exploring our Thibetan frontiers would keep a look-out for this animal. At present all we know of it is from Professor Milne-Edwards's description of animals collected by the Abbé David, to whom we are also indebted for the next species.

No. 301. PTEROMYS ALBORUFUS.

The Red and White Flying Squirrel.

HABITAT.—Thibet; district of Moupin.

DESCRIPTION.—I have but a bare note of this species taken long ago from Milne-Edwards's work on the Mammals of Thibet, so I will quote

Anderson's description from the types he examined: "The head, the sides of the neck, the throat and upper part of the chest, variegated with white, through which the rich maroon of the ground colour is partially seen, and it forms a ring around the eye; the hinder part of the back is yellow, and the tail, immediately beyond its base, is also yellowish for a short way, fading into the deep maroon of its latter two-thirds. It has no black tip. The feet are concolorous with the body; the under parts are pale rich orange yellow; the ears are large and moderately pointed."—'Anat. and Zool. Res.,' p. 284.

SIZE.—Head and body, about 23 inches; tail, 16 inches.

No. 302. PTEROMYS MAGNIFICUS.

The Red-bellied Flying Squirrel (*Jerdon's No.* 162).

NATIVE NAME.—*Biyom*, Lepcha.

HABITAT.—South-eastern Himalayas, Nepal, Sikim, Bhotan; also in the hill ranges of Assam.

DESCRIPTION.—Upper parts dark chestnut or a rich lustrous dark maroon chestnut, with a golden yellow mesial line in some; the hairs are black tipped, the dark portions of the back being finely but obscurely punctulated with dark orange; the shoulders and thighs are golden yellow, and the under-parts are orange fawn or orange red; so is also the margin of the parachute; the ears are large, semi-nude, sparsely clad with pale red hair externally, and bright red posteriorly, the base of the upper surface being clad with long hair; the sides of the face below the eyes are yellowish; there is a black zone round the eyes; the chin and the feet are blackish; the tail is orange red, tipped more or less broadly with black.

SIZE.—Head and body, about 16 inches; tail, 22 inches.

The young of this species have not the dorsal line, the head and neck are concolorous with the body, as is also the tail at its base; the under parts are pale yellowish-red. According to Dr. Anderson the skulls of *Pteromys magnificus* and *P. oral* differ in the shorter muzzle and the more elevated character of the inter-orbital depression of the latter. This animal is occasionally found at Darjeeling, and according to Jerdon it used to be more common there before the station was so denuded of its fine trees. It frequents the zone from 6000 to 9000 feet, and feeds on acorns, chestnuts and other hard fruit; also on young leaves and shoots. There is a coloured plate of this species in the 'Journal of the Asiatic Society of Bengal,' vol. xiii. part i. p. 67.

No. 303. PTEROMYS ALBIVENTER.

Pteromys inornatus of Jerdon, No. 161.

The White-bellied Flying Squirrel.

NATIVE NAME.—*Rusigugar*, i.e., flying rat, Kashmiri.

HABITAT.—From Nepal, along the North-western Himalayas to Kashmir.

DESCRIPTION.—Upper parts grizzled reddish-brown or dark grey with a rufous tinge, or a reddish-bay, darker on the upper surface of the parachute, and outside of limbs; head, neck, and breast greyish-rufous; cheeks grey; chin, throat and lower part of breast white, faintly tinged with rufous in the belly; under part of parachute rufous, tinged white, with a greyish posterior margin. Occasionally a dark brown band over the nose and round the eyes; the whiskers and feet blackish.

SIZE.—Head and body, 14 inches; tail, 16 inches.

This is a common squirrel at Simla. One was killed close to the house in which I was staying in 1880 at the Chota Simla end of the station by a native servant, who threw a stick at it, and knocked it off a bough, and I heard of two living ones being hawked about for sale about the same time—which, to my regret, I failed to secure, some one having bought them. They are common also in Kashmir, where they live in holes made in the bark of dead fir-trees. They are said to hybernate during the season there. A melanoid variety of this species is mentioned by Dr. Anderson as being in the Leyden Museum. It was obtained by Dr. Jerdon in Kashmir, and presented to the Museum by the late Marquis of Tweeddale.

No. 304. PTEROMYS CANICEPS.

Sciuropterus caniceps of Jerdon, No. 163.

The Grey-headed Flying Squirrel.

NATIVE NAME.—*Biyom-chimbo*, Lepcha.

HABITAT.—Sikim and Nepal.

DESCRIPTION.—At first sight this seems to be a grey-headed form of the last species, but with larger ears; the head is iron grey; round the eyes and a patch above and below orange fulvous or chestnut; the base of the ears the same. Regarding this Dr. Anderson, on comparing it with the last, writes: "On a more critical examination of *P. caniceps* it appears to me, judging from Hodgson's types of the species, that it has larger ears, and if this should prove to be a persistent character, then the grey head and the chestnut speck above and below the eye, and the bright chestnut tuft behind the ears, assume a specific importance which they would not otherwise have." But he adds that his observations are merely from preserved specimens, and that the

description of the magnitude of the ears is one yet to be settled by further investigation of the living animal. Jerdon's description is "entire head iron-grey; orbits and base of ears deep orange fulvous; whole body above, with parachute and tail, a mixture of blackish and golden yellow; limbs deep orange ochreous; margin of parachute albescent; beneath the neck whitish; rest of the lower parts pale orange-red; tip of tail black; ears nearly nude; tail sub-distichous." The fur is softer, denser, and longer than in the last two species.

SIZE.—Head and body, about 14 inches; tail, 15 to 16 inches.

No. 305. PTEROMYS PEARSONII.

Sciuropterus villosus of Jerdon, No. 166.

The Hairy-footed Flying Squirrel.

HABITAT.—Sikim and Upper Assam.

DESCRIPTION.—Upper part of head and back rich glossy reddish-brown, grizzled with black; the parachute blackish-brown, sparsely washed with faint reddish brown.

"Fur very fine, soft, and rather long, but adpressed, and the hidden portion is almost black, narrowly tipped with the reddish-brown, the sides of the hair being blackish-brown. On the parachute only a few hairs have the reddish band, and these are most numerous towards the margin; the tail is rather bushy and but slightly distichous, and the hidden portion of its fur is pale fawn at the base, passing into pale chestnut brown, washed with dusky brown on the sides and upper surface; the margins of the eyelids are dark brown, and the sides of the face are pale rufous; the ears are moderately large and rounded, rather dark brown towards the tips, and pencilled at the base, anteriorly and posteriorly, with long delicate hairs. There are no true cheek bristles, but the moustachial hairs are very long; the under surface is pale ferruginous, palest on the mesial line, and most rufescent on the outer half of the membrane, the margin of which inferiorly is pale yellowish; the hairs on the membrane have dark slaty—almost black—bases, the ferruginous being confined to the tips; the fur of the under-parts is very soft and dense; the feet are well clad, more especially so those of the hind limbs."—*Anderson.*

SIZE.—Head and body, 8 inches; tail, 8 inches.

Jerdon says it is found at elevations of 3000 to nearly 6000 feet.

No. 306. PTEROMYS FUSCOCAPILLUS.

Sciuropterus of Jerdon, No. 167.

The Small Travancore Flying Squirrel.

HABITAT.—Southern India and Ceylon.

DESCRIPTION.—Upper parts rufous chestnut according to Kellaart,

so named it *Sciuropterus Layardii*; rufescent fulvous or dark brownish isabelline hue, as Jerdon describes it; the fur dusky blackish colour for three-fourths of its length; the tips coarser and coloured rufous chestnut (*Kellaart*); hairs fuscous with a fulvous tip (*Jerdon*); two-thirds of the base dusky ashy, the remainder reddish-brown with a black tip (*Anderson*); the ears are moderate in size, posteriorly ovate with a long pencil of blackish hairs at the base of the posterior margin and at the external surface of the upper angle; cheek bristles well developed; the cheeks white, washed with yellowish, as also before the ears; the margin round the eyes blackish; the parachute is dark brown above washed with pale brown, and the edge is pale yellow; lower parts yellowish-white; the tail is very bushy, and not distichous in the adult, though partially so in the young; it is sometimes yellowish-brown, sometimes dusky brown, especially in the latter half, the under surface being pale brown at the base, passing into blackish-brown. Kellaart says of the Ceylon specimens: "Tail flat and broad, of a lighter chestnut above, washed with black, and under surface of a deep black, except at tip," but apparently he had only one specimen to go upon, and therefore we cannot accept his observations as conclusive.

SIZE.—Head and body, $7\frac{3}{4}$ inches; tail, $6\frac{3}{4}$ inches with hair.

No. 307. PTEROMYS FIMBRIATUS.

Sciuropterus of Jerdon, No. 164.

The Grey Flying Squirrel.

HABITAT.—North-west Himalayas.

DESCRIPTION.—Fur long, soft greyish, with sometimes a tinge of brown; the hairs are grey at the base, then brown with a black tip; face white; orbits dark brown; chin and under-parts white; the tail is broad, bushy, and rather tapering, more or less fulvous washed with black, black towards the tip; the feet are broad, and according to Dr. Gray the outer edges of the hind feet have a broad fringe of hair, whence probably its specific name; but Dr. Anderson is of opinion that this character is unreliable.

SIZE.—Head and body, 12 inches; tail, 11 inches.

Blyth's *S. Barbei* was probably the same as this; he had only drawings and assertions to go upon. The species is extremely doubtful.

No. 308. PTEROMYS ALBONIGER.

Sciuropterus of Jerdon, No. 165.

The Black and White Flying Squirrel.

NATIVE NAMES.—*Khim*, Lepcha; *Piam-piyu*, Bhotia.

HABITAT.—Nepal, Sikim, Bhotan, Assam, Sylhet, Burmah, Western Yunnan and Cambodia.

DESCRIPTION.—Dr. Anderson says the name applied to the species is not appropriate, as many individuals have the upper parts more or less yellowish, but it is dark above, blackish, faintly washed with hoary or rufous; white beneath with a slight yellow tinge; the ears and feet flesh-coloured.

Jerdon says the young are pure black and white; the teeth are bright orange red.

SIZE.—Head and body, 11 inches; tail, 8¼ to 9 inches.

Jerdon procured it near Darjeeling; it frequents elevations from 3000 to 5000 feet.

No. 309. PTEROMYS SPADICEUS.

The Red Flying Squirrel.

NATIVE NAME.—*Kywet-shoo-byan*, Arakanese.

HABITAT.—Arakan.

DESCRIPTION.—Upper parts bright ferruginous bay; under parts woolly and dull white; the membrane, limbs, and tail dusky; the terminal third of the tail pale rufous.

SIZE.—Head and body, 5 inches; tail, 4¼ inches.

ARCTOMYDINÆ—THE MARMOTS.

Stout-bodied, short-tailed animals, with a rudimentary thumb with a flat nail. They are gregarious and terrestrial, living in burrows, where they store provisions against inclement seasons. Some of the genera have cheek pouches, but the true marmots, such as our Indian species, have not. They differ somewhat in dentition from the squirrels in having the first upper molar somewhat larger, and the other molars also differ in having transverse tubercles on the crown. The first upper tooth is smaller than the rest; the ears are short and round, as is also the tail; the hind-feet have five toes, the fore-feet a tubercle in the place of the thumb.

GENUS ARCTOMYS.

Stout body, short tail, large head and eyes, no cheek pouches, mammæ ten to twelve.

Dental formula: Inc., $\frac{1-1}{1-1}$; pre-molars, $\frac{1-1}{1-1}$; molars, $\frac{4-4}{3-3}$.

No. 310. ARCTOMYS BOBAC.

Thibet Marmot of Jerdon, No. 168.

The Bobac, or Poland Marmot.

NATIVE NAMES.—*Brin*, Kashmiri; *Kadia-piu*, Thibetan; *Chibi*, Bhotia; *Lho*, or *Potsammiong*, Lepcha.

HABITAT.—The Himalayan range from Kashmir to Sikim, in Thibet, Ladakh, Yarkand, also throughout Central Asia and Eastern Europe from the south of Poland and Gallicia over the whole of Southern Russia and Siberia, to the Amoor and Kamtchatka.

DESCRIPTION.—Above sub-rufescent cat-grey, washed with blackish brown on the back and sides and front of face, rufescent yellow beneath; the hind limbs more rufous; fur close, adpressed, rather harsh; tail with a black tip.

The hairs are tinged with three bands of dusky rufescent yellow and blackish-brown, the latter being most intense on the face, forehead, head and back (*see* 'P. Z. S.' 1871, p. 560). In the plate given in the report by Mr. Blanford on the mammalia collected during the second Yarkand Mission the back is somewhat barred with dark brown, as is also the tail. The sexes are alike, and of nearly equal size.

SIZE.—Head and body, about 24 inches; tail, 5 to 6 inches. This animal is seldom found at a lower elevation than 12,000 feet, and from that to 16,000 feet according to Jerdon, but Dr. Stoliczka noticed it in Ladak at a height of 17,800 feet.

"It burrows in the ground, living in small societies, and feeding on roots and vegetables. It lifts its food to its mouth with its fore-feet. It is easily tamed. One was brought alive to Calcutta some years ago, and did not appear, says Mr. Blyth, to be distressed by the heat of that place. It was quite tame and fearless, and used to make a loud chattering cachinnation. It was fond of collecting grass, &c., and carrying it to its den. Travellers and sportsmen often meet with this marmot, and speak of its sitting up in groups, and suddenly disappearing into its burrows. The cured skins form an important item of commerce, and are brought to Nepal, and in great numbers to China" (*Jerdon*). Mr. Blanford, in alluding to the conditions under which marmots are liable to produce permanent varieties, says: "each colony or group being isolated, and frequently at a distance of many miles from the next colony, the two in all probability rarely, if ever, breed with each other." Therefore several which are recorded as distinct species may in time be proved to be merely varieties of one. Mr. Blanford keeps to the specific name *Himalayanus* of Hodgson in his report.

No. 311. ARCTOMYS CAUDATUS.

The Red Marmot.

NATIVE NAME.—*Drun*, Kashmiri.

HABITAT.—The North-western Himalayan range. It is found in Kashmir, the Wurdan Pass, Ladakh, the valley of the Dras river.

DESCRIPTION.—General colour rufous-ochreous, darkest above, "the tips of the hairs are washed with black, which is most intense on the back from the occiput to the lumbar region; pale yellow on the shoulders, which have few, if any, black-tipped hairs, and also along the sides, which are nearly free from them; chin, throat, belly, fore-legs and inside of front of lower limbs deep rusty red; the outside of thighs pale rufous yellow, with a few black-tipped hairs; greyish hairs around the lips; cheeks washed with blackish; a large deep black spot on the upper surface of the nose; the rest of the front of the face rufous yellow; tail black, washed more or less with yellowish-grey, the last four inches black; the fur coarse and nearly 2½ inches in length, loose and not adpressed; the black tips are not very long, and the yellow shows through them as a rule, but there are patches where they wholly obscure it; the base of the hair generally is rather rufous dark brown, and is succeeded by a broad rufous yellow band followed by the apical black one. Palm, including nails, 2 1/2 inches; sole, including nails, 3 1/2 inches; the heel is more sparsely clad with hairs along its margin than is the tarsus of *A. bobac*" (*Dr. J. Anderson*, 'P. Z. S.' 1871, pp. 561, 562). Mr. Blanford, who writes of this as *Arctomys caudatus* of Jacquemont, being of opinion that Hodgson's *A. Hemachalanus* is a smaller and differently-coloured species, and doubting whether *A. caudatus* inhabits the Eastern Himalayas, says: "*Arctomys caudatus* is one of the largest species of marmot, being nearly two feet long exclusive of the tail, which measures with the hairs at the end half as much more. The general colour is yellowish-tawny, more or less washed with black on the back, and with all the under-parts and limbs rusty red. In some specimens (males?) the back is much blacker than in others, the hairs being dusky or black throughout, whilst other specimens have only the tips of the hairs black." I am inclined to think that Mr. Blanford is right, for Jerdon thus describes *A. Hemachalanus*: "General colour dark grey, with a full rufous tinge, which is rusty, and almost ochreous red on the sides of the head, ears, and limbs, especially in summer; the bridge of the nose and the last inch of the tail dusky brown; head and body above strongly mixed with black, which he equals or exceeds the pale one on these parts; claws long; pelage softer and fuller than in the last."

SIZE.—Jerdon says of the *drun*: "Head and body, about 13 inches."

Now the size given in the 'P. Z. S.' above quoted is, "length, 22 inches from tip of nose to vent; tail, 10½ inches, exclusively of the hair, nearly half the length of the body and head." This agrees better with Mr. Blanford's account.

No. 312. ARCTOMYS HEMACHALANUS.

The Eastern Red Marmot (Jerdon's No. 169).

NATIVE NAMES.—*Sammiong*, Lepcha; *Chipi*, Bhotia.

HABITAT.—The Eastern Himalayas, Sikim, Nepal.

DESCRIPTION.—As given above by Dr. Jerdon.

SIZE.—Head and body, 13 inches; tail, 5½ inches. Hodgson kept some of this species in his garden for some time. They were somnolent by day, active by night, and did not hybernate in Nepal. They were fed on grain and fruit, and would chatter a good deal over their meals, but in general were silent. They slept rolled up into a ball, were tame and gentle usually, but sometimes bit and scratched like rabbits, uttering a similar cry.

No. 313. ARCTOMYS AUREUS.

The Golden Marmot.

HABITAT.—Yarkand, Kaskasee pass, 13,000 feet, on the road from Kashgar to Sarikol and the Pamir.

DESCRIPTION—after Blanford, who described and named this species ('Jour. As. Soc. Beng.' 1875): "General colour tawny to rich brownish-yellow, the dorsal portion conspicuously tinged with black from all the hairs having black tips, but these are far more conspicuous in some specimens (males ?) than in others; face grey to blackish, with a rufous tinge covered with black and whitish hairs mixed, about half an inch long on the forehead. The black hairs on the face are more prevalent in those specimens (perhaps males) which have the blackest backs; the middle of the forehead is in some cases more fulvous. On the end of the nose is a blackish-brown patch, and there is a narrow band of black hairs with a few white mixed round the lips; the sides of the nose are paler; whiskers black. Hairs of the back, 1¼ to 1½ inches long, much mixed with woolly fibres, dark slaty at the extreme base for about a quarter inch, then pale straw colour, becoming deeper golden yellow towards the extremity, the end black. In the blackest specimens the black tips are wanting on the posterior portion of the back. Tail yellow, the same colour as the rump, except the tip, which is black, from a length varying from an inch to about 2½ inches (in three specimens out of four it does not exceed an inch); hairs of the tail about two inches long, brown at the base. Lower parts rather browner, and sometimes

with a rufous wash; the hairs shorter and thinner, chocolate brown at the base without the short woolly under fur, which is very thick on the back. Feet above yellowish-tawny, like the sides" ('Scientific Results of the Second Yarkand Mission'; Mammalia).

SIZE.—Head and body, 16 to 18 inches; tail, 5 to 6 inches. Though this agrees in size with *A. Hemachalanus* it differs considerably in colour, and, according to Mr. Blanford, also in the skull. There is a beautifully drawn and coloured plate of this marmot in the work from which I have just quoted; also of *A. Himalayanus* and *A. caudatus*.

No. 314. ARCTOMYS DICHROUS.

HABITAT.—Afghanistan; mountainous country north of Cabul.

DESCRIPTION.—Less yellow than the last, without any black on the back, and having the upper parts pale dull tawny, and the lower rufous brown. The tail concolorous with the belly, tinged here and there with rich rufous brown, the tip paling to nearly yellowish-brown.

SIZE.—Head and body, 17 inches; tail, 6½ inches.—*Anderson*, 'Ann. and Mag. Nat. Hist.,' vol. xvi. 1875.

No. 315. ARCTOMYS ROBUSTUS.

Is a Thibetan species, described by Prof. Milne-Edwards, 'Recherches sur les Mammifères,' p. 309. I have not the work by me just now.

SECTION II.—MYOMORPHA—RAT-LIKE RODENTS.

The second section of the order GLIRES, containing the following families—those that are not Indian being in italics:—

Myoxidiæ, *Lophiomyidæ*, Muridæ, Spalacidæ, *Geomyidæ*, *Theridomyidæ* (fossil), Dipodidæ.

The molar dentition is from $\frac{3-3}{3-3}$ to $\frac{6-6}{6-6}$, the former being the usual number; the tibia and fibula are united for at least a third of their length; the zygomatic arch is slender, and the malar process rarely extends so far forwards as in the preceding section, and is generally supported below by a continuation of the maxillary zygomatic process; the collar-bones are perfect (except in *Lophiomyidæ*). Upper lip cleft; the muffle small and naked; tail cylindrical, sometimes hairy, but commonly covered with scales arranged in rings.

In all the Indian mammalogy this section is probably the most difficult to write about. Our knowledge of the smaller rodents is

extremely imperfect, and is just engaging increased attention. In the meanwhile I feel that, while I make use of such material as is now available, before long much will have to be revised and corrected after the exhaustive inquiries now being made by Dr. Anderson are published.

The Indian families with which we have to deal are but three—the *Muridæ*, *Spalacidæ*, and the *Dipodidæ*. The *Arvicolidæ* of Jerdon's work is merely a sub-family of *Muridæ*. Of these the *Muridæ* take the first place, as containing the greater number of genera. It is estimated that the total number of species known of this family throughout the world exceed 330, of which probably not more than one-fourth or fifth are to be found in India and adjacent countries.

FAMILY MURIDÆ.

CHARACTER.—"Lower incisors compressed; no premolars; molars rooted or rootless, tuberculate or with angular enamel folds; frontals contracted; infra-orbital opening in typical forms high, perpendicular, wide above and narrowed below, with the lower root of the maxillary zygomatic process more or less flattened into a perpendicular plate; very rarely the opening is either large and oval, or small and sub-triangular. Malar short and slender, generally reduced to a splint between the maxillary and squamosal processes; external characters very variable; pollex rudimentary, but often with a small nail; tail generally sub-naked and scaly, rarely densely haired."—*Alston*, 'P. Z. S.' 1876.

This family is divided into about ten sub-families, of which the Indian ones are as follows: *Platacanthyominæ; Gerbillinæ; Phlæomyinæ; Murinæ; Arvicolinæ; Cricetinæ.*

The other four are *Sminthinæ*, *Hydromyinæ*, *Dendromyinæ*, and *Siphneinæ*, none of which are found within our limits.

GENUS PLATACANTHOMYS.

CHARACTER.—Molars $\frac{3}{3}$, divided into transverse laminæ; infra-orbital opening as in typical *Muridæ;* incisive foramina and auditory bullæ small; form *myoxine* (or dormouse-like); fur mixed with flat spines; tail densely hairy. The general resemblance of this animal to the dormouse (*Myoxus*) is striking, to which its hairy tail and its habits conduce, but on closer examination its small eyes, thin ears, short thumb of the fore-foot bring it into the murine family. The genus was

first noted and named by Blyth, who seemed inclined to class it as a dormouse, but this has not been upheld for the reasons given above, and also that *Platacanthomys* has the normal *murine* number of molars, viz.: $\frac{3-3}{3-3}$, whereas *Myoxus* has an additional premolar above and below. These points were first brought to notice by Prof. Peters of Berlin (*see* 'P. Z. S.' 1865, p. 397. There is a coloured plate of the animal in the same volume, but it is not so well executed as most of the illustrations in the Society's works.

No. 316. PLATACANTHOMYS LASIURUS.

The Long-tailed Spiny Mouse (*Jerdon's No.* 198).

HABITAT.—Southern India.

DESCRIPTION.—Light rufescent brown; the under fur paler, more rufous on the forehead and crown; whiskers black; under parts dull white; the hairs on the tail, which are arranged distichously, are darker than those of the body, infuscated except at the tip of the tail, where they are whitish; the muzzle is acute; ears moderate and naked; the fur above is mixed densely with sharp flat spines; the under coat is delicate and fine; the few spines on the lower parts are smaller and finer; the thumb is without a nail.

SIZE.—Head and body, 6 inches; tail, $3\frac{1}{2}$, or five inches including the hair; planta, 1 inch.

This species was discovered by the Rev. Mr. Baker in the Western Ghâts of Malabar, and in Cochin and Travancore, at an elevation of about 3000 feet. He writes of it: "It lives in clefts in the rocks and hollow trees, and is said to hoard ears of grain and roots, seldom comes into the native huts, and in that particular neighbourhood the hillmen told me they are very numerous. I know they are to be found in the rocky mountains of Travancore, but I have never met with them on the plains." In another place he adds: "I have been spending the last three weeks in the Ghâts, and, amongst other things, had a great hunt for the new spiny dormice. They are most abundant, I find, in the elevated vales and ravines, living only in the magnificent old trees there, in which they hollow out little cavities, filling them with leaves and moss. The hill people call them the 'pepper-rat,' from their destroying large quantities of ripe pepper (*Piper nigrum*). Angely and jackfruit (*Artocarpus ovalifolia* and *integrifolia*) are much subject to their ravages. Large numbers of the *shunda* palm (*Caryota*) are found in these hills, and toddy is collected from them. These dormice eat through the covering of the pot as suspended, and enjoy themselves. Two were brought to me in the pots half drowned. I procured in one morning sixteen specimens. The method employed in obtaining them was to

...e long bamboos (with thin little branches left on them to climb by) to the trees; and, when the hole was reached, the man cut the entrance large enough to admit his hand, and took out the nest with the animals rolled up in it, put the whole into a bag made of bark, and brought it down. They actually reached the bottom sometimes without being disturbed. It was very wet, cold weather, and they may have been somewhat torpid; but I started a large brown rat at the foot of one of these trees, which ran up the stem into a hole, and four dormice were out in a minute from it, apparently in terror of their large friend. There were no traces of hoarding in any of the holes, but the soft bark of the trees was a good deal gnawed in places. I had two of these dormice alive for some time, but, as they bit and gnawed at everything intended to keep them in durance, I was obliged to kill both. I noticed that when their tails were elevated, the hairs were perfectly erect like a bottle-brush" ('Proc. As. Soc. Beng.' 1859, p. 290).

SUB-FAMILY GERBILLINÆ.

Incisors narrow; molars divided into transverse laminæ; pterygoid fossæ short; auditory bullæ usually large; hind limbs very long; tail long and hairy.

GENUS GERBILLUS.

Form murine, with the exception of the elongated hind-limbs; muzzle pointed; ears moderate and oval; eyes very large and bright; occipital region broad; auditory bullæ large; upper incisors grooved; first molar with three laminæ, the second with two, and third with one only; hinder tarsus and toes much elongated; the fore-limbs small; tail long and hairy, with a tuft at the end.

No. 317. GERBILLUS INDICUS.

The Indian Jerboa-Rat, or Kangaroo-Rat (Jerdon's No. 170).

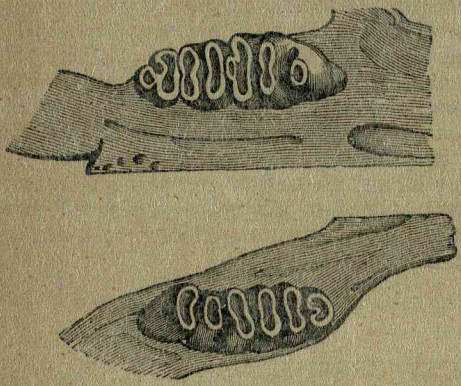
NATIVE NAMES.—*Hirna-mus*, Hindi; *Jhenku-indur*, Sanscrit and Bengali; *Yeri-yelka* of the Waddurs; *Tel-yelka* of the Yanadees; *Billa-ilei*, Canarese.

HABITAT.—All over India and in Ceylon, but apparently not in Burmah.

DESCRIPTION.—Light fulvous brown above or fawn colour, paling on the sides; under-parts white; the hairs of the back are ashy at the base.

...th fulvous tips, a few thin black hairs intermixed chiefly on the side and cheeks.

The eyebrow is whitish; whiskers long and black and a few grey; the nose is elongated; the upper jaw projecting nearly half an inch beyond the lower; tail, which is longer than the body, is blackish above and below, pale laterally, and terminates with a black tufted tip; the ears are large and nearly naked; the eye is particularly large and lustrous, which, with its graceful bounds, have given it its Indian name of "antelope-rat" (*Hirna-mus*).



Dentition of *Gerbillus* (magnified).

SIZE.—Head and body, about 7 inches; tail, 8½ inches; fore-foot, $\frac{5}{10}$ inch; hind-foot, 2 inches. Weight, 6¾ ounces.

This graceful little creature frequents bare plains and sandy country in general, where it forms extensive burrows. Hardwicke writes of it: "These animals are very numerous about cultivated lands, and particularly destructive to wheat and barley crops, of which they lay up considerable hoards in spacious burrows. A tribe of low-caste Hindus, called Kunjers, go in quest of them at proper seasons to plunder their hoards, and often within the space of twenty yards square find as much corn in the ear as could be crammed in a bushel." Sir Walter Elliot's account of their burrows is most interesting. He says: "The entrances, which are numerous, are small, from which the passage descends with a rapid slope for two or three feet, then runs along horizontally, and sends off branches in different directions. These galleries generally terminate in chambers from half a foot to a foot in width, containing a bed of dried grass. Sometimes one chamber communicates with another furnished in like manner, whilst others appear to be deserted, and the entrances closed with clay. The centre chamber in one burrow was very large, which the Wuddurs attributed to its being the common apartment, and said that the females occupied the smaller ones with their young. They do not hoard their food, but issue from their burrows every evening, and run and hop about, sitting on their hind legs to look round, making astonishing leaps, and on the slightest alarm flying into their holes." This account differs from that of Hardwicke as regards the hoarding of food, and from what I can learn is the more correct.

The food of this animal is grain, grass, and roots, but Kellaart mentions certain carnivorous propensities, for one night several of them nearly devoured an albino rat which had been put into the same cage with them. McMaster says of its agility: "I have seen them when released from a trap baffle and elude dogs in the most extraordinary manner by wonderful jumps made over the backs, and apparently into the very teeth of their pursuers."

Buchanan-Hamilton's assertion that "these animals live in holes which they dig in the abrupt banks of rivers and ponds" is misleading. They may do so occasionally, but in general they choose sandy plains. The female is prolific, bringing forth from eight to twelve young ones, and Dr. Jerdon states that it is said to have occasionally as many as sixteen to twenty. With regard to Kellaart's accusation of its being carnivorous at times, I may say I have noticed such tendencies amongst several other rodents which are supposed to be purely vegetarians. I have also known ruminants take to flesh-eating when opportunity offered.

No. 318. GERBILLUS HURRIANÆ.

The Desert Jerboa-Rat (*Jerdon's No.* 171).

HABITAT.—The sandy deserts west of the Jumna and Hurriana; also in Afghanistan according to Horsfield's Catalogue, and probably in Rajpootana, Sindh, and the Punjab.

DESCRIPTION.—Pale rufous or sandy above, with fine dusky lines, the hairs being blackish at the base, the rest fawn coloured, with a blackish tip very minute; sides paler, with fewer dusky lines; under-parts white, tinged more or less with fulvous or fawn on the belly; limbs pale fawn; orbits pale; whiskers whitish, a few of the upper ones dark; tail yellowish-rufous or fawn colour throughout, with a line of dusky brown hairs on the upper surface of the terminal half, gradually increasing in length to the tips.

SIZE.—Smaller than the last species. Head and body, 5 inches; tail, 4½.

Jerdon says of this rat that it is "exceedingly numerous in the sandy downs and sand-hills of Hurriana, both in jungles and in bare plains, especially in the former, and a colony may be seen at the foot of every large shrub almost. I found that it had been feeding on the kernel of the nut of the common *Salvadora oleifolia*, gnawing through the hard nut and extracting the whole of the kernel. Unlike the last species, this rat, during the cold weather at all events, is very generally seen outside its holes at all hours, scuttling in on the near approach of any one, but soon cautiously popping its head out of its hole and again issuing forth. In the localities it frequents it is far more abundant than I have ever seen *G. Indicus* in the most favourable spots" ('Mammals of India,' p. 186).

No. 319. GERBILLUS CRYPTORHINUS.

The Lobe-nosed Jerboa-Rat.

HABITAT.—Yarkand.

DESCRIPTION—after Mr. Blanford, who first described and named the species: "Colour above sandy rufescent, some specimens rather more rufous than others; below white, the two colours sharply divided on the sides; cheeks pale; supercilia whitish; feet white; tail above rather more rufous than the back, paler and occasionally whitish below, becoming dark brown or blackish above near the end, and with the slight tuft of longer hairs at the end of the same dark colour; fur soft and glossy, about half an inch long in the middle of the back, all the basal portion being at least three-quarters of the length, dark ashy; the terminal portion pale yellow brown to pale rufous, with numerous longer hairs with black tips mixed; on the under surface the hairs are white throughout; on the tail the hair is rather short, coarse, and close together; there are a very few longer black tips mixed, but scarcely enough to produce an effect in the general colour.

"The ears are oval and of moderate length, densely clad with brown hairs on the anterior portion of the outer surface, and with a fringe of longer hairs on the anterior margin; the posterior portion of the external surface is nearly naked, except near the margin, and the anterior portion of the inner surface is completely destitute of hair, but the inner surface is more hairy near the hinder margin. The whiskers are very numerous, the longest slightly exceeding the head; the uppermost behind being black, all the rest white; all are mixed at the base with long hairs, which cover the side of the nose; soles of the fore-feet with scattered white hairs, but nearly naked; those of the hind-feet densely covered with hair everywhere except at the extreme tips of the toes and at the heel.

"Mammæ, eight—four pectoral and four inguinal, as usual in the genus.

"The most remarkable character of these species is the presence at the end of the snout of a semi-circular lobe, which forms a flap completely covering the openings of the nostrils. This lobe can, of course, only be well seen in the specimens preserved in spirit. In the dried skin its presence can sometimes be detected, but not always. In the only spirit specimen, an adult female, the flap measures about 0·3 inch in breadth, and is barely an eighth of an inch long.

"It is hairy both outside and inside, the hairs being very short and rather scattered inside; the surface below the nostrils covered by the flap is also hairy. The use of this lobe is evidently to keep out sand and dust from the air passages" (W. T. Blanford's 'Mammalia of the Second Yarkand Mission,' p. 56).

SIZE.—Head and body, about 5½ inches; tail, 5 inches; length of fore-foot, 0·5 inch; hind-foot, 1·4 inch.

The peculiarity of the lobe, which was first detected by Mr. Oscar Fraser in removing a skull from a spirit specimen, distinguishes this species from the other Asiatic forms. There is also a peculiarity in the skull noticed by Mr. Blanford, which is that the lachrymal process, instead of being anchylosed to the adjoining bones, as in others of the genus, is free, and this species is therefore distinguished from the one most resembling it, *G. unguiculatus* from Chinese Mongolia, in which the lachrymal process is united to the frontal.

No. 320. GERBILLUS ERYTHRURUS.

The Red-tailed Jerboa-Rat.

HABITAT.—Afghanistan and Persia.

DESCRIPTION.—Rufous brown above, with a few long black hairs, more numerous on the rump and thighs; under fur slaty; under-parts white, gradually blending with the colour of the sides; ears much larger than in the last species, hairy outside and near the margin inside; soles of hind feet and toes thickly covered with hair, except on the hinder half of the tarsus; tail very rufous—brown with a black tip, black hairs are scattered along the upper surface, and form a black band towards the end above, finally covering the whole tip.

SIZE.—Head and body, about 6 inches; tail, equal.

Mr. Blanford, to whose 'Eastern Persia' I am chiefly indebted for the above description, writes: "From *G. Hurrianæ*, which Jerdon thought might probably be the same, the present form is distinguished by its much larger ears and by the hind feet, and especially the toes, being more thickly covered with hair beneath; the fur too is longer and the colour browner on the back; the tail is more rufous, and the tip blacker; the skull is larger and broader; the nasal portion more elongate and less concave above, and the hind upper molar has a distinct talon, or rudimentary second transverse ridge, in young specimens, traces of which may be detected in the form of the worn tooth."

Its habits are similar to those of the last species.

No. 321. GERBILLUS NANUS.

The Dwarf Jerboa-Rat.

HABITAT.—Baluchistan.

DESCRIPTION.—The fur is soft and long, rufous brown or fawn colour above, white below, the colours being less sharply distinguished than in *G. Indicus*; the hairs of the upper parts have no black tips, and the

basal two-thirds are slaty grey. There is a broad white supercilium in front, joining the white area of the sides of the face, so that the brown of the nose is reduced to a rather narrow band; ears almost naked, a few short whitish hairs near the edge only; whiskers nearly all white; a few of the upper hairs brown near the base; feet white above, naked beneath, tail light brown above, whitish beneath; towards the end a band of darker brown hairs runs along the upper portion, those at the end lengthened; but there is a less marked tuft than usual, and there are no black hairs at the end (Blanford's 'Eastern Persia,' vol. ii. p. 72, *with plate*).

SIZE.—Head and body, 2·6 inches; tail, exclusive of hair, 4·5 inches; hair, 0·55 inches.

This curious little animal was first found and named by Mr. W. T. Blanford, who obtained two specimens, with others of *G. Hurrianæ*, in a large area of ground that was flooded. He at first supposed them to be the young of *G. Indicus*, but found on subsequent examination that they were full grown.

SUB-FAMILY PHLŒMYINÆ.

Incisors broad; molars divided into transverse laminæ; infra-orbital opening typical; claws large.

GENUS NESOKIA.

Muzzle blunt; ears moderate; claws long; fur rather harsh; tail short, scaly, sparsely haired; palate narrow; incisive foramina short; auditory bullæ rather small; incisors broad; first molars with three laminæ, the rest with only two.—*Alston.*

There has been some confusion regarding the species of this genus. Jerdon, in his 'Mammals of India,' gives only two, including *Arvicola Indica* and *Mus kok* of Gray, *Mus providens* of Elliot, and *Mus pyctoris* of Hodgson, under *Nesokia Indica*, and classifying *Nesokia Huttoni* with *N. Hardwickii*; but Dr. Anderson, after a most careful examination of specimens from all parts of India, has proved the distinctness of *Mus providens vel kok* from the species called by Jerdon *Nesokia Indica*, which, being a synonym of *N. Hardwickii*, he has now renamed *Mus* (*Nesokia*) *Blythianus* (*see* 'Jour. As. Soc. Beng.' 1878, vol. xlvii. pt. ii.), and Mr. Blanford had clearly demonstrated that *N. Huttoni* is a distinct species from *N. Hardwickii* ('Zool. of Persia,' vol. ii. p. 59).

No. 322. NESOKIA HARDWICKII.

Hardwick's Field-Rat (*Jerdon's No.* 173).

HABITAT.—North-western India.

DESCRIPTION.—General colour sandy brown on the upper parts, paler on the sides, dusky grey, with a tinge of yellowish-rufous on the under-parts; muzzle, feet, and tail flesh-coloured; ears of the same, but rather darker; head short and bluff; muzzle broad and deep; eye moderately large; ears moderate, rounded, clad with minute hairs; fur soft and moderately long, of three kinds, viz. short under-fur, ordinary hairs, and mixed with them, especially on the back and rump, numerous long black hairs which project a good way beyond the fur.

SIZE.—Head and body, nearly 8 inches; tail, about 4½ inches.

It is probable that this species is identical with *Mus Griffithi*, though the dimensions given by Horsfield ('Cat. Mam. Mus. E. I. Comp.') and the description do not quite agree. He gives the size of head and body at 6½ inches; tail, 3 inches, and says that the teeth are nearly white.

No. 323. NESOKIA HUTTONI.

Hutton's Field-Rat.

HABITAT.—Northern India, Afghanistan and Persia.

DESCRIPTION.—Colour above from ferruginous brown to sandy brown, lower parts isabelline, but frequently appear dark in consequence of the fur being thin or worn; the basal portion dark slaty grey both above and below the animal; hairs on the back soft and of moderate length, a very few black hairs being scattered amongst the brown ones; tail naked, and ears almost naked, the latter having only a few extremely short hairs, thinly scattered, and the feet are covered above very sparsely with short whitish hairs (*see* Blanford's 'Persia,' vol. ii., for description and plate). Nose and feet flesh-coloured; ears and tail darker and brownish; mammæ eight, as usual in the genus.

According to Dr. A. Barclay (quoted by Dr. Anderson) the holes of this rat do not run deep, but ramify horizontally just below the surface of the ground. It throws out a mound of earth at the exit of the hole.

No. 324. NESOKIA SCULLYI.

Scully's Field-Rat.

NATIVE NAME.—*Mughi*, Turki.

HABITAT.—Kashgaria at Sanju, south-east of Yarkand.

DESCRIPTION.—Light rufescent brown above, dirty white beneath; fur fine and silky, blackish-grey at the base, and for two-thirds, the last third of the longer hairs being fawn colour; face earthy brown;

whiskers black, tipped with white; ears very short, semi-nude; feet and claws flesh-coloured; tail naked, with a few scattered fine short hairs.

SIZE.—Head and body, 6·6 inches; tail, 5·2 inches.

No. 325. NESOKIA PROVIDENS.

The Southern India Field-Rat (*Jerdon's No.* 172).

NATIVE NAMES.—*Kok*, Canarese; *Golatta-koku*, Telegu of the Yanadees; *Yea-kwet* (?) Burmese.

HABITAT.—Southern India and Ceylon, probably Burmah, as one species is mentioned there by Blyth.

DESCRIPTION.—Head short and truncated, with a deep muzzle; ears nearly round, semi-nude, sparsely covered with minute hairs; eyes moderately large, half-way between snout and ear; feet largish; claws short and stout; tail nearly equalling length of head and body, semi-nude, ringed, and with short brown bristly hairs round the margin of the annuli; whiskers full and long; colour of the fur—which is harsh and long, as in the rest of the genus, and of the usual three kinds—is a brown, mixed with a tinge of fawn; the under-parts are whitish, with a yellowish tinge; the nose, ears, and feet are dark flesh-coloured or brownish, and the feet are covered with short brown hair. The incisors are orange yellow; the claws yellowish.

Sir Walter Elliot states that a variety found in red soil is much redder in colour than that inhabiting the black land. The skull is considerably smaller, according to Dr. Anderson, than that of the Bengal *Nesokia, N. Blythiana*, of the same age, from which it is also distinguished by its more outwardly arched malar process of the maxillary; by its considerably smaller teeth and long but less open anterior palatine foramina. The brain case is also relatively shorter and more globular than that of *Nesokia Blythiana*.

SIZE.—Head and body, about 7 inches; tail, 6½ inches.

The habits of this rat are similar to those of the Bengal species, to which I will allude further on, and it has the same way of taking to water when pursued.

Jerdon says that this rat is most destructive to tea-trees, biting the roots just below the surface, more, he believes, because they happen to come in the way of their burrows than to feed on them.

Sir Walter Elliot writes: "In its habits it is solitary, fierce, living secluded in spacious burrows, in which it stores up large quantities of grain during the harvest, and when that is consumed lives upon the *huryale* grass and other roots. The female produces from eight to ten at a birth, which she sends out of her burrow as soon as they are able to provide for themselves. When irritated it utters a low grunting cry, like the bandicoot. The race of people known by the name of

Vuddurs, or tank-diggers, capture this animal in great numbers as an article of food, and during the harvest they plunder their earths of the grain stored up for their winter consumption, which in favourable localities they find in such quantities as to subsist almost entirely upon it during that season of the year. A single burrow will sometimes yield as much as half a seer (1 lb.) of grain, containing even whole ears of jowaree (*Holchus sorghum*)." Sir Walter Elliot goes on to give a most interesting account of the construction of the burrows of this animal.

No. 326. NESOKIA BLYTHIANA.

The Bengal Field-Rat.

NATIVE NAME. — *Yenkrai*, Bengalee.

HABITAT.—From Ghazipur in the North-west to Eastern Bengal and Cachar. Very common about Calcutta.

DESCRIPTION.—Fur coarse as in the genus, profusely intermixed with long piles, more numerous on the lumbar and sacral regions, which project a long way beyond the ordinary pelage. The general colour a dark brown with yellowish hairs intermingled, which give a somewhat rufous tinge, paler beneath. Nose, ears, and feet flesh-coloured; tail naked, ringed, and sparsely covered with short bristly hairs at the margin of the rings; feet moderately large; claws short and stout; eyes moderately large, placed a little nearer to the ear than to the snout; ears rounded, semi-nude, covered with a fine down; whiskers black; incisor teeth rich orange, but generally white towards their tips.

The female has eight pairs of mammæ.

SIZE.—Head and body, 8¼ inches; tail, 6½ inches.

I have already alluded to the distinguishing features of the skull of this species, as compared with *Nesokia providens*. From the skull of *N. Hardwickii* it differs in its considerably narrower incisors and smaller and more irregularly laminated molars, and by its long and open anterior palatine foramina. It has also a more arched skull (*Anderson*).

This animal, which is included in Jerdon's *Nesokia Indica*, is very generally distributed over Lower Bengal. In the neighbourhood of Calcutta, Alipore for instance, it is abundant, and is a great nuisance in gardens. It burrows in tortuous directions, only a few inches below the ground, there being no definite plan, some being more complicated than others—the principal passage leading to a chamber containing a nest of leaves and grass. I have been told by natives that large quantities of grain are stored by these rats. When I first heard of its aquatic powers, I was led to believe that it was a species of vole, and was particularly desirous to get one, not being aware of any true water-rat in India. However, the reports of the natives have been confirmed by what Sir Walter Elliot states regarding the habits of *N. providens*,

and by Dr. Anderson, who made several experiments with these rats in captivity. He says: "To test this aquatic power, I had two rats placed in a large wire birdcage, and the cage partially submerged; if the rats, when in those circumstances, were much annoyed, they immediately dived to the bottom of the cage, where they could be observed running about under water. I also had them removed from the cage, and let loose in the large sheet of water in the Zoological Gardens, between the two iron bridges. When let loose at the bank, and an attempt was made to catch them, they immediately dived; and the stronger of the two did not appear at the surface for some time, when it was observed at a considerable distance from the bank making for the opposite side."

In confinement these rats are not engaging pets; they show a considerable amount of surliness and ferocity. I have noticed that on approaching the bars of the cage, one would grind its teeth, put back its ears, and fly at you with a grunt.

No. 327. NESOKIA BARCLAYIANA.

Barclay's Field-Rat.

HABITAT.—Northern India, the North-west and some parts of Bengal (Purneah) and Assam.

DESCRIPTION.—General colour brownish; under surface silvery grey; feet and muzzle flesh-colour; tail nearly black; claws horny white; a white band from the nose through the eye; muzzle short and bluff; forehead slightly arched; tail exceeding the length of the trunk, but not equal to head and body, ringed, and sparsely clad; fur coarse; piles moderately long.

SIZE.—Head and body, about $8\frac{3}{4}$ inches; tail, $7\frac{1}{4}$ inches.

This rat was first discovered by Dr. Arthur Barclay at Goona in Central India, and apparently it appears to be identical with specimens collected at Srinagar in Kashmir, in the Purneah district, and in Cachar.

The next two have usually been classed as true *Mus*, and the latter is to be found in Jerdon; but, from the breadth of the incisors and the lamination of the molars, which are less sinuous and relatively larger than in *Mus*, and from other characteristics of the skull, they are nearer allied to *Nesokia* than to the true rats.

No. 328. MUS (NESOKIA) ELLIOTANUS.

Elliot's Field-Rat.

HABITAT.—Bengal, Assam, Khasia hills.

DESCRIPTION.—This rat is thus described by Dr. Anderson. It is the nearest approach in size to the bandicoot: "Head short and deep;

muzzle deep and broad: eye half-way between ear and nose, moderately large; ears not large, rounded, sparsely covered with short hairs; feet large and well developed, with strong claws, and sparsely clad; tail sparsely covered with short bristles on the margins of the annuli, and nearly equalling the length of the body and head. Pelage coarse, with moderately large piles, most numerous on the back; vibrisæ moderately long.

General colour, above brown, with intermixed yellowish or pale brown hairs producing much the same colour as in *M.* (*N.*) *Blythianus*; paler on the sides, and passing into greyish on the under-parts; nose and feet flesh-coloured; ears dark brown; tail blackish ('J. A. S. B.' 1878, vol. xlvii. pt. ii. p. 231).

No. 329. MUS (NESOKIA) GIGANTEUS.

The Bandicoot (*Jerdon's No.* 174).

NATIVE NAMES.—*Indur*, Sanscrit; *Ghunse*, Hindi; *Ikria*, Bengali; *Heggin*, Canarese; *Pandi-koku*, i.e. pig-rat, Telegu; *Oora-meyoo*, Singhalese.

HABITAT.—Throughout India; also in Ceylon.

DESCRIPTION.—Fur coarse, consisting of the three kinds, of which the coarser piles are very long, and almost hide the general pelage on the lumbar and dorsal regions. These piles are almost absent on the head, neck, and sides; general colour earthy brown, with yellowish hairs intermixed; the piles blackish-brown; under-parts dusky brown, mixed with grey; limbs brownish; nose, inside of ear and feet flesh-coloured; tail black, ringed, and sparsely haired. The female has twelve mammæ.

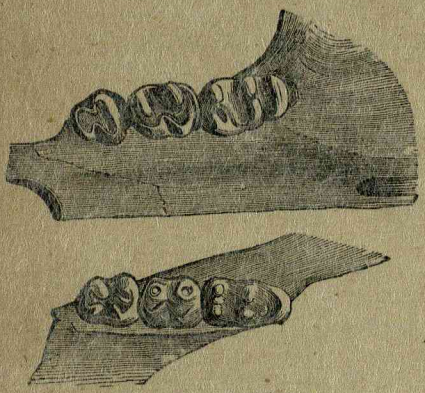
SIZE.—Head and body, from 12 to 15 inches; tail, from 11 to 13. Weight, about 3 lbs.

This is a well known rat, but it is not common in Calcutta, although supposed to be so. People frequently mistake very large specimens of the common brown house-rat (*Mus decumanus*) for this animal, which, Blyth remarks, is rare here. Jerdon states that it is common in the fort of Madras, where he killed many, some of large size. When assailed it grunts like a pig, hence its Telegu name *Pandi-koku*, from which the word bandicoot is derived. McMaster states that the bandicoot, though so formidable in appearance, does not show so good a fight as an ordinary English rat, being a sluggish and cowardly animal; and though, from its size and weight, it takes a good deal of worrying, it seldom does much in self defence, and any moderately good dog can kill it with ease. It is however a most destructive animal, doing much damage to granaries, gardens, and even poultry-yards. In some parts of the country, as for instance Fort St. George in Madras, Government used to pay a reward of one anna for every bandicoot killed within the walls.

SUB-FAMILY CRICETINÆ.

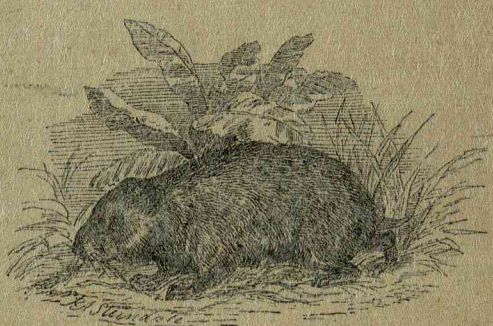
CHARACTER.—Molars tuberculate; infra-orbital opening sub-typical, not much narrowed below, and the perpendicular plate little developed; large internal cheek pouches.—*Alston.*

GENUS CRICETUS—THE HAMSTERS.



Dentition of *Cricetus.*

Form thick-set, with short limbs and tail, the latter sparsely haired, not scaly. "Skull with marked but rounded supra-orbital ridges continued into temporal ridges; coronoid process high and falcate" (*Alston*). The incisors are plain; the molars tuberculated when young, but in the old animal the tubercles are worn down and exhibit laminæ. They are very nearly related to the true rats, but differ conspicuously in the possession of large cheek pouches—like those of the pouched monkeys, into which they stuff the grain they carry to their burrows. The hind-limbs have five toes, the fore-feet four only, the thumb being represented by a wart. The European hamster is a very destructive little animal, from its numbers and the quantity of grain it stores away in its burrows. They have two sets of burrows for summer and winter, the latter being the deepest and most complicated. They pass the winter in a torpid state, but make up for it by their activity in the summer months. The young are produced twice in the year and in



Cricetus.

number varying from six to eighteen, and they develop very rapidly. Their eyes open in about a week, and when a fortnight old the parents drive them off to shift for themselves. The European hamster is a most savage little creature, and has been known to attack even a red-hot bar, and hold on in spite of the pain.

The two following are dwarf species—*Cricetulus* of some authors :—*

No. 330. CRICETUS PHÆUS.

The Persian Hamster.

HABITAT.—Yarkand, Gilgit, Persia.

DESCRIPTION.—Cinereous above, white below; the colour varies from pure ashey grey to grey with an isabelline tinge.—*Blanford.*

SIZE.—Head and body, about 4 inches; tail, 1¼ inches.

No. 331. CRICETUS FULVUS.

The Sandy Hamster.

HABITAT.—Yarkand, Gilgit.

DESCRIPTION.—Colour above light sandy brown to sandy grey; no band down the back; lower parts, feet, and tail white; fur very soft, fully half an inch long in the middle of the back in some specimens, Rather larger than the last species. (*See* Blanford's 'Second Yarkand Mission,' p. 45.)

SIZE.—Head and body about 4½ inches; tail about 1½ inches.

SUB-FAMILY MURINÆ.

CHARACTER.—Molars tuberculate, at least in youth; infra-orbital opening typical; pterygoid fossæ lengthened; auditory bullæ moderate; cheek pouches absent or very small; tail scaly, more or less naked, cosmopolitan (*Alston*). Three molars in each jaw, the first of which is the largest and the hinder one the least. I think that, with the exception of the islands of the Pacific Ocean, some of the members of this family are known in every quarter of the globe.

GENUS MUS.

"Muzzle pointed; eyes prominent; ears rather large, sub-naked; fur soft (rarely mixed with spines); pollex rudimentary; claws short; tail moderate or long, scaly, with scattered hairs; no cheek pouches;

* Dallas mentions (Cassell's 'Nat. Hist.') a species from Kumaon, *Cricetus songarus.*

skull elongate, narrow; temporal ridges nearly parallel; palate compressed; incisive foramina long; auditory bullæ moderately large; coronoid process high, falcate; incisors rarely grooved; molars with transverse ridges, each composed in youth of three tubercles" (*Alston*).

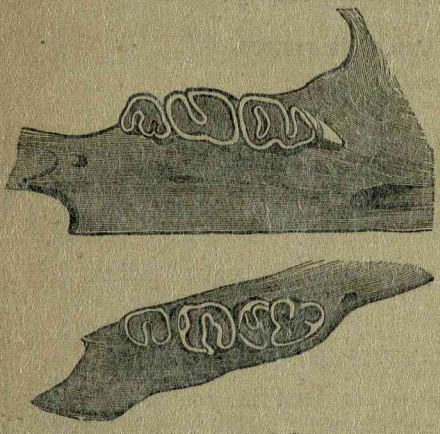
No. 332. MUS RATTUS.

The Black Rat (*Jerdon's No.* 175).

NATIVE NAMES.— *Kala-mus*, *Kala-chuha*, Hindi; *Kala-meeyo*; Singhalese.

HABITAT.—Chiefly Europe, but is said to be of south Asian origin; it is stated to occur in towns near the sea-coast in India, and Kellaart obtained it in Trincomalee only.

DESCRIPTION.—Greyish-black above, dark ashy beneath, or, as Kellaart describes it, "above blackish-brown, along the dorsal line nearly black; sides paler, some of the hairs with pale fulvous tips; beneath and inside of limbs fur very short, of a uniform sooty ash colour, separated from the colour above by a distinct line of demarcation; ears large, rounded, slightly fulvous externally" ('Prodromus Faunæ Zeylanicæ,' p. 58).



Dentition of Black Rat.

SIZE.—Head and body about 6½ to 7½ inches; tail, 7½ to 8 inches.

Jerdon says of this rat that the muzzle is sharper than that of the brown rat; the ears are more oval; it is lighter in its make, and has much longer hair.

Whether this rat be, as Jerdon seems to suspect, imported into India in ships or not, it is generally supposed to have had its origin in southern Asia, and is almost identical with the Egyptian rat (*M. Alexandrinus*). It was the common rat of England, and indeed of northern Europe, whence it was expelled by its formidable rival, the brown rat, before which it has gradually receded, and it is seldom found now in England.

No. 333. MUS DECUMANUS.

The Brown Rat (Jerdon's No. 176).

NATIVE NAMES.—*Ghur-ka-chuha*, Hindi; *Demsa-indur*, Bengali; *Manei-ilei*, Canarese; *Gaval-meeyo*, Singhalese.

HABITAT.—Throughout India, Ceylon, and in some parts of Burmah.

DESCRIPTION.—Fur greyish-brown, mixed with tawny above, with longer piles of a dark colour, almost black; ears round; tail generally longer than head and body, scaly, with short bristles at the margins of the rings.

SIZE.—Head and body, from 8 to 10 inches; tail, from 6 to 11 inches.

The brown rat of India is identical with that of Europe, most naturalists being now agreed that it originally came from the East. It was supposed by Pallas that the brown rat crossed over into Russia about the year 1727. When frightened by an earthquake, numbers swam over the Volga from countries bordering on the Caspian Sea. It seems to have driven out the black rat before it wherever it made its appearance. In England it was introduced by shipping about the middle of the last century, and has since then increased to such an extent as to swarm over the whole country, and render the old English black rat a comparatively rare animal. From its ferocity and fecundity the brown rat is a veritable pest; if it cannot beat a retreat from an enemy it will show most determined fight, and in large numbers will attack and kill even men. A story is related by Robert Stephenson, the great engineer, that in a coal-pit in which many horses were employed, the rats, allured by the grain, had gathered in large numbers. On the pit being closed for a short time, and the horses being brought up, the first man who descended on the re-opening of the work was killed, and devoured by the starving rats. Similar stories have been told of men in the sewers of Paris. In the horse slaughterhouses at Montfaucon in Paris, the rats swarm in such incredible numbers that the carcases of horses killed during the day would be picked clean to the bone during the night; sometimes upwards of thirty horses would be so devoured. This shows the carnivorous tendencies of these abominable pests. I confess to a general love for all animals, but I draw the line at rats. There is something repulsive about one of these creatures, and a wicked look about his large protruding eye, like a black glistening bead, and his ways are not pleasant; instead of keeping, as he ought, to sweet grain and pleasant roots, he grubs about for all the carrion and animal matter he can get.

I find there is no bait so enticing to the brown rat as a piece of chicken or meat of any kind. I have heard stories of their attacking children, and even grown-up people when asleep, but I cannot vouch

for the truth of this beyond what once happened to myself. I was then inhabiting a house which swarmed with these creatures, and one night I awoke with a sharp pain in my right arm. Jumping up, I disturbed a rat, who sprang off the bed, and was chased and killed by me. I found he had given me a nip just below the elbow. I once had a most amusing rat-hunt in the house I now occupy. I had then just taken it over on the part of the Government, in 1868. The whole building is floored with polished marble, which, being new, was like looking-glass. I found an enormous rat, which I took for a bandicoot, in one of the bath-rooms, and, shutting him in for a while, I closed the doors of a very large room adjoining, which was quite empty, and then turned my friend in with a small black-and-tan terrier. The scrimmage that ensued was most laughable, as both rat and dog kept slipping and sliding all over the place. At last the former was pinned in a corner, where he made a most determined stand, and left several marks before he died. They seldom now come so high as the third story, but we had two or three last year which dug a hole through a brick wall into my study, and they were surreptitiously disposed of unknown to my eldest little girl, whose passionate love for every living creature made her take even the rats under her protection, and one of them would come out every morning in the verandah to be fed by her with crumbs and grain. This one was spared for a while, but I was not sorry to find one day that it had fallen into a tub of water in a bath-room and was drowned.

The brown rat breeds several times in the year, and has from ten to fourteen at a time, and it is to be hoped that there is considerable mortality amongst the infants. I have never kept rats as pets, but have noticed amongst mice a tendency on the part of the mother to devour her offspring. I have no doubt that this also is the case with the brown rat, and aids in keeping down its numbers. It is stated that they will attack, kill, and eat each other. The Rev. J. G. Wood remarks in his Natural History: "From some strange cause the male rats far outnumber the females, the proportion being about eight of the former to three or four of the latter. This disproportion of the sexes may possibly be caused by the cannibalistic habits of the rat, the flesh of the female being more tender than that of the opposite sex. Whatever may be the cause, it is clear that the wider increase of these creatures is greatly checked by the comparative paucity of females." During the late siege of Paris by the Germans, amongst the various articles of food which necessity brought into use, rats held a high place as a delicacy. It is a difficult matter to stop the burrowing of rats; the best plan is to fill the holes with Portland cement mixed with bits of bottle glass broken in small pieces. It is said that quicklime will temporarily prevent rats from entering a hole, as the lime burns their feet. A friend of mine lately told me of some wonderful Japanese

sword-lime which he uses. It is spread on a board, and will retain any rat that puts even one foot on it. An albino variety is common, and is sold for pets. Rats are partial to certain scents, and some are consequently used by trappers. In Cooley's 'Cyclopædia' the following receipts are given :—

1. Powdered cantharides steeped in French brandy. It is said that rats are so fond of this that if a little be rubbed on the hands they may be handled with impunity.

2. Powdered assafœtida 8 grains, oil of rhodium 2 drams, oil of aniseed 1 dram, oil of lavender ½ dram. Mix by agitation.

3. Oil of aniseed ½ ounce, tincture assafœtida ¼ ounce.

4. Oil of aniseed ¼ ounce, nitrous acid 2 to 3 drops, musk (triturated with a little sugar) 1 grain.

These scents are not only rubbed on traps, but a few drops are mixed with the various rat poisons, of which perhaps the most efficacious is phosphorous paste:

No. 334. MUS ANDAMANENSIS.

The Andaman Rat.

HABITAT.—The Andaman and Nicobar islands.

DESCRIPTION.—A little darker on the back than *Mus decumanus*, paler on the sides, and dull white below. "The long piles are at once distinguished by their flattened spinous character, which is also slightly the case in *M. rattus*, though much less conspicuously than in the present species. It would appear to be a burrower in the ground" (*Blyth*). Ears round as in the brown rat.

SIZE.—Head and body, about 8 inches; tail the same.

No. 335. MUS ROBUSTULUS.

The Burmese Common Rat.

HABITAT.—British Burmah.

DESCRIPTION.—Dark-brown above, under-parts whitish, stoutly formed, with tail not quite so long as head and body; feet conspicuously white.

SIZE.—Head and body, about 6 inches; tail, a little shorter.

Mr. Mason remarks of this rat that they are only second to the white ants for the mischief they perpetrate. "They burrow in the gardens, and destroy the sweet potatoes; they make their nests in the roofs by day, and visit our houses and larders by night. They will eat into teak drawers, boxes, and book-cases, and can go up and down anything but glass. In the province of Tonghoo they sometimes appear in immense numbers before harvest, and devour the paddy like

locusts. In both 1857 and 1858 the Karens on the mountains west of the city lost all their crops from this pest." They seem to migrate in swarms, and cross rivers by swimming. Mr. Cross captured one out of a pair he observed swimming the Tenasserim river at a place where it is more than a quarter of a mile wide. *M. Berdmorei* is the same as this species.

The following three are Burmese rats collected by Dr. Anderson during the Yunnan Expedition, and are new species named by him :—

No. 336. MUS SLADENI.

Sladen's Rat.

HABITAT.—Kakhyen hills ; Ponsee at 3500 feet.

DESCRIPTION.—Head rather elongated ; snout somewhat elongate ; muzzle rather deep ; ears large and rounded, sparsely clad with short hairs ; feet well developed, hinder ones rather strong ; claws moderately long and sharp ; the feet pads markedly developed, indicating an arboreal habit of life ; tail slightly exceeding length of head and body, coarsely ringed, there being three rings to each one-tenth of an inch ; the hairs sparse and brown ; general colour of upper surface reddish-brown, more rufous than brownish, palest on the head, many hairs with broad yellow tips ; cheeks greyish-rufous ; chin, throat, and chest whitish, also the remaining under-parts, but with a tinge of yellowish ; ears and tail pale brownish. (Abridged from Anderson's 'Anat. and Zool. Res.' p. 305.)

SIZE.—Head and body of one, about 6·30 inches ; tail, 7·20 inches.

Dr. Anderson says this species is closely allied to Hodgson's *Mus nitidus*, but its skull is less elongated, with a shorter facial portion, with very much shorter nasals, and with a more abruptly defined frontal contraction than either in *M. nitidus* or *M. rufescens* so called. He adds that this appears to be both a tree and a house rat.

No. 337. MUS RUBRICOSA.

The Small Red Rat of the Kakhyen Hills.

HABITAT.—Kakhyen hills and the Burmo-Chinese frontier at Ponsee, and in the houses of the Shan Chinese at Hotha.

DESCRIPTION.—"Snout moderately pointed and long ; ears small, and somewhat pointed ; hind foot long and narrow ; claws moderately long, compressed and sharply pointed ; upper surface dark rusty brown, darkest on the middle and back, and palest on the muzzle, head and shoulder ; on the sides and lower part of shoulder the reddish brown tends to pass into greyish ; feet greyish ; the sides of the snout greyish ; all the under-parts silvery grey tending to white, without any trace of

fous, or but with a very faint yellowish blush; the tail, dull brown, is somewhat shorter than the body and head, and it is coarsely ringed, 2½ rings to one-tenth of an inch, the hair being short, sparse, and dark brown" ('Anat. and Zool. Res.' p. 306).

SIZE.—Head and body, 5·70 inches; tail, 5·15 inches.

No. 338. MUS YUNNANENSIS.

The Common House Rat of Yunnan.

HABITAT.—Yunnan, at Ponsee; Hotha and Teng-yue-chow.

DESCRIPTION.—"Muzzle rather short and broad; ear large and rounded, its height considerably exceeding the distance between the inner canthus and the front of the muzzle, sparsely clad with short hairs; feet well developed; hind foot moderately long; pads prominent; claws compressed, strong, curved, and sharp; tail coarsely ringed, three rings to one-tenth of an inch; upper surface dark rich brown, with intermixed pale hairs, with broad brown tips, the sides of the face below the moustachial area, chin, throat, and all the under-parts yellowish washed with rufous; the ears and tail dusky brown; feet pale yellowish, and more or less brownish above; the tail varies in length, but is generally longer than the body and head, although it may occasionally fall short of that length" ('Anat. and Zool. Res.' pp. 306, 307).

SIZE.—Head and body, 5·70 inches; tail, 5·65 inches. An adult female had a much longer tail.

No. 339. MUS INFRALINEATUS.

The Striped-bellied Rat (*Jerdon's No.* 178).

HABITAT.—Madras; Bustar forests.

DESCRIPTION.—"Above, the fur fulvous, with the shorter hairs lead coloured; throat, breast, and belly pure white, with a central pale fulvous brown streak; tail slightly hairy."—*Jerdon.*

SIZE.—Head and body, 5½ inches; tail, not quite 5 inches; another about 5 inches; tail, 4¼ inches.

Jerdon calls this a field rat in his popular name for it, but I think that the term should be restricted to the *Nesokia* or true field and earth-burrowing rats. He is of opinion that Gray's *Mus fulvescens* from Nepal is the same, the description tallying to some extent, concluding with: "in one specimen a central yellow streak," i.e. on the belly.

No. 340. MUS BRUNNEUS.

The Tree Rat (*Jerdon's No.* 179).

HABITAT.—India and Ceylon. The common house rat of Nepal.

DESCRIPTION.—Above rusty brown; below rusty, more or less

cescent; extremities pale, almost flesh-coloured; ears rather long; head rather elongated; tail equal to and sometimes exceeding head and body.

SIZE.—Head and body, from 8½ to 9½ inches; tail, from 9 to 9½ inches.

Jerdon states that this rat, which Dr. Gray considered identical with *M. decumanus* (*see* 'Ann. and Mag. Nat. Hist.' vol. xv. 1845, p. 267), "is to be found throughout India, not habitually living in holes, but coming into houses at night; and, as Blyth remarks, often found resting during the day on the *jhil-mil* or venetian blinds. It makes a nest in mango-trees or in thick bushes and hedges. Hodgson calls it the common house rat of Nepal, and Kellaart also calls it the small house rat of Trincomalee." It is probable that this is the rat which used to trouble me much on the outskirts of the station of Nagpore. It used to come in at night, evidently from outside, for the house was not one in which even a mouse could have got shelter, with masonry roof, and floors paved with stone flags. Kellaart evidently considered it as distinct from *M. decumanus*, which he stated to be rare in houses in the town of Trincomalee, though abundant in the dockyard.

No. 341. MUS RUFESCENS.

The Rufescent Tree Rat (*Jerdon's No.* 180).

NATIVE NAMES.—*Gachua-indur*, Bengali; *Ghas-meeyo*, Singhalese.

HABITAT.—India generally; Ceylon.

DESCRIPTION.—Fur above pale yellowish-brown; under fur lead coloured, mixed with longer piles of stiff, broad, plumbeous black tipped hairs; head long; muzzle narrow; whiskers long and black; ears large, subovate, slightly clad with fine hairs; eyes large; incisor teeth yellow; feet brownish above, but the sides and toes are whitish; tail longer than head and body.

SIZE.—Head and body, from 5½ to 7½ inches; tail from 6½ to 8½ inches.

This is *M. flavescens* of Elliot, and is so noticed in Kellaart's 'Prodromus.' He calls it "the white-bellied tree-rat of Ceylon," and he states that it lives on trees or in the ceiling of houses in preference to the lower parts. Sir Walter Elliot observed it chiefly in stables and out-houses at Dharwar. According to Buchanan-Hamilton it makes its nests in cocoanut-trees and bamboos, bringing forth five or six young in August and September. "They eat grains, which they collect in their nests, also young cocoanuts. They enter houses at night, but do not live there." Kellaart's *M. tetragonurus* is a variety of this, if not identical.

No. 342. Mus niveiventer.

The White-bellied House Rat (Jerdon's No. 181).

Habitat.—The lower Himalayan ranges.

Description.—"Above blackish-brown, shaded with rufous; below entirely pure white, tail and all."—*Blyth.*

Size.—Head and body, 5¼ to 7 inches; tail, 6 to 7½ inches. Hodgson stated this to be a house rat in Nepal, but not very common. Jerdon found it common at Darjeeling. Specimens have been received from Mussoorie.

No. 343. Mus nitidus.

The Shining Brown Rat (Jerdon's No. 182).

Habitat.—Nepal; Darjeeling.

Description.—Dusky brown above, dusky hoary below. According to Hodgson it is "distinguished for its smooth coat or pelage, wherein the long hairy piles are almost wanting. It is a house rat, like *M. niveiventer*, but much rarer, and frequents the mountains rather than the valleys." The long hairs are ⅛ inch in length, horny at the base, with black tip, the short fur ashy, with rufous tips.

Size.—Head and body, 6½ inches; tail 7¼ inches.

Blyth writes of this species ('J. A. S. B.' vol. xxxii. 1863, p. 343): "We have several specimens of what I take to be this rat from Darjeeling. They are especially distinguished by the fineness and softness of the fur. One specimen only, of eight from Darjeeling, which I refer to this species, has the lower parts pure white, abruptly defined."

There is a smaller rat, only four inches in length, which agrees exactly with the above, which Hodgson named *M. horietes*. It is not mentioned in Blyth's Catalogue, but it has not been overlooked by Blyth, as Jerdon's remarks would lead one to suppose, for in the 'Memoir on the Rats and Mice in India,' by the former, in the 'J. A. S. B.' vol. xxxii. for 1863, it is entered with a quotation from Hodgson.

No. 344. Mus caudatior.

The Chestnut Rat (Jerdon's No. 183).

Habitat.—The lower Eastern Himalayas, i.e., Nepal, Darjeeling, &c.; also in Burmah, Lower Pegu, and Martaban.

Description.—Above a fine bright cinnamon colour, with inconspicuous black tips; the under-parts white, which is abruptly divided from the cinnamon hue above" (*Blyth*). Sometimes yellowish-white (*Jerdon*). Muzzle sharp; ears and tail long.

SIZE.—Head and body, about six inches; tail, 7¾ inches.

According to Blyth the Nepal specimens are darker than those from Burmah, which he says "differs only from the Nepalese animal of Mr. Hodgson by having the upper parts entirely of a bright cinnamon colour."

No. 345. MUS CONCOLOR.

The Common Thatch Rat of Pegu.

HABITAT.—Upper and Lower Burmah, Malayan peninsula.

DESCRIPTION.—I have been unable to trace any accurate description of this rat, which Blyth says "conducts from the long-tailed arboreal rats to the ordinary house mice." In his 'Catalogue of the Mammals of Burmah,' published in the 'Jour. Asiatic Soc. Beng.' for 1875, he remarks that "it requires to be critically examined in the fresh state." In the 'J. A. S. B.,' vol. xxviii. p. 295, he describes a young one as dark greyish mouse colour; but this is not reliable, as the young rats and mice change colour as they attain full growth.*

No. 346. MUS PALMARUM.

The Nicobar Tree Rat.

HABITAT.—Nicobar Islands.

No. 347. MUS CEYLONUS.

HABITAT.—Ceylon.

DESCRIPTION.—Fur soft, lead colour; hair of upper parts tipped with dark fawn and black; ears large, naked; whiskers long, black; tail longer than the head and body, scaly.

SIZE.—Head and body, 4¾ inches; tail, 6 inches.

"This small rat is found in out-houses in the cinnamon gardens at Colombo. I have no reason to think it to be the young of the former species (*M. decumanus*); the teeth were well developed; the darker colour and long tail will easily distinguish the species from other Colombo rats" (*Kellaart*). The character of the molar teeth is all that can be depended on in the foregoing description, and this may require further investigation. The young of rats and mice are always darker than the adults, and the tail is longer in proportion.

* Since writing the above, Dr. Anderson has kindly allowed me to examine the specimens of *Mus concolor* in the museum, and in the adult state they are considerably more rufescent. In one specimen, allowing for the effects of the spirit, the fur was a bright rufescent brown; but, whatever be the tint of the prevailing colour, it pervades the whole body, being but slightly paler on the under-parts. Size, about 4 inches; tail, about 4½ inches.—R. A. S.

The following are doubtful species :—

No. 348. MUS PLURIMAMMIS.

Jerdon's No. 177.

This, which Blyth considered a good species, is, I am informed, referable with *M. Taraiyensis* and *M. Morungensis* to Gray's *Nesokia Bengalensis*. The type and drawing of it are in the British Museum.

No. 349. MUS ÆQUICAUDALIS

of Hodgson, described in Horsfield's Catalogue as pure dark brown above, with a very slight cast of rufescent in a certain aspect; underneath from the chin to the vent, with interior of thighs, yellowish-white; ears nearly an inch long; head proportionately long ('Ann. and Mag. Nat. Hist.' new series, iii. p. 203). This, with Blyth's *M. nemoralis*, seems identical with *M. brunneus*.

Mus arboreus of Horsfield's Catalogue is *Mus rufescens*. It remains to be seen whether there is sufficient difference between *M. rufescens* and *M. niveiventer* to warrant the separation of the latter as a distinct species.

The following species lead on to the mice—beginning with the long-tailed arboreal species, *Vandeleuria* of Gray, which connect the arboreal rats with the house mice.

The characteristics of *Vandeleuria* are: upper incisors triangular, grooved in front; ears hairy; fur soft, with long bristles interspersed; long tail, sparsely haired; hind feet very long, slender; soles bald beneath; toes ·45 long, slender, compressed, the pads much more strongly developed than in ground mice; the inner and outer toes with a small flattened nail.

No. 350. MUS OLERACEUS.

The Long-tailed Tree Mouse (*Jerdon's No.* 184).

NATIVE NAMES.—*Marad-ilei*, Canarese; *Meina-yelka*, Telegu of the Yanadees (*Jerdon*).

HABITAT.—Throughout India from north to south, but has not been reported from Ceylon. In Burmah Dr. Anderson found it in the valley of the Nampoung, a frontier stream dividing Burmah from China.

DESCRIPTION.—Upper surface rich rufous or chestnut red, paling to brown on the ears and muzzle before the eyes; under-parts white, with a yellowish tinge; feet pale brown, shading off into white on the toes; under surface of feet yellowish; tail brownish or dusky with grey hairs;

it tapers to a point, finely ringed; sparsely haired between the rings, the hairs more numerous and longer towards the tips. The length of the head, according to Dr. Anderson, whose description ('Anat. and Zool. Res.' p. 313) is more complete than Jerdon's, is about one-third the length of the body; the muzzle is moderately long and slightly contracted behind the moustachial area; eyes large; ears ovate, sparsely clad.

SIZE.—Head and body, from 2½ to 3 inches; tail one-half longer than the combined length of body and head.

Jerdon says of this pretty little mouse that "it is most abundant in the south of India, where it frequents trees, and very commonly palm-trees, on which it is said to make its nest generally. It, however, occasionally places its nest in the thatch of houses, on beams, &c. It is very active, and from its habits difficult to procure" ('Mammals of India,' p. 202). According to Sykes it constructs its nest of oleraceous herbs in the fields, and Hodgson states it to tenant woods and coppices in Nepal.

No. 351. MUS NILAGIRICUS.

The Neilgherry Tree Mouse (*Jerdon's No.* 185).

HABITAT.—Ootacamund.

DESCRIPTION.—"Above deep but bright chestnut brown, beneath bright fawn yellow, with a distinct line of demarcation between the two colours; head rather elongated; ears long, oval; tail somewhat hairy."—*Jerdon.*

SIZE.—Head and body, 3½ inches; tail, 5 inches.

This tree mouse was discovered and named by Dr. Jerdon. He says: "The first I observed was brought into the house by a cat. I afterwards, on two or three occasions, found the nest, a mass of leaves and grass, on shrubs and low trees, from four to five feet from the ground, and on one occasion it was occupied by at least eight or ten apparently full-grown mice."

No. 352. MUS BADIUS.

The Bay Tree Mouse.

HABITAT.—The valley of the Sittang, Burmah.

DESCRIPTION.—"Similar to *M. oleraceus*, but with the eye fully twice as large, and black whiskers; colour of the upper parts a more rufous chestnut or cinnamon hue, of the lower parts white, almost pure."—*Blyth.*

SIZE.—Head and body, 3 inches; tail, 4⅜ inches.

No. 353. MUS GLIROIDES.

The Cherrapoonjee Tree Mouse.

HABITAT.—Khasia hills.

DESCRIPTION.—Fur exceedingly dense and fine, of a light brown, tinged with fawn; the basal two-thirds of the piles are dusky ash coloured; the lower parts are white, very faintly tinged with fawn; the white purest about the lips and chin; whiskers long; feet large and sparsely clad with white hairs; a distinct brown mark on each hind foot reaching almost to the division of the toes; ears smallish, ovoid, naked.

SIZE.—Head and body, 2 inches; tail (?) mutilated.

Blyth says this animal has much of the aspect of the European dormouse (*Myoxus avellanarius*), but nothing is said about its dentition, which would at once settle the question whether the young specimen with its imperfect tail were a true *Mus* or a species of *Myoxus*.*

No. 354. MUS PEGUENSIS.

The Pegu Tree Mouse.

HABITAT.—The Sittang valley, Burmah.

DESCRIPTION.—Fulvescent olive brown on the upper parts, yellowish-white below; whiskers remarkably long; the tail very long and conspicuously haired towards the tip; more so, Blyth remarks, than any other mouse, especially when held up to the light.

SIZE.—Head and body, $3\frac{1}{8}$th inches; tail, $3\frac{7}{8}$; in one specimen, $4\frac{1}{2}$ inches.

We now come to the terrestrial or house mice

No. 355. MUS URBANUS.

The Common Indian Mouse (*Jerdon's No.* 186).

NATIVE NAMES.—*Lengtia-indur*, Bengali; *Mesuri*, *Musi*, *Chuhi*, Hindi.

HABITAT.—Throughout India and Ceylon.

DESCRIPTION.—Somewhat resembling the English mouse, but with very much longer, coarser tail, larger eyes, and smaller ears; dusky reddish-brown above, somewhat paler below; the feet paler still, whitish in some; the tail nude, thick at base, longer by an inch than the head and body, and of a dark brown colour. The young are more dusky.

SIZE.—Head and body, about 2 to 3 inches; tail, 3 to 4 inches.

I have kept these mice in confinement for considerable periods, and have had many opportunities of studying their habits of late. During many years' residence in the Currency Office, I never once found a mouse in my private quarters on the third story, although I frequently

* See Appendix A for description and dentition of *Myoxus*.

observed them in the vaults and strong rooms on the ground floor. During my absence at Simla in 1880 my quarters were unoccupied, as the Public Works Department were giving the building a thorough repair. It was then, I suppose, a few of the mice from the ground floor were driven upstairs, and, being unmolested by us, as we liked to see the little things playing about, they increased to a most uncomfortable extent within eight months. I failed to discover their breeding places, though I suspect they made much use of a large doll's-house for the purpose, for on taking out the front staircase, under which the bells of the establishment were hung, I found a nest of torn paper, and I caught two young ones in one of the rooms. Some of them came out every night whilst we were at dinner, and paid a visit to a rose-headed parraquet (*Palæornis rosa*), mounting up on Polly's perch, and sitting down to supper in the tin receptacles for food at each end. She generally treated them with silent contempt, or gave a snappish little peck if they were too familiar; sometimes, when they were too sky-larky, she retreated to her ring above, where she swung and looked down at them from a coign of vantage. Their agility in running up and down the wires of a cage is marvellous. They have also an extraordinary faculty for running up a perpendicular board, and the height from which they can jump is astounding. One day, in my study, I chased one of these mice on to the top of a book-case. Standing on some steps, I was about to put my hand over him, when he jumped on to the marble floor and ran off. I measured the height, and have since measured it again, 8 feet 9½ inches.

I consider this species the most muscular of all mice of the same size. I have had at the same time in confinement an English mouse (albino), a Bengal field mouse, and house mice from Simla of another species, and none of them could show equal activity. I use, for the purpose of taming mice, a glass fish-globe, out of which none of the other mice could get, but I have repeatedly seen specimens of *M. urbanus* jump clear out of the opening at the top. They would look up, gather their hind quarters together, and then go in for a high leap. They are much more voracious than the Simla or other mice. The allowance of food given would be devoured in less than half the time taken by the others, and they are more given to gnawing. What sort of mothers they are in freedom I know not, but one which produced four young ones in one of my cages devoured her offspring before they were a week old. I have two before me just now as I write, and they have had a quarrel about the highest place on a little grated window. The larger one got the advantage, so the other seized hold of her tail, and gave it a good nip.

Now we come to some doubtful species, doubtful in the sense that they should not be separated, but considered as one to be named afterwards, according to priority of discovery. Dr. Anderson is at present

vestigating the matter, and we must await his decision, but from such external observations as I have been able to make, it appears probable that the following will prove identical :—

Mus homourus; Mus Darjeelingensis; Mus Tytleri; Mus Bactrianus; Mus cervicolor (?)—*Jerdon's Nos.* 187, 189, 190, 191, *and* 192. These are all hill mice, except the last, and found under the same conditions.

No. 356. MUS HOMOURUS.

HABITAT.—Lower Himalayan range.

DESCRIPTION.—Dark rufescent above, rufescent white below; hands and feet fleshy white; tail equal to length of head and body; "fur more gerbille-like in character than in *M. musculus*" (or *urbanus*), stated to be the common house mouse of the Himalayan hill stations from the Punjab to Darjeeling. Stated by Hodgson to have eight teats only in the female, other mice having ten. Possibly his description was founded on young specimens. I myself was of opinion for some time that I had got two species of hill mice, a larger and a smaller, the latter being so much darker in colour, but I kept them till the young ones attained full size in six months, at which time they were not distinguishable from the old ones. Hodgson may have overlooked the pectoral mammæ when he noted the number.

SIZE.—Head and body, 3¼ inches; tail, 3½ inches.

No. 357. MUS DARJEELINGENSIS.

DESCRIPTION.—Dusky brown, with a slight chestnut reflection; underparts pale yellowish-white.

SIZE.—Head and body, 3 inches; tail, 2¼ inches.

No. 358. MUS TYTLERI.

HABITAT.—Dehra Doon.

DESCRIPTION.—Fur long and full, pale, sandy mouse-coloured above, isabelline below; pale on the well-clad limbs, and also on the tail laterally and underneath.

SIZE.—Head and body, 2¾ inches; tail, 2¾ inches.

No. 359. MUS BACTRIANUS.

HABITAT.—Punjab, Kashmir, Candahar, Baluchistan, and Southern Persia.

DESCRIPTION.—Upper parts brown above, with a sandy tinge, more

with the head; the longer hairs with a dusky tip; the basal two-thirds deep ash; under-parts and feet white; tail clad thinly with fine whitish hair; the fur in general long, dense, and silky.

SIZE.—Head and body, from 2¼ to 3¼ inches; tail, about the same.

This is the mouse, I think, that I caught in the house at Simla in 1880. Of eight specimens I got—seven in a cupboard in the dining-room and one in a bath-room—I sent two in spirits to the Indian Museum and brought down to Calcutta three alive, which I kept for about seven months, when they died. I have since then seen living specimens of *M. bactrianus* from Kohat, with which they appear to be identical. They also resemble—I speak under correction—*M. cervicolor*, which is a field mouse found in Bengal. I made the following notes regarding them: Fur very fine, close and silky, rufescent brown, more rufous on the head, isabelline below; feet flesh-coloured, hinder ones large, much larger than those of the English mouse; the hind-quarters are also more powerful; has a very pretty way of sitting up, with the body bent forwards, and its hands clasped in an attitude of supplication. The young mice seem darker both above and below, and are much more shy than the old ones, of which one soon after being caught took bits of cake from my fingers through the bars of its cage. More delicate looking than *Mus urbanus*, with a much shorter and finer tail; less offensive in smell.

Dr. Anderson got, not long ago, two of these mice in a box from Kohat. They bore the journey uncommonly well, and were in lively condition when I saw them at the Museum. Whilst we were talking about them, we noticed an act of intelligence for which I should not have given them credit had I not seen it with my own eyes. They were in a box with a glass front; in the upper left-hand corner was a small sleeping chamber, led up to by a sloping piece of wood. The entrance of this chamber was barred by wires bent into the form of a lady's hair-pin, and passed through holes in the roof of the box.

The mice had been driven out, and the sleeping-chamber barred, for they were having their portraits taken. Whilst we were talking we found, to our surprise, that one mouse was inside the chamber, although the bars were down. There seemed hardly space for it to squeeze through; however, it was driven out, and we went on with our conversation, but found, on looking at the cage again, that our little friend was once more inside, so he was driven out again, and we kept an eye on him. To our great surprise and amusement we saw him trot up his sloping board, put his little head on one side, and seize one of the wires, which worked very loosely in its socket, give it a hitch up, when he adroitly caught it lower down, hitched it up again and again till he got it high enough to allow him to slip in underneath, and then he was quite happy once more. He had only been in the box two days, so he was not long in finding out the weak point. I begin to believe now in rats dipping their tails

into oil-bottles, and other wonderful stories of murine sagacity that one reads of. Mice are supposed to live from two-and-a-half to three years. I had the English albino above mentioned for three.

No. 360. Mus crassipes.

The Large-footed Mouse (*Jerdon's No.* 188).

Habitat.—Mussoorie and, according to Jerdon, the Neilgherries.

Description.—This is stated to be like *M. homourus*, but the difference is well marked in a very much longer tail and much larger feet.

Size.—Head and body, $2\frac{3}{4}$ inches; tail, $\frac{3}{4}$ inch; hind foot, $\frac{3}{4}$ inch.

No. 361. Mus sublimis.

Habitat.—Ladakh, 13,000 feet.

Description.—Brown above; whitish below; the colours gradually blending; fur soft and long; all except the tips dark slaty grey, the terminal portions of the shorter hairs being light brown, and of the longer hairs dark brown; upper whiskers black; lower white; ears oval; feet thinly clad with short light brown hairs; tail with short bristly hairs, dusky brown above, whitish below; tail longer than head and body.

Size.—Head and body, 2·6 inches; tail, 3·05; length of hind foot, 0·83 inch.

Mr. Blanford, who named the above species, which was procured in the expedition to Yarkand, is doubtful whether it may not be referable to the last species.

No. 362. Mus pachycercus.

Habitat.—Yarkand.

Description.—Sandy brown above; under-parts white; fur soft and very like *M. bactrianus*; ears large, rounded, hairy; feet clad above with white hair; soles naked; tail thick, shorter than head and body, and thinly clad with white bristles throughout; skin dark above, pale below; incisors deep yellow.

Size.—Head and body, 2·35 inches; tail, 1·9 to 2 inches.

Mr. Blanford says this is a house mouse. It is figured in Blanford's 'Mammalia of the Second Yarkand Mission.'

No. 363. Mus erythronotus.

Habitat.—Yarkand, Persia.

Description.—Rufous, washed with blackish above, white below, abruptly separated; hairs on the back are slaty at the base, then blackish and bright ferruginous at the tips, the extreme points being black, except

on the sides, where the black tip is wanting; upper whiskers black, lower white; ears large, rounded, naked; feet white above, dusky and naked below; tail equal to head and body, nearly naked. Mammæ six.

SIZE.—Head and body, 4 inches; tail, 4·2 inches.

This mouse is figured and carefully described in Blanford's 'Eastern Persia,' vol. ii. p. 35.

No. 364. MUS CERVICOLOR.

The Fawn-coloured Field Mouse.

HABITAT.—Bengal, Nepal, Southern India.

DESCRIPTION.—"Distinguished by its short tail. Above dull fawn, below sordid white; lining of ears and extremities pale" (*Blyth*). "Ears large, hairy" (*Jerdon*). Of the specimens I have seen the fur is soft and of a light sandy brown above and white below, very like *M. bactrianus*.

SIZE.—Head and body, 3½ inches; tail, 2⅞ inches.

No. 365. MUS TERRICOLOR.

The Earth-coloured Field Mouse.

HABITAT.—India generally, I think. It has been found in the valley of the Ganges, in Bengal, in the Santal district west of Midnapore, and Southern India.

DESCRIPTION.—The colour varies according to the soil, but in general fawn brown, more or less rufescent—those from the valley of the Ganges being darker than those from the ferruginous soil of other parts. The under-parts are white, abruptly separated from the brown; fur short and soft.

SIZE.—Head and body, 2½ inches; tail, 2⅛ inches.

No. 366. MUS PEGUENSIS.

The Pegu Field Mouse.

HABITAT.—The valley of the Sitang River, Burmah.

DESCRIPTION.—"Fur very full and dense, pale fulvescent olive brown on the upper parts, slightly yellowish-white below; whiskers remarkably long" (*Blyth*). Tail longer than head and body, and well clad with hairs, especially towards the tip.

SIZE.—Head and body, 3⅛ inches; tail, nearly 4 inches.

No. 367. MUS NITIDULUS.

The Shiny Little House Mouse of Pegu.

HABITAT.—The Sitang valley in Burmah.

DESCRIPTION.—The description given of this mouse by Blyth is

extremely vague. He says: "A house mouse apparently, with tail equal to head and body, and uniformly furnished with minute setæ to the end; ears large and ample; colour nearly that of *M. decumanus*, with the under-parts subdued white, tolerably well defined."

He remarks further on that the front teeth are conspicuously larger than those of *M. musculus* and *M. urbanus*.

SIZE.—Head and body, 3¼ inches; tail, the same.

No. 368. MUS BEAVENI.

Beaven's Mouse.

HABITAT.—Maubhum, and, according to Blyth's Catalogue, Burmah, valley of the Salween.

DESCRIPTION.—"Above rusty brown, medially black; lips and the whole under side pale ochraceous; feet white, all the hair being slate coloured at the base; tail above brown, below with white hairs; upper whiskers black, lower white. Rather smaller and more delicately built than our common harvest mouse."—*Prof. Peters*, 'P. Z. S.' 1866, p. 559.

No. 369. MUS CUNICULARIS.

The Little Rabbit-Mouse.

HABITAT.—Cherrapunji, Assam.

DESCRIPTION.—"A small field (?) mouse, remarkable for its ample ears and tail shorter than head and body; colour of a wild rabbit above, below white; and the feet with brownish hairs above, but with white hairs upon the toes; tail conspicuously ringed; the setæ minute and inconspicuous."—*Blyth.*

SIZE.—Head and body, 2½ inches; tail, 2⅛ inches; ears posteriorly half an inch.

No. 370. MUS ERYTHROTIS.

The Cherrapunji Red-eared Mouse.

HABITAT.—Cherrapoonji, Assam.

DESCRIPTION.—A small mouse with very deep soft fur, very long and silky, of a rich dark brown colour, grizzled and brightly tinged with rufous or rufo-ferruginous towards the tail, and upon the ears conspicuously. In such spirit specimens as I have seen the colour was darker than in life, but the soft silkiness of the fur could be seen to advantage as it floated in the clear liquid; the lower parts are whitish, tinged with fawn; feet with brown hairs above; ears small and hirsute, and the tail is also hairy.

SIZE.—Head and body, 2¼ inches; tail, 2⅜ inches.

No. 371. MUS FULVIDIVENTRIS.

HABITAT.—Ceylon, Trincomalee.

DESCRIPTION.—This is a small mouse very like *Mus cervicolor*, or perhaps *M. terricolor*, which it more nearly approaches in size. Kellaart in his 'Prodromus,' calls it *cervicolor*, but Blyth afterwards separated it under the name given above, though after all I think he was doubtful whether it ought to have been so distinguished. The fur is long, soft, and glossy, fulvous fawn brown above, paler below; feet dingy grey.

SIZE.—Head and body, $2\frac{9}{10}$ inches; tail, $2\frac{5}{10}$ inches.

No. 372. MUS KAKHYENENSIS.

The Kakhyen Mouse.

HABITAT.—Burmo-Chinese frontier, Ponsee.

DESCRIPTION.—Differs from *Mus urbanus* by its shorter tail, longer hind feet, and larger ears; muzzle moderately deep, and short; ears large and rounded; fur long, dense, and soft, reddish-brown on the upper parts, with a dark speckled appearance due to the stronger hairs having broad brown tips; sides of the head dusky greyish; chin to vent and under-parts greyish-white, with a silvery sheen; feet dusky pale brown; ears and upper surface of tail dark brown, under surface of tail pale brown.—*Anderson.*

SIZE.—Head and body, 2·90 inches; tail, 3·36 inches.

This mouse was discovered and named by Dr. Anderson, who procured one example at Ponsee, where it occurs, he says, on the old rice and Indian corn clearings. The next species is also a new one discovered and named by him.

No. 373. MUS VICULORUM.

The Kakhyen House Mouse.

HABITAT.—The Burmo-Chinese frontier, Ponsee.

DESCRIPTION.—Muzzle rather sharply pointed, moderately long and not deep; ears moderately large, rounded; its height a little in excess of the distance between the inner canthus and the front of the muzzle; hind-feet not long; tail a little longer than the body and head, finely ringed, five rings to one-tenth of an inch; fur soft, short, dense, dull dark brown on the upper parts, tending to blackish on the back, paling to brownish on the sides, and passing into pale dusky brownish on the under parts with a silvery sheen; feet brownish; toes with shining greyish-yellow hairs; ears and tail brown. (*See* Anderson's 'Anat. and Zool. Res.,' p. 308.)

SIZE.—Head and body, $2\frac{9}{10}$ inches; tail, 3·14 inches.

This species, according to Dr. Anderson, frequents the villages and houses of the Kakhyens. He obtained it at Ponsee.

We now come to an interesting little group of mice, of which the hairs are mixed with flat spines, which form the genus *Leggada* of Gray, a term taken from the Wuddur name for the next species.

GENUS LEGGADA.

CHARACTERISTICS.—Molars high, with somewhat convex crowns; the cross ridges of the upper grinders deeply three-lobed; the front one with an additional lunate lobe at the base of its front edge; fur fine, mixed with numerous spines somewhat flattened.

No. 374. LEGGADA PLATYTHRIX.

The Brown Spiny Mouse (Jerdon's No. 194).

NATIVE NAMES.—*Leggade* and *Kal-yelka*, of Wuddurs; *Gijeli-gadu*, Telegu, of Yanadees; *Kal-ilei*, Canarese.

HABITAT.—Southern India.

DESCRIPTION.—Sandy brown or light brown fawn above, white underneath, with a band of pale fawn separating the two colours.

The fur mixed with flat transparent spines, smaller beneath; head long; muzzle pointed; ears rather large, oblong, rounded, about half an inch in length.

SIZE.—Head and body, 3½ inches; tail, 2½ inches.

The following description has been given by Sir Walter Elliot and reproduced in Jerdon's 'Mammals': "The Leggade lives entirely in the red gravelly soil in a burrow of moderate depth, generally on the side of a bank. When the animal is inside the entrance is closed with small pebbles, a quantity of which is collected outside, by which its retreat may always be known. The burrow leads to a chamber in which is collected a bed of small pebbles on which it sits, the thick close hair of the belly protecting it from the cold and asperity of such a seat. Its food appears to be vegetable. In its habits it is monogamous and nocturnal.

"In one earth which I opened, and which did not seem to have been originally constructed by the animal, I found two pairs, one of which were adults, the other young ones about three-parts grown. The mouth of the earth was very large, and completely blocked up with small stones; the passage gradually widening into a large cavity, from the roof of which some other passages appeared to proceed, but there was only one communication with the surface, viz. the entrance. The old pair were seated on a bed of pebbles, near which, on a higher level, was another collection of stones probably intended for a drier retreat; the young

were in one of the passages, likewise furnished with a heap of small stones."

Dr. Jerdon adds he has often opened the burrows of this mouse, and can confirm the above account. He also states that the Yanadees of Nellore declare that one variety uses small sticks instead of stones to sit upon, and they give it a distinct appellation, but he could not detect any difference in the specimens they brought him.

No. 375. LEGGADA SPINULOSA.

The Dusky Spiny Mouse (*Jerdon's No.* 195).

HABITAT.—Punjab, and also Southern India.

DESCRIPTION.—"Nearly affined to *M. platythrix* (Sykes), but of a dark dusky colour above, with fulvous tips to the softer fur; below and all the feet dull whitish; upper rodential tusks orange, the lower white; whiskers long and fine, the posterior and longer of them black for the basal half or more, the rest white."—*Blyth*, 'J. A. S. B.' 1863.

SIZE.—Head and body, $3\frac{3}{4}$ inches; tail, 3 inches.

No. 376. LEGGADA JERDONI.

The Himalayan Spiny Mouse (*Jerdon's No.* 196).

HABITAT.—Himalayan range, up to 12,000 feet.

DESCRIPTION.—"Bright dark ferruginous above, pure white below; some fine long black tips intermingled among the spines of the back; limbs marked with blackish externally; the feet white."—*Blyth's* 'Mem., J. A. S. B.' vol. xxxii.

SIZE.—Head and body, 4 inches; tail, $3\frac{1}{2}$ inches.

Dr. Jerdon first found this mouse at Darjeeling, but afterwards in the valley of the Sutlej in Kunawur, at an elevation of nearly 12,000 feet, living under large stones.

No. 377. LEGGADA LEPIDA.

The Small Spiny Mouse (*Jerdon's No.* 197).

NATIVE NAMES.—*Chitta-burkani*, *Chit-yelka*, *Chitta-ganda*, Telegu of Wuddurs; *Chitta-yelka* of Yanadees.—*Jerdon.*

HABITAT.—Southern India.

DESCRIPTION.—Similar to *L. platythrix*, but smaller and more weakly spinous; above pale sandy brown, pure white below, the two colours clearly separated. "The spines are small, fine, transparent, and of a dusky tinge, tipped with fawn; head very long; muzzle pointed; ears large, ovate, naked; tail naked, limbs rather long, fine."—*Jerdon.*

SIZE.—Head and body, $2\frac{1}{2}$ to 3 inches; tail, $2\frac{3}{4}$ inches.

DESCRIPTION.—Jerdon says of this mouse that he has found it in gravelly soil in gardens and woods in most parts of Southern India, making a small burrow, which generally has a little heap of stones placed at a short distance from the hole. It is preyed on now and then by the common Indian roller or jay, and it is very generally used as a bait to catch that bird with bird-lime.

GENUS GOLUNDA.

The following rats are separated by Gray as a distinct genus, which from the Canarese name of the type he has called *Golunda*, the characteristics of which are: "the grinders, when perfect, low, with a broad, flat crown; the cross ridges of the crown of the upper grinders divided into three distinct slightly raised tubercles; upper incisors grooved; rest like *Mus*."

No. 378. GOLUNDA ELLIOTI.

The Bush Rat or Coffee Rat (Jerdon's No. 199).

NATIVE NAMES.—*Gulandi*, Canarese; *Gulat-yelka* of Wuddurs; *Sora-panji-gadur*, Telegu of Yanadees; *Cofee-wattee-meeyo*, Singhalese (this name seems to me a corruption of "coffee rat").

DESCRIPTION.—Fur thick and stiff, fulvous brown, mixed with black, some olive brown mixed with fulvous, tawny grey beneath; hairs of upper parts flattened, ashy grey, tipped yellow, with some thinner and longer ones, also tipped yellow, with sub-terminal black band; under fur soft and of a light lead colour; face and cheeks rough; ears moderate, sub-ovate, hairy; tail round, tapering, scaly and hairy, dark brown above, yellowish below; cutting teeth yellow.

SIZE.—Head and body, 4½ inches; tail, 4 inches.

Dr. Kellaart says these are the rats most destructive to coffee-trees, whole plantations being sometimes deprived of buds and blossoms by them.

There is an illustration of one in Sir Emerson Tennent's 'Natural History of Ceylon' in the act of cutting off the slender branches which would not bear its weight in order to feed on the buds and blossoms when fallen to the ground. "The twigs thus destroyed are detached by as clean a cut as if severed with a knife." Sir Walter Elliot writes of it: "The *gulandi* lives entirely in the jungle, choosing its habitation in a thick bush, among the thorny branches of which, or on the ground, it constructs a nest of elastic stalks and fibres of dry grass thickly interwoven. The nest is of a round or oblong shape, from six to nine inches in diameter, within which is a chamber about three or four inches in diameter, in which it rolls itself up. Round and through the bush are sometimes observed small beaten pathways along which the little animal

seems habitually to pass. Its motion is somewhat slow, and it does not appear to have the same power of leaping or springing by which the rats in general avoid danger. Its food seems to be vegetable, the only contents of the stomach being the roots of the haryalee grass. Its habits are solitary (except when the female is bringing up her young) and diurnal, feeding in the mornings and evenings." Dr. Jerdon says: "The Yanadees of Nellore catch this rat, surrounding the bush and seizing it as it issues forth, which its comparatively slow actions enable them to do easily. According to Sir Emerson Tennent the Malabar coolies are so fond of their flesh that they evince a preference for those districts in which the coffee-plantions are subject to their incursions, where they fry the rats in cocoanut-oil or convert them into curry." Both he and Dr. Kellaart mention the migratory habits of this animal on the occurrence of a scarcity of food. Kellaart says that in one day on such visits more than a thousand have been killed on one estate alone.

No. 379. GOLUNDA METLADA.

The Soft-furred Bush Rat (*Jerdon's No.* 200).

NATIVE NAMES.—*Mettade*, of Wuddurs; *Metta-yelka*, Telegu of Yanadees; *Kera ilei*, Canarese.

HABITAT.—Southern India and Ceylon.

DESCRIPTION.—Fur very soft; above deep yellowish, olive brown or reddish-brown, with a mixture of fawn; under fur lead colour; chin and under parts whitish; head short; muzzle sharp; ears long and hairy; tail shorter than body, scaly, but scales covered with short black adpressed hairs; feet pale.

SIZE.—Head and body, 3½ to 5½ inches; tail, 2¼ to 4¼ inches.

The specific name of this rat is an absurd corruption, such as is not unfrequent in Dr. Gray's names, of the native *mettade*, which means soft. According to that accurate observer Sir Walter Elliot, "the *mettade* lives entirely in cultivated fields in pairs or small societies of five or six;* making a very slight and rude hole in the root of a bush, or merely harbouring among the heap of stones thrown together in the fields, in the deserted burrow of the *kok*,† or contenting itself with the deep cracks and fissures formed in the black soil during the hot months. Great numbers perish annually when these collapse and fill up at the commencement of the rains. The monsoon of 1826 having been deficient in the usual fall of rain at the commencement of the season, the *mettades* bred in such numbers as to become a perfect plague. They ate up the seed as soon as sown, and continued their ravages when the grain approached to maturity, climbing up the stalks of jowaree and cutting off the ear to devour the grain with greater facility. I

* In this case probably parents and young.

† *Nesokia providens.*

how many whole fields completely devastated, so much so as to prevent the farmers from paying their rents. The ryots employed the Wuddurs to destroy them, who killed them by thousands, receiving a measure of grain for so many dozens, without perceptibly diminishing their numbers. Their flesh is eaten by the Tank-diggers. The female produces six to eight at a birth."—'*Madras Journ. Lit. Sc.*' x. 1839.

Kellaart's *Golunda Newera* is, I fancy, the same, although the measurement he gives is less. Head and body, 3¼ inches; tail, 2½. The description tallies, although Kellaart goes upon difference in size and the omission of Gray to state that *G. meltada* had the upper incisors groved. He says that "this rat is found in pairs in the black soil of Newara Elia, and is a great destroyer of peas and potatoes." So its habits agree.

GENUS HAPALOMYS.

This was formed by Blyth on a specimen from Burmah of a murine animal "with a long and delicately fine pelage and exceedingly long tail, the terminal fourth of which is remarkably flattened and furnished with hair more developed than in perhaps any other truly murine form; limbs short, with the toes remarkably corrugated underneath; the balls of the inguinal phalanges greatly developed, protruding beyond the minute claws of the fore-feet, and equally with the more developed claws of the hind-feet; head short; the ears small and inconspicuous; the skull approaches in form that of *Mus Indicus*,* but the rodential tusks are broader and flatter to the front. Molars as in the *Muridæ* generally, but much worn in the specimen under examination; they are considerably less directed outward than usual, and the bony palate has therefore the appearance of being narrow; the superorbital ridges project much outward in form of a thin bony plate, and there is a considerable process at the base of the zygoma anteriorly and posteriorly to the anti-orbital foramen; zygomata broad, and compressed about the middle."

No. 380. HAPALOMYS LONGICAUDATUS.

HABITAT.—Shway Gheen, in the valley of the Sitang river in Burmah, or its adjacent hills.

DESCRIPTION.—"Fur long and soft, measuring about five-eights of an inch on the upper parts, slaty for the basal two-thirds, then glistening brown with black tips, and a few long hairs of very fine texture interspersed; lower parts dull white; whiskers black, long and fine, and there is a tuft of fine blackish-hair anterior to the ears."—*Blyth.*

SIZE.—Head and body of a male, 5⅜ inches; tail 7¼ inches. Of

* *Nesokia Blythiana.*

another specimen, female: 5¼ inches; tail, 7½ inches; sole, 1⅛ inch; ears posteriorly, 1¼ inch.

Specimens of adult male and female with a young one were forwarded to the Asiatic Society's Museum by Major Berdmore.

We have now come to the end of the purely murine group as far as they exist within the limits assigned to these investigations. I ought perhaps to give some short notices of the following specimens discovered in Thibet by the Abbé David, and described by Professor Milne-Edwards in his 'Recherches sur les Mammifères.'

No. 381. MUS OUANG-THOMÆ.

The Kiangsi Rat.

HABITAT.—Kiangsi in Thibet.

DESCRIPTION.—A tawny grey above, mixed with long hairs, tipped with brown, greyish below; between the fore-paws a crescent of pure white, which is a distinguishing mark of the species.

SIZE.—A little less than *Mus rattus*, which is about seven inches long; tail an inch longer.

This rat Professor Milne-Edwards describes from a single specimen; it is apparently rare, and was named after the Abbé David's Chinese servant.—'Recherches sur les Mammifères,' p. 290.

No. 382. MUS FLAVIPECTUS.

The Yellow-breasted Rat.

HABITAT.—Moupin; Thibet.

DESCRIPTION.—Reddish-brown; chin greyish; throat and chest tawny, mixed with grey; belly and inside of limbs yellowish-grey; ears large, nearly naked; incisors deep yellow; tail brown, covered with short hairs.

SIZE.—About 7¾ inches; tail, 6¼ inches.—'Mammifères,' p. 289.

No. 383. MUS GRISEIPECTUS.

The Grey-breasted Rat.

HABITAT.—Moupin; Thibet.

DESCRIPTION.—Brown above; the under-parts of a clear grey.

SIZE.—About the same as the last, but with a somewhat shorter tail.—'Mammifères,' p. 290.

No. 384. MUS CONFUCIANUS.

HABITAT.—Moupin; Thibet.

DESCRIPTION.—Fawn brown above, pure white below; lower part of cheek white; on the back the fur is interspersed with longer hairs of a blackish tint; feet pale.

SIZE.—Head and body, about 4 inches.—'Mammifères,' p. 286.

No. 385. MUS CHEVRIERI.

HABITAT.—Moupin; Thibet.

DESCRIPTION.—General colour tawny brown, grizzled with dark brown; lower parts of a clear grey, almost white; ears short; feet small; tail covered with short hair.

SIZE.—About 4¾ inches; tail about 3½ inches.—'Mammifères,' p. 288.

No. 386. MUS PYGMÆUS.

The Pigmy Mouse.

HABITAT.—Moupin; Thibet.

DESCRIPTION.—Distinguished by its very short ears and the square form of its head; deep brown above; greyish-yellow beneath; tail shorter than in the common mouse.

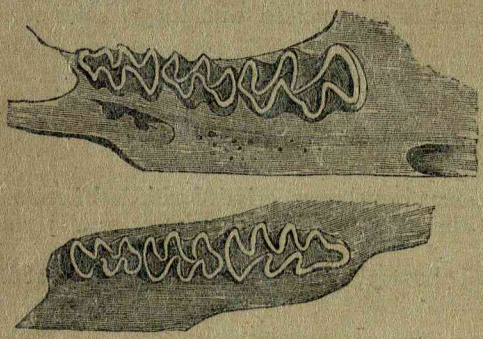
SIZE.—About 2¾ inches; tail, about 2 inches.—'Mammifères,' p. 291.

ARVICOLINÆ.

In this sub-family the molars are generally semi-rooted or rootless. The *Arvicolinæ* or Voles consist of the American Musquash (*Fiber zibethicus*), a very beaver-like water rat of large size; the Lemmings (*Myodes*), of which there are several species which are celebrated for their vast migrations; and the true Vole (*Arvicola*), which is the only genus found in India, and then only in the colder climate of the Himalayas. There are several species in Europe, of which three are found in England. According to Professor Dallas, the true Voles number about fifty species, arranged by various writers under a considerable number of sub-genera. In India we have only eight known species, and two more from the adjacent country of Thibet.

The European forms of *Arvicolæ* have been divided by Blasius into four sub-genera of two divisions—the first division having rooted molars in the adult animal—containing one sub-genus only, *Hypudæus* of Illiger;

The second division consists of three sub-genera with rootless molars, viz. *Paludicola*, *Agricola*, and *Arvicola*, which last has again been subdivided into long-eared and short-eared Voles—*Arvicola* and *Microtus*—distinguished by the former having eight and the latter four mammæ, and respectively six and four tubercles on the plantæ, the ears of the latter being almost hidden by the fur.



Dentition of *Arvicola*.

None of the forms with which we have now to deal belong to the first division, for, as far as the matter has been investigated, the Indian Voles have rootless molars, but the character of the teeth in some differs from the European forms, and therefore Mr. Blanford has proposed a new section, *Alticola*, for their reception. I have not space here, nor would it accord with the popular character of this work, to go minutely into all the variation of dentition which distinguish the different species. To those who wish to continue to the minutest details the study of the Indian Voles, I recommend a most careful and elaborate paper on them by Mr. W. T. Blanford, F.R.S., in the Journal of the Asiatic Society of Bengal, vol. L., pt. ii.; but without entering into the microscopic particulars of each species, I may here give a general idea of the formation of the teeth of the *Arvicolæ* differing as it does so much from others of the myomorphic or mouse-like group of rodents. In these the general contour of the molar teeth is roundish oblong, the margins being wavy or indented, according to the convolutions of the enamel, but in the Voles there is a sharp angularity about these indentations; the marginal lines, instead of being in well-rounded curves, are sharply zigzag, forming acute angles. If you were to draw two close parallel zigzag lines it would give you some idea of the contour of these teeth. The molars are in fact composed of alternating triangular prisms, with the outer folds of enamel forming deep and acute angles. The other characteristics of this family are: skull, with brain case rhomboidal, frontals much contracted; infra-orbital opening typical; limbs moderate; tail moderate, or short and hairy.

GENUS ARVICOLA.

Muzzle blunt; fore-feet small, with short claws; soles naked; tail longer than the hind-foot, clad with short hairs; incisors plain, smooth in front. The fore-feet in some species have but a small wart in place of a thumb; in others there is a small thumb with a minute claw. The hind-feet have five toes.

No. 387. ARVICOLA STOLICZKANUS.

The Yarkand Vole.

HABITAT.—Yarkand.

DESCRIPTION.—"Bright ferruginous brown above, pure white beneath; fur soft, rather woolly, 0·5 to 0·6 inch long on the middle of the back, the basal portion throughout both head and body being dark leaden grey; this is the case on the back for about three-quarters of the length of the hairs; the remaining quarter is rufous white, tipped with darker rufous, whilst numerous rather longer hairs are dark rufous-brown at the ends; rather a sharp line divides the rufous of the back from the white belly; upper part of the head the same colour as the back; upper whiskers dark brown, lower, including the longest, white; ears small, rounded, hairy, completely concealed by the fur, with rather short bright rufous hair near the margin inside; and covered outside with longer and paler hair; feet small, the thumb of the fore-foot quite rudimentary and clawless; remaining claws long, compressed, sharply pointed, but much concealed by the long white hairs which cover the upper part of the foot, soles naked; tarsus hairy below, a few hairs between the pads of the toes; tail short, apparently about a quarter the length of the body and head together, covered with stiff fulvescent white hair, which extends about half an inch beyond the end."—*W. T. Blanford*, 'Sc. Res. of Second Yarkand Mission,' p. 43.

SIZE.—Head and body, about 4 inches; tail, with hair, 1½.

No. 388. ARVICOLA STRACHEYI.

The Kumaon Vole.

HABITAT.—Kumaon.

DESCRIPTION.—Light brown above, with a greyish tint and dusky forehead; under-parts, feet, and tail white; ears small, not longer than the fur, and thickly clad with hair; feet of moderate size; thumb as in the last; tail short and covered with white hairs.

SIZE.—Head and body, about 3·7 inches; tail; 0·7.

This vole was procured first by Capt. (now Lieut.-Gen.) R. Strachey at Kumaon.

No. 389. ARVICOLA WYNNEI.

The Murree Vole.

NATIVE NAME.—*Kannees.*

HABITAT.—Northern Himalayas; Murree.

DESCRIPTION.—Dark brown above, with a slight greyish tinge; head rufescent, and under-parts pale brown; tail dark brown; ears short and rounded, hidden by the fur; fore-feet rather large; thumb small, with a short claw; incisors orange.

SIZE.—Head and body, about $4\frac{3}{4}$ inches; tail $1\frac{1}{4}$ inch.

No. 390. ARVICOLA ROYLEI.

The Cashmere Vole (Jerdon's No. 202).

HABITAT.—Kashmir; Kunawur near Chini at 12,000 feet.

DESCRIPTION.—Yellowish-brown, with a rufous tint on the back, paler below; tail brown above, whitish underneath; feet concolorous with the under-part; ears small, hairy and nearly hidden by the fur; incisors yellow in front.

SIZE.—Head and body, $3\frac{3}{4}$ inches; tail, $1\frac{2}{12}$ inch.

Jerdon states he got this vole at Kunawur, near Chini, again on the south side of the Barendo pass, and also in the Pir Punjal.

No. 391. ARVICOLA BLANFORDI.

The Gilgit Vole.

HABITAT.—Kashmir territory; Gilgit, at an elevation of 9000 to 10,000 feet.

DESCRIPTION.—Light greyish-brown above, slightly tinged with rufous; greyish-white underneath; fur soft, the basal three-fourths being slaty grey, the rest fawn colour, in some instances with black tips, the hairs of the under-parts being white tipped; ears moderately large, well above the fur, hairy; very long whiskers, chiefly white, a few brown; feet whitish, moderate size; tail cylindrical, not tapering, and well clad with hair, which project about a fifth of an inch beyond the end of the vertebræ.

SIZE.—Head and body, about $4\frac{1}{2}$ inches; tail, 2 inches.

This vole was described by Dr. J. Scully in the 'Annals and Magazine of Natural History,' for November, 1880, vol. vi., and he named it after Mr. W. T. Blanford. It is said to be common on the mountains around Gilgit.

The next two species come under the section *Paludicola*.

No. 392. ARVICOLA BLYTHII.

HABITAT.—Western Thibet, Leh and Ladakh.

DESCRIPTION.—General colour above yellowish-brown, below pale isabelline; fur soft; basal two-thirds of the upper hairs, and one-half of the lower hairs, dark slaty; the upper hairs are tipped, some isabelline and some, which are coarser and longer, dark brown; ears round, small, equal, with the fur thinly clad with pale brown hairs inside, and more thickly so with longer hairs outside; upper whiskers dark brown, lower whitish; feet pale isabelline; soles naked; tail cylindrical, distinctly ringed, covered with short light brown hair like the under-parts in colour.

SIZE.—Head and body, about 3 to 4 inches; tail, 1 to 1¼ inch.

Mr. Blanford has written fully regarding this species, which was the type of Blyth's genus *Phaiomys*, in the 'Scientific Results of the Second Yarkand Mission,' page 39, in which he contends, after going through a mass of literature on the subject, that there are no grounds for constituting it the type of a new species; and, if this be conceded, then the specific name given by Blyth, viz. *leucurus*, being forestalled, it is necessary to rename it, which he has done in honour of that well-known naturalist.

No. 393. ARVICOLA MANDARINUS.

The Afghan Vole.

HABITAT.—Afghanistan; Chinese Mongolia.

DESCRIPTION.—Light greyish rufescent brown above, white beneath; ears short, hidden by the fur and hairy; feet whitish; tail rufescent brown.

SIZE.—About 4 inches; tail about 1 inch.

This vole, which is described and figured by Milne-Edwards, is supposed to have been found in Afghanistan from a specimen in Griffith's collection. *A. mandarinus* comes from Chinese Mongolia, and it is figured in the 'Recherches sur les Mammifères.'

The next species was made a separate genus, *Neodon*, by Hodgson, which has been adopted by Jerdon; but there are no good grounds for continuing this separation. Mr. Blanford is certainly of this opinion, and in his remarks on it (*see* his 'Sc. Results Second Yarkand Mission,' pp. 41–42) he writes: "The genus *Neodon*, appears to be founded on characters of only specific importance, and the type *N. Sikimensis* is, I think, a true *Arvicola*.

No. 394. ARVICOLA SIKIMENSIS.

The Sikim Vole (Jerdon's No. 203).

NATIVE NAMES.—*Phalchua*, Nepalese, apparently Hindi; *Cheekyu*, Kiranti; *Singphuci*, Thibetan.

HABITAT.—Nepal; Sikim; Thibet.

DESCRIPTION.—Fur soft and silky. "Deep brownish-black above with a slight rusty shade, minutely and copiously grizzled with hairs of a deep ferruginous tint" (*Horsfield*). Or a deep golden brown from yellow hairs being intermixed; bluish-grey beneath, with a slight fulvous tint; fur leaden grey for the basal three-fourths, the terminal fourth being brownish or tawny with some tipped black; the hairs of the under-parts are dipped with dirty white; ears project beyond the fur moderately, and are hairy; feet very slender; tail thinly clad with short brown hair. The female has six mammæ.

SIZE.—Head and body, about 4¾ inches; tail, 1½ inch. Horsfield gives 5 inches for head and body.

According to Jerdon this vole has only been procured in Sikim near Darjeeling, at heights varying from 7000 to 15,000 feet; but I believe the area it inhabits to be much larger. Hodgson found his specimens at Darjeeling, and on one occasion got a nest in a hollow tree in the forest; it was saucer-shaped, of soft grass without any lining, and contained a male, female, and two young. The latter were "2⅛ inches long, hairy above, nude below, and blind; the ears also closed." Jerdon writes: "Mr. Atkinson found it under fallen trees and stones on the top of Tonglo, near Darjeeling, 10,000 feet, whence also I had a specimen brought me."

The next species is one described and figured by Professor Milne-Edwards, and from Thibet he has two illustrations of it—one of an entire blackish-brown, the other darker above, but with the black belly.

No. 395. ARVICOLA MELANOGASTER.

HABITAT.—Moupin in Tibet.

DESCRIPTION.—"It is characterised by the colour of the lower parts, which are a blackish-grey. The upper parts are sometimes as black as a mole, sometimes grizzled with brown" ('Mammifères,' p. 284). The brown specimen with the dark belly is evidently a rarity.

FAMILY SPALACIDÆ.

The members of this family are characterised by very large incisors; some have premolars, as in *Bathyergus* and two other genera, but not in the *Spalacinæ*, of which our bamboo-rat (*Rhizomys*) is the representative in India. "The grinding teeth are rooted, not tuberculate, but with re-entering enamel folds; infra-orbital opening moderate or small,

with no perpendicular plate; occipital plane high, often sloped boldly forward; palate narrow; form cylindrical; eye and ear-conch very small, sometimes rudimentary; limbs short and stout; claws large; tail short or absent" (*Alston*, 'P. Z. S.' 1876, p. 86). There are two sub-families—*Spalacinæ* and *Bathyerginæ*.

GENUS RHIZOMYS—THE BAMBOO-RAT.

"Form robust; eyes very small; ears very short, naked; pollex rudimentary; tail rather short, partially haired; skull broad; occipital plane only slightly sloped forward; infra-orbital opening small, sub-triangular; upper incisors arched forward; no premolar; upper molars with one deep internal and two or more external enamel-folds; the lower molars reversed."—*Alston*.

No. 396. RHIZOMYS BADIUS.

The Chestnut Bamboo-Rat (*Jerdon's No.* 201).

NATIVE NAME.—Known to the Chingpaws or Kakhyens as the *Yewcron*.—*Anderson*.

HABITAT.—The Sikim and Nepal Terai; Burmah; Arakan; Kakhyen Hills.

DESCRIPTION.—Fine fur, of a grey or slaty grey for two-thirds of the basal portion, the remaining upper third being from a deep to a bright chestnut. "Most intense on the head, and dullest on the rump" (*Anderson*). "Below dark ashy grey" (*Jerdon*). "The fur of the under-parts in these Eastern examples of the species" (referring to those from the Kakhyen hills) "is paler and more reddish than chestnut, whereas in some Nepal animals it inclines even to slaty grey, washed with reddish. The area immediately around the muzzle and the chin is pale brownish, with a tinge of greyish, and the teeth are brilliant reddish, the nose, ears, feet, and tail being pale flesh-coloured" (*Anderson*, 'Anat. and Zool. Res.' p. 329).

Rhizomys badius.

SIZE.—Head and body, 7 inches; tail, about 2½ inches.

Jerdon says of this species that "it eats the roots of bamboos and other trees, constructing burrows under the roots. It is said to be very bold, and easily taken." "In Burmah it constructs its burrows amongst a rank and tall jungle grass, on the roots of which it is said to live" (*Anderson*). Blyth, who writes of the Burmese form, says: "it is barely separable from *R. badius*, from which it seems to differ only in its much brighter colouring."

No. 397. RHIZOMYS ERYTHROGENYS.

The Red-cheeked Bamboo-Rat.

HABITAT.—Burmah; the Salween hill tracts; Tenasserim.

DESCRIPTION.—Upper parts dark iron grey; almost black on the top of the head; the upper lip, chin and upper part of the throat are white, also the chest and belly, which are however more or less tinged with grey and reddish; the lower portion of the throat is dark grey; the sides of the head and cheeks are bright golden red; the feet are sparsely clad and leaden coloured, except the toes of the hind feet, which are fleshy white; tail rather thick at the base, quite naked, not scaly, and of a leaden hue; claws rather broad, and moderately strong.

SIZE (of the living female).—Head and body, 14¾ inches; tail, 5·35 inches.

Dr. Anderson, from whose work I have taken the above description, and who was the first to describe and name this animal, says that a female was recently received in the Zoological Gardens from Mr. A. H. Hildebrand.

No. 398. RHIZOMYS PRUINOSUS.

The Hoary Bamboo-Rat.

HABITAT.—Assam; very common about Cherrapoonjee; Burmah; Kakhyen hills east of Bhamo.

DESCRIPTION.—Brown above, grizzled with white; the base of the fur being slaty grey, tipped with brown, and intermixed with longer hairs, terminating in white bands; underneath much the same, only the white-tipped hairs are shorter and less numerous; whiskers dark brown; the head is generally more grey; ears, nose, feet and tail of a dusky flesh tint; tail one-third of the body.

SIZE.—Head and body, about 11 to 13 inches; tail, 3 to 4 inches.

No. 399. RHIZOMYS MINOR.

The Small Bamboo-Rat.

NATIVE NAME.—*Khai*, Arracanese.

HABITAT.—Burmah, Upper Martaban, and at Yanageen on the Irrawaddy.—*Blyth.*

DESCRIPTION.—"Dark sooty brown above, slightly tinged with deep umber, which is most distinct on the sides of the head and neck, and in reflected light; the under parts are like the upper, only the brown tint is almost absent; the whiskers are black, and tail very sparsely haired" (*Anderson*). "Dusky brown colour, with white muzzle and around the eye, and pale naked feet" (*Blyth*).

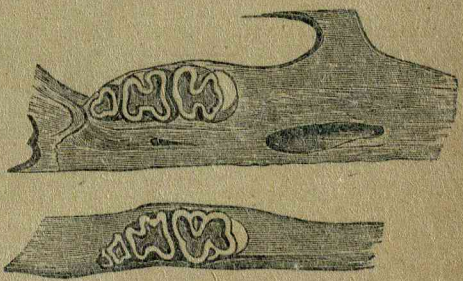
SIZE.—Head and body, 6½ inches; tail, 1¾ inch.

Blyth says he obtained a living specimen in Upper Martaban, and recognised it as the same as what had been obtained in Siam. The Rev. Mr. Mason writes of it: "This animal, which burrows under old bamboo roots, resembles a marmot more than a rat; yet it has much of the rat in its habits. I one night caught a specimen gnawing a cocoa-nut, while camping out in the jungles."

I may here mention a curious little animal, which is apparently a link between the MURIDÆ and the SPALACIDÆ, *Myospalax fuscocapillus*, named and described by Blyth ('J. A. S. B.' xv. p. 141), found at Quetta, where it is called the "Quetta mole." A full account of it by Mr. W. T. Blanford is to be found in the 'Journal Asiatic Society of Bengal,' (vol. L. pt. ii.).

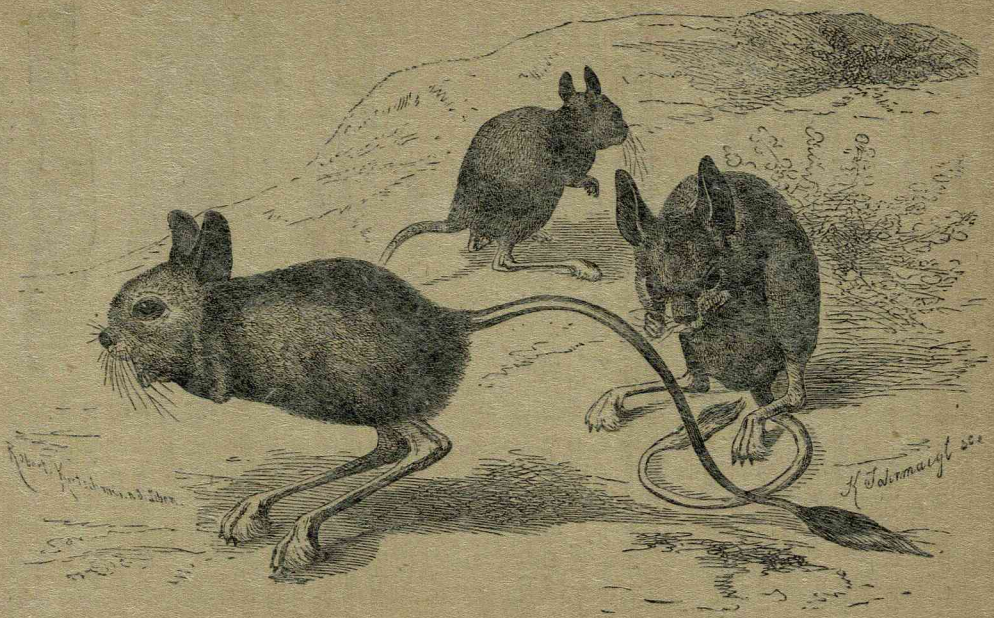
FAMILY DIPODIDÆ.

This family contains a form of rodent similar to, yet more pronounced than, the jerboa rats, of which I have already treated. It includes the true Jerboas (*Dipus*), the American Jumping Mice (*Zapus*), the *Alactaga*, and the Cape Jumping Hare (*Pedetes caffer*). The characteristics of the family are as follows:—



Dentition of Jerboa.

"Incisors compressed; premolars present or absent; grinding teeth rooted or rootless, not tuberculate, with more or fewer transverse enamel folds; skull with the brain-case short and broad; infra-orbital opening rounded, very large (often as large as the orbit); zygomatic arch slender, curved downwards; the malar ascending in front to the lachrymal in a flattened perpendicular plate; facial surface of maxillaries minutely perforated; mastoid portion of



Dipus.

auditory bullæ usually greatly developed; metatarsal bones elongated, often fused into a cannon bone; form gracile; front portion of body and fore-limbs very small; hind limbs long and strong, with from three to five digits; tail long, hairy. Three sub-families" (*Alston* On the Order GLIRES, 'P. Z. S.' 1876). The three sub-families are *Zapodidæ*,* *Dipodinæ* and *Pedetinæ*, but we have only to deal with the second.

GENUS DIPUS—THE JERBOAS.

Hind feet with three digits; tail cylindrical and tufted; incisors grooved; premolars absent, or, if found, then in the upper jaw and rudimentary; skull with very broad occipital region; greatly developed auditory bullæ; the cervical vertebræ are more or less anchylosed, and the metatarsals are united. They are not found in the plains of India, though one species inhabits Yarkand, and two more are found in Eastern Persia.

No. 400. DIPUS LAGOPUS.

The Yarkand Jerboa.

HABITAT.—Koshtak, south of Yarkand; Yarkand; and Yangihissar. —*Blanford.*

DESCRIPTION.—"Colour above light sandy brown, slightly washed with dusky, below pure white; a white band across the outside of the thigh; tail pale brown above, whitish below, with a tuft of longer hair, altogether about 2½ inches long; at the end the terminal portion pure white, the proximal portion black or dark-brown on the upper part and sides, but brown or white beneath the tail. The fur is very soft and rather long, 0·6 to 0·8 inch in the middle of the back; on the upper parts it is ashy grey at the base and for the greater parts of its length, pale sandy brown near the end; the extreme tip dusky brown; on the lower parts it is white throughout; ears about half the length of the head, oval, naked inside, thinly clothed with short brown hair outside; face sandy; the hairs grey at the base; sides of head whitish; whiskers as usual very long, exceeding three inches; the uppermost brown; the longest white, except at the base; the lower entirely white; the long hairs beneath the hind feet all white, as are the feet throughout."—*Blanford*, 'Sc. Res. of Sec. Yarkand Mission,' pp. 58, 59.

* Formerly *Jaculinæ*.

GENUS ALACTAGA.

"Hind feet with *five* digits, of which the first and fifth do not reach the ground; tail cylindrical, tufted; skull with the occipital region less broad, and the auditory bullæ smaller; infra-orbital opening with no separate canal for the nerve; incisors plain. One very small premolar present above only."—*Alston.*

No. 401. ALACTAGA INDICA.

NATIVE NAME.—*Khanee*, Afghan.

HABITAT.—Afghanistan; Eastern Persia.

DESCRIPTION.—Fawn colour above; the hair with black tips and ashy grey at the base; under-parts white; upper parts of thigh white; a black spot behind and inside the thigh just below the white; remainder of the outside and lower part of the inside of the thighs brown; a white line running down the front, and extending over the upper portion of the tarsi and feet; proximal portion of tarsus brown at the sides. (*See* 'Blanford's Eastern Persia,' vol. ii. p. 77.) The tail is brown with a white tip; ears thinly clad with brown hairs; head brown above, whitish around the eyes; whiskers black.

SIZE.—Head and body, 3½ inches; tail, 7 inches.

This animal is unfortunately named, as it is not Indian at all; equally unfortunate, as Mr. Blanford has shown, is Blyth's name *Bactrianus*, for it does not inhabit that tract, so the original title stands. Hutton, in his 'Rough Notes on the Zoology of Candahar' ('J. A. S. B.' xv. p. 137), writes of it as follows: "This beautiful little animal is abundant over all the stony plains throughout the country, burrowing deeply, and when unearthed bounding away with most surprising agility after the manner of the kangaroo-rat. It is easily tamed, and lives happily enough in confinement if furnished with plenty of room to leap about. It sleeps all day, and so soundly that it may be taken from its cage and examined without awaking it; or at most it will half open one eye in a drowsy manner for an instant, and immediately close it again in sleep. It retires to its burrows about the end of October, and remains dormant till the following April, when it throws off its lethargy and again comes forth." There is a good engraving of this animal in Cassel's new Natural History.

We have now closed our account of the Myomorpha or Mouse-like Rodents, and will proceed to the next Section, HYSTRICOMORPHA, or Porcupine-like Rodents.

SECTION III.—HYSTRICOMORPHA.

PORCUPINE-LIKE RODENTS.

This section contains six families, viz. :—

Octodontidæ . .	. .	= 3 sub-families, 18 genera.
Hystricidæ . .	. .	= 2 sub-families, 5 genera.
Chinchillidæ . .	. .	= 5 genera, of which two are fossil.
Dasyproctidæ . .	. .	= 2 genera.
Dionymidæ . .	. .	= 1 genus.
Caviidæ	. .	= 3 genera.

Of these we have to deal with but one, the second family, *Hystricidæ*, the rest belonging to Africa in part, but the majority to the American continent, chiefly South America.

I give the general characteristics of the section as laid down by Mr. Alston :—

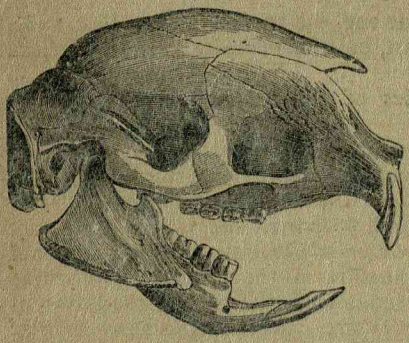
"One premolar above and below (except in *Ctenodactylus*) ; grinding teeth rooted or rootless, not tuberculate ; frontals with no distinct post-orbital processes (except in *Chætomys*) ; infra-orbital opening large, subtriangular, or oval ; zygomatic arch proportionately stout ; molar not advancing far forward, (except in *Ctenodactylinæ* and *Chinchillidæ*) and not supported below by a continuation of the maxillary zygomatic process ; incisive foramina small ; foramina in the base of skull proportionally large ; an inter-pterygoid fissure ; mandible with its angular portion springing from the *outer side* of the bony covering of the lower incisor, triangular, usually pointed behind ; coronoid process small, and condyle low ; clavicles perfect or imperfect ; fibula persistent as a distinct bone throughout life ; upper lip rarely cleft ; muffle clad with fine hairs ; nostrils pointed above, sigmoid or linear ; ears usually emarginate behind ; tail hairy, sub-naked, or scaly."—'P. Z. S.,' 1876, p. 90.

As I have said before, we have only to do with the *Hystricidæ* or Porcupines, but many of the others are familiar by name. Of the *Octodontidæ* the best known is the coypu of the Andes, one of the largest of the rodents, and the ground-rat or ground-pig of western and southern Africa. The chinchilla, which is the typical form of the third family, is known to all, especially ladies, from its delicate soft fur. The agouti of South America is the representative of the *Dasyproctidæ*. The family *Dinomyidæ* consists of one animal only, *Dinomys Branickii* ; the only known example of which was obtained in Peru on the Montana de Vitoc. It was found walking about in a yard at daybreak, and showed so little fear of man that it suffered itself to be killed by the stroke of a sword. It is a pity no one was sensible enough to try and

take it alive. As yet nothing is known of its habits. Of the last family, *Caviidæ*, the cavy and the capybara are well known to travellers in South America, and the common guinea pig is familiar to us all.

FAMILY HYSTRICIDÆ—THE PORCUPINES.

In this family the hairs of the body are more or less converted into spines or quills; the form of the skull is peculiar, being ovate, often greatly inflated with air cavities in the bones; the facial portion is broad and short; the malar portion of the zygomatic arch has no inferior angular process as in the *Octodontidæ*; the occipital plane or hinder-surface is perpendicular, with a median ridge; the incisor teeth are large and powerful; the molars with external and internal folds, four in each jaw. The form is robust; limbs sub-equal; fore-feet with four toes, and a small wart-like thumb; hind-feet with four and five toes; tail long in some, short in others. There are two sub-families,—*Sphingurinæ* and *Hystricinæ*. With the genera of the first we have nothing to do. They include the prehensile-tailed porcupines of South America, *Sphingurus prehensilis*, *S. villosus*, and *S. Mexicanus*, all arboreal forms, and the Canada porcupine (*Erythizon dorsatus*) which is covered with woolly hairs and spines intermixed. The true porcupines, sub-family *Hystricinæ*, consist of two genera, both of which are represented in India—*Atherura* and *Hystrix*.



Skull of Porcupine.

SUB-FAMILY HYSTRICINÆ—THE TRUE PORCUPINES.

Grinding teeth semi-rooted; skull rather more elongate; infra-orbital foramen of great size; clavicles imperfect, attached to the sternum, and not to the scapula; upper lip furrowed; tail not prehensile; soles of feet smooth. The female has six mammæ. In these points they differ from the American arboreal porcupines (*Sphingurus*), the skull of which is very short, the tail prehensile, the soles of the feet tuberculated, and the female has only four mammæ.

The two genera, *Atherura* and *Hystrix*, which compose this sub-family, are distinguished by long tail and flattened spines (*Atherura*), and short tail and round spines (*Hystrix*).

GENUS ATHERURA—THE LONG-TAILED PORCUPINE.

Nasal part of skull moderate; upper molars with one internal and three or four external folds, the latter soon separated as enamel loops; the lower teeth similar but reversed; the spines are flattened and channelled; the tail long and scaly, with a tuft of bristles at the end.

No. 402. ATHERURA FASCICULATA.

The Brush-tailed Porcupine.

HABITAT.—Assam, Khasia hills, Tipperah hills, Burmah, Siam, and the Malayan peninsula.

DESCRIPTION.—"The general tint of the animal is yellowish-brown, freckled with dusky brown, especially on the back; the spines, taken separately, are brown white at the root, and become gradually darker to the point; the points of the spines on the back are very dark, being of a blackish-brown colour. The long and stout bristles, which are mixed with the spines on the back, are similarly coloured" (*Waterhouse*, 'Mammalia,' vol. ii. p. 472). The spines are flat on the under-surface and concave on the upper, sharply pointed and broadest near the root. Mixed with the spines on the back are long bristles, very stout, projecting some three inches beyond the spines, which are only about an inch in length; below these is a scanty undergrowth of pale coloured hairs; the tail is somewhat less than half the length of the head and body, scaly, and at the end furnished with a large tuft of flattened bristles from three to four inches long, of a dirty white colour, with sometimes dusky tips; the ears are semi-ovate; whiskers long and stout, and of a brown colour; muzzle hairy; feet short, five toes, but the thumb very small, with a short rounded nail.

SIZE.—Head and body, 18 inches; tail, exclusive of tuft, 7½ inches.

Specimens of this animal were sent home to the Zoological Gardens, from Cherrapoonjee in the Khasia hills, by Dr. Jerdon. This species is almost the same as the African form (*A. Africana*). They are about the same in size and form and in general appearance. This last is found in such plenty, according to Bennett, in the Island of Fernando Po as to afford a staple article of food to the inhabitants. Blyth was of opinion that the Indian animal is much paler and more freckled than the African.

GENUS HYSTRIX—THE PORCUPINE.

"Spines cylindrical; tail short, covered with spines and slender-stalked open quills; nasal cavity usually very large; air sinuses of frontals greatly developed; teeth as in *Atherura*. The hind-feet with five toes; claws very stout."

The hinder part of the body is covered by a great number of sharp spines, ringed black and white, mostly tipped with white; the spines are hollow or filled with a spongy tissue, but extremely tough and resistant, with points as sharp as a needle. The animal is able to erect these by a contraction of the skin, but the old idea that they could be projected or shot out at an assailant is erroneous. They easily drop out, which may have given an idea of discharge. The porcupine attacks by backing up against an opponent or thrusting at him by a sidelong motion. I kept one some years ago, and had ample opportunity of studying his mode of defence. When a dog or any other foe comes to close quarters, the porcupine wheels round and rapidly charges back. They also have a side-way jerk which is effective.

No. 403. HYSTRIX LEUCURA.

The White-tailed Indian Porcupine (*Jerdon's No.* 204).

NATIVE NAMES.—*Kanta-sahi*, *Sayi*, *Sayal*, *Sarsel*, Hindi; *Sajru*, Bengali; *Chotia-dumsee*, Nepali; *Saori*, Gujrati; *Salendra* and *Sayal*, Mahrathi; *Yed*, Canarese; *Ho-igu*, Gondi; *Phyoo*, Burmese; *Heetava*, Singhalese.

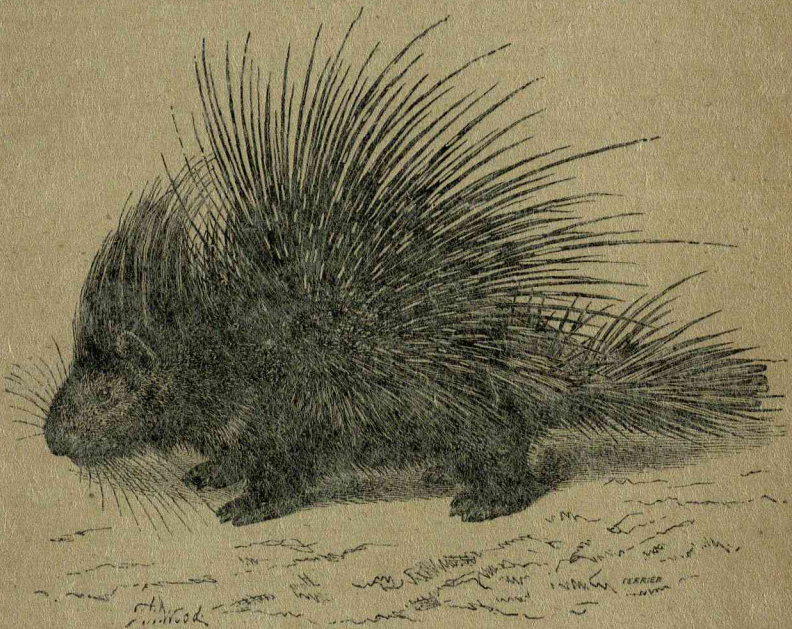
HABITAT.—All over India (except perhaps Lower Bengal), Burmah and Ceylon.

DESCRIPTION.—Blackish-brown; muzzle clad with short, stiff, bristly hairs; whiskers long and black, and a few white spines on the face; spines on the throat short, grooved, some with white setaceous points forming a half-collar; crest of head and neck formed of long black bristles, with here and there one with a long white tip; the spines of the sides are short, flattish, grooved or striated, mostly with white points; the large quills of the back are either entirely black or ringed at the base and middle with white, a few with white tips; the longer and thinner quills on the back and sides have long white terminations; many of these again, particularly the longest, have a basal and one or two central white rings; the short quills on the mesial line of the lumbar region are nearly all white, and the longer striated quills of this region are mostly white; quills of the tail white or yellowish, a few black ones at the root; pedunculated quills are long, broad, and much flattened in old animals.

SIZE.—Head and body, 32 inches; tail, 8 inches.

The description given in his 'Prodromus Faunæ Zeylanicæ' by

Mr. Kellaart, who was a most careful observer, has been of great assistance to me in the above, as it was also, I fancy, to Jerdon, and his subsequent remarks are worthy of consideration. "The identification of species from single characters," he observes, "is at all times difficult and unsatisfactory in the genus *Hystrix*, particularly so as regard the conformation of the skull." And again: "The number of molars varies also in different specimens. In two adults obtained at Trincomalee there were only three molars on each side of the jaw, four being the dental formula of the genus *Hystrix*."



Hystrix leucura.

I think such aberrations ought to warn us from trying to make too many genera out of these animals. Dr. Gray, whose particular forte—or shall I say weakness?—was minute subdivision, classed (in 1847) the Indian porcupines in three sub-families, *Hystrix*, *Acanthion*, and *Atherura*; and *Acanthion* he some years after (1866, *see* 'P. Z. S.' p. 308) divided again into three groups, *Œdocephalus*, *Acanthochærus* and *Acanthion*. The difference in the skull of *Hystrix* and *Acanthion* lies in the inter-maxillaries and the grinders, as follows:—

Hystrix—Inter-max. broad, truncated, wide behind as before; *grinders*

long, longer than broad, one fold on the inner, and three or four on the outer side.

Acanthion—Inter-max. triangular, tapering behind; *grinders* sub-cylindrical, not longer than broad, one fold on the inner, two or three on the outer side.

According to Waterhouse the European porcupine (*Hystrix cristata* of Linnæus) is the *Acanthion Cuvieri* of Gray; and Gray, who afterwards modified his views of 1847 in 1866, wrote of it: "I am not aware of any external characters by which this species can be distinguished from the *Hystrix cristata*, though the skull is so different." Gray in another place writes that: "Though the skulls of *H. leucurus* preserve a very distinct character, yet they vary so much amongst themselves as to show that skulls afford no better character for the distinction of species than any other single character, such as colour, but can only be depended on when taken in connection with the rest of the organisation." In these circumstances I think it will be better not to attempt any further subdivision of the Indian porcupines in the present work beyond the two already given, viz. *Hystrix* and *Atherura*. There is a great similarity between the Indian *H. leucura* and the European *H. cristata*. According to Waterhouse the quills in the lumbar region, which are white in the Indian, are dusky in the European, which last has long white points to the bristles of the crest, whereas in the Indian one some only of the points are white, and the rest quite brown.

The Indian porcupine lives in burrows, in banks, hill sides, on the bunds of tanks, and in the sides of rivers and nullahs. It is nocturnal in its habits, and in the vicinity of cultivation does much damage to such garden stuff as consists of tubers or roots. In the jungle its food consists chiefly of roots, especially of some kinds of wild yam (*Dioscorea*). I have found porcupines in the densest bamboo jungles of the central provinces, where their food was doubtless young bamboo shoots and various kind of roots.

The porcupine all the world over is known to be good eating, and is in many countries esteemed a delicacy. The flesh is white and tender, and is much prized by most people in those places where it abounds. Brigadier-General McMaster, in his 'Notes on Jerdon,' in speaking of the only instance where he found a porcupine on the move after daylight, says: "Just at dawn a porcupine appeared, and, as I suppose his house was somewhere between us, trotted and fed, grunting hog-like, about the little valley at our feet until long after the sun was well up, and until I, despairing of other game, and bearing in mind his delicious flesh (for that of a porcupine is the most delicate I know of), shot him. Well may the flesh be tender and of delicate flavour, for, as many gardeners know to their cost, porcupines are most scrupulously dainty and epicurean as to their diet. A pine-apple is left by them until the

every night before it is fit to be cut. Peas, potatoes, onions, &c., are not touched until the owner has made up his mind that they were just ready for the table." The Gonds in Seonee were always on the look-out for a porcupine. I described in my book on that district the digging out of one.

"The entrance of the animal's abode was a hole in a bank at which the dogs were yelping and scratching; but the bipeds had gone more scientifically to work by countermining from above, sinking shafts downwards at various points, till at last they reached his inner chamber, when he scuttled out, and, charging backwards at the dogs with all his spines erected, he soon sent them flying, howling most piteously; but a Gondee axe hurled at his head soon put an end to his career, for a porcupine's skull is particularly tender."

The female produces from two to four young, which are born with their eyes open. Their bodies are covered with short soft spines, which, however, speedily harden. It is said that the young do not remain long with their mother, but I cannot speak to this from personal experience. I have had young ones, but not those born in captivity.

No. 404. HYSTRIX BENGALENSIS.

The Bengal Porcupine (*Jerdon's No.* 205).

NATIVE NAME.—*Sajaru* or *Sajru*, Bengali.

DESCRIPTION.—"Smaller than the last; crest small and thin; the bristles blackish; body spines much flattened and strongly grooved, terminating in a slight seta or bristle; slender flexible quills much fewer than in *leucura*, white, with a narrow black band about the centre; the thick quills basally white, the rest black, mostly with a white tip; a distinct white demi-collar; spines of lumbar region white, as are those of tail and rattle; muzzle less hirsute than in *leucura*."

SIZE.—Head and body, 28 inches; tail, 8 inches.

There is occasionally a variety to be found of this species with orange-coloured quills, or rather the orange hue is assumed at times. Jerdon mentions the fact that Sclater describes his *H. Malabarica* as having certain orange-coloured quills in place of white, and also that Blyth considered the two species identical. He also states that Mr. Day procured specimens of the orange porcupine from the Ghâts of Cochin and Travancore, and that they were considered more delicate eating by the native sportsmen, who aver that they can distinguish the two kinds by the smell from their burrows; but he was not apparently aware at the time that a specimen of *H. Malabarica* with orange quills in the Zoological Gardens in London moulted, and the red quills were replaced by the ordinary black and white ones of the common Indian kind. Dr. Sclater afterwards (*see* 'P. Z. S.' 1871, p. 234) came to the conclusion that *H. Malabarica* was synonymous with *H. leucura*.

No. 405. HYSTRIX (ACANTHION) LONGICAUDA.

The Crestless Porcupine (Jerdon's No. 206).

NATIVE NAMES. — *Anchotia-sahi* or *Anchotia-dumsi* in Nepal; *Sathung*, Lepcha; *O'—e* of the Limbus (*Hodgson*). (N.B.—The *ch* must not be pronounced as *k*, but as *ch* in church.) *Anchotia* means crestless, the crested porcupine being called *Chotia-dumsi*.

HABITAT.—Nepal and Sikim, and on through Burmah to the Malayan peninsula, where it was first discovered.

DESCRIPTION.—Distinguished from the other species "by its inferior size, total absence of crest on its head, neck, and shoulders, by its longer tail, by the white collar of the neck being evanescent, and lastly by the inferior size and smaller quantity of the spines or quills."—*Hodgson.*

It is covered with black spinous bristles from two to three inches long, shortest on the head and limbs. The large quills of the back and croup are from seven to twelve inches long, mostly with one central black ring.

SIZE.—Head and body, 24 inches; tail, 4, or with the quills, 5½ inches.

This is Hodgson's *H. alophus*, which is, I think, a more appropriate name than the one given, for its tail is not so very long in proportion. Hodgson says of it: "They breed in spring, and usually produce two young about the time the crops ripen. They are monogamous, the pair dwelling together in burrows of their own formation. Their flesh is delicious, like pork, but much more delicate flavoured, and they are easily tamed so as to breed in confinement. All tribes and classes, even high-caste Hindoos, eat them, and it is deemed lucky to keep one or two alive in stables, where they are encouraged to breed. Royal stables are seldom without at least one of them."

This animal was described by Gray as *Acanthion Hodgsonii*, the *lesser Indian porcupine*. Waterhouse, in writing of *Hystrix (Acanthion) Javanica*, says: "The habits of the animal, as recorded by Müller, do not differ from those of *H. Hodgsonii*"; and Blyth, as mentioned by Jerdon, was of opinion that the two species were one and the same. The *Acanthochærus Grotei*, described and figured by Dr. Gray in 1866 ('P. Z. S.' p. 306), is the same as this species. It is to be found at Darjeeling amongst the tea plantations, between 4000 and 5000 feet elevation.

No. 406. HYSTRIX YUNNANENSIS.

HABITAT.—Burmah, in the Kakhyen hills, at elevations of from 2000 to 4500 feet.

DESCRIPTION—after Dr. Anderson, who first discovered and named

this species: "Dark brown on the head, neck, shoulders, and sides passing into a deep black on the extremities, a very narrow white line passing backwards from behind the angle of the mouth to the shoulder; under surface brownish; the spiny hairs of the anterior part of the trunk flattened, grooved or ungrooved. The crest begins behind the occiput and terminates before the shoulders; the hairs are long, slender and backwardly curved, the generality of them being about 4½ inches long, while the longer hairs measure about six inches.

"They are all paler than the surrounding hairs, and the individual hairs are either broadly tipped with yellowish-white, or they have a broad sub-apical band of that colour. The short, broad, spiny hairs, lying a short way in front of the quills, are yellow at their bases, the remaining portion being deep brown, whereas those more quill-like spiny hairs, immediately before the quills, have both ends yellow tipped.

"The quills are wholly yellow, with the exception of a dark brown, almost black band of variable breadth and position. It is very broad in the shorter quills, and is nearer the free end of the quill than its base, whereas in the long slender quills it is reduced to a narrow mesial band. The stout strong quills rarely exceed six inches in length, whilst the slender quills are one foot long. Posteriorly above the tail and at its sides many of the short quills are pure white. The modified quills on the tail, with dilated barb-like free ends are not numerous, and are also white. There are three kinds of rattle quills, the most numerous measure 0·65 inch in the length of the dilated hollow part, having a maximum breadth of 0·21 inch, whilst there are a few short cups 0·38 inch in length, with a breadth of 0·17 inch, and besides these a very few more elongated and narrow cylinders occur."—'Anat. and Zool. Res.,' p. 332.

SUB-ORDER DUPLICIDENTATA—DOUBLE-TOOTHED RODENTS.

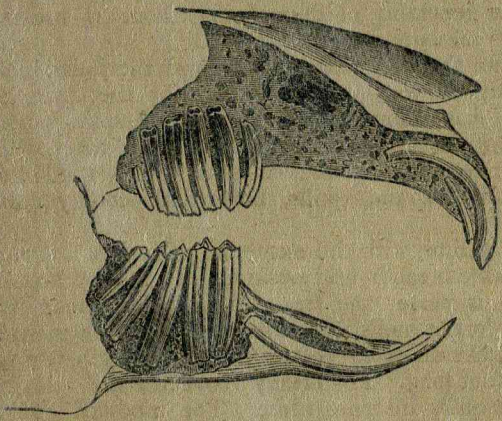
These rodents are distinguished by the presence of two small additional incisors behind the upper large ones. At birth there are four such rudimentary incisors, but the outer two are shed, and disappear at a very early age; the remaining two are immediately behind the large middle pair, and their use is doubtful; but, as Dallas remarks, "their presence is however of interest, as indicating the direction in which an alliance with other forms of mammalia more abundantly supplied with teeth is to be sought."

Another distinctive characteristic of this sub-order is the formation of the bony palate, which is narrowed to a mere bridge between the alveolar

borders; or portions of the upper jaw in which the grinding teeth are inserted.

The following synopsis of the sub-order is given by Mr. Alston :—

Incisors $\frac{4}{2}$; at birth $\frac{6}{2}$; the outer upper incisor soon lost; the next pair very small, placed directly behind the large middle pair; their enamel continuous round the tooth, but much thinner behind; skull with the optic foramina confluent, with no true alisphenoid canal; incisive foramina usually confluent; bony palate reduced to a bridge between the alveolar borders; fibula anchylosed to tibia below, and articulating with the calcaneum; testes permanently external; no vesicular glands. Two families."—'P. Z. S.' 1876, p. 97.



Dentition of Hare.

There are only two families each of one existing genus—LEPORIDÆ, genus *Lepus*, the Hare; and LAGOMYIDÆ, genus *Lagomys*, the Pika, or Mouse-Hare, as Jerdon calls it. There are three fossil genera in the first family, viz. *Palæolagus*, a fossil hare found in the Miocene of Dacota and Colorado, *Panolax* from the Pliocene marls of Santa Fe, and *Praotherium* from Pennsylvanian bone-caves. A fossil Lagomys, genus *Titanomys*, is found in the Post-Pliocene deposits in various parts of Europe, chiefly in the south.

FAMILY LEPORIDÆ—THE HARES.

"Three premolars above and two below; molars rootless, with transverse enamel folds dividing them into lobes; skull compressed; frontals with large wing-shaped post-orbital processes; facial portion of maxillaries minutely reticulated; basisphenoid with a median perforation, and separated by a fissure from the vomer; coronoid process represented by a thin ridge of bone; clavicles imperfect; ears and hind-limbs elongated, tail short, bushy, recurved."—*Alston.*

Hares are found all over the world except in Australasia. The Rabbit is much more localised; in India we have none, unless the Hispid Hare,

The black rabbit of Dacca sportsmen, is a true rabbit; it is said to burrow, but whether it is gregarious I know not. Another point would also decide the question, viz. are the young born with eyes open or shut? The hare pairs at about a year old, and has several broods a year of from two to five; the young are born covered with hair and their eyes open, whereas young rabbits are born blind and naked. The hare lives in the open, and its lair or "form" is merely a slight depression in some secluded spot. It has been noticed that the hare always returns to its form, no matter to what distance it may have wandered or have been driven.

No. 407. LEPUS RUFICAUDATUS.

The Common Indian Red-tailed Hare (*Jerdon's No.* 207).

NATIVE NAMES.—*Khargosh*, *Kharra*, Hindi; *Sasru*, Bengali; *Mullol*, Gondi.

HABITAT.—India generally.

DESCRIPTION.—"General hue rufescent, mixed with blackish on the back and head; ears brownish anteriorly, white at the base, and the tip brown; neck, breast, flanks and limbs more or less dark sandy rufescent, unmottled; nape pale sandy rufescent; tail rufous above, white beneath; upper lip small; eye-mark, chin, throat, and lower parts pure white." —*Jerdon.*

SIZE.—Head and body, 20 inches; tail, with hair, 4 inches; ear externally about 5 inches; maximum weight, about 5 lbs.

The Indian hare is generally found in open bush country, often on the banks of rivers, at least as far as my experience goes in the Central Provinces. Jerdon says, and McMaster corroborates his statement, that this species, as well as the next, take readily to earth when pursued, and seem to be well acquainted with all the fox-holes in their neighbourhood, and McMaster adds that they seem to be well aware which holes have foxes or not, and never go into a tenanted one.

The Indian hare is by no means so good for the table as the European one, being dry and tasteless, and hardly worth cooking.

No. 408. LEPUS NIGRICOLLIS.

The Black-naped Hare (*Jerdon's No.* 208).

NATIVE NAMES.—*Khargosh*, Hindi; *Malla*, Canarese; *Sassa*, Mahrathi; *Musal*, Tamil; *Kundali*, Telegu; *Haba*, Singhalese.

HABITAT.—Southern India and Ceylon; stated to be found also in Sind and the Punjab.

DESCRIPTION.—"Upper part rufescent yellow, mottled with black; single hairs annulated yellow and black; chin, abdomen, and inside of hind-limbs downy white; a black velvety spot on the occiput and upper

t of neck extending to near the shoulders; the spot under the neck is in some specimens of a bright yellow colour; ears long, greyish-brown, internally with white fringes, at the apical part dusky, posteriorly black at the base; feet yellowish; tail above grizzled with black and yellow, beneath white."—*Kellaart.*

SIZE.—Head and body, 19 inches; tail, 2½ inches; ears, 4¾ inches.

A friend of Brigadier-General McMaster's, writing to him, says: "The black-naped hare of the Neilgherries, which appears to be the same as that of the plains, only larger from the effect of climate, often, when chased by dogs, runs into holes and hollow trees. I have found some of the Neilgherry hares to be nearly, if not quite, equal to the English hares in flavour. I think a great deal depends upon keeping and cooking.

No. 409. LEPUS PEGUENSIS.

The Pegu Hare.

NATIVE NAME.—*Yung*, Arakanese.

HABITAT.—Pegu, Burmah.

DESCRIPTION.—Very like *L. ruficaudatus*, but with the tail *black* above; the colour of the upper parts is separated more distinctly from the pure white of the under parts.

SIZE.—Head and body, about 20 inches.

No. 410. LEPUS HYPSIBIUS.

The Mountain Hare.

HABITAT.—Northern Ladakh.

DESCRIPTION.—Colour rufous brown, more or less mixed with black on the back, dusky ashy on the rump; lower parts white with a slight rufescent tinge, fur long, woolly, rather curly, and thick; head brown, whitish round the eyes; whiskers partly black, partly white; outside surface of ears brown in front, whitish behind, the brown hairs having short black tips; the extreme tip of ears black; tail white; throughout limbs chiefly white, a brownish band running down the anterior portion of the fore-legs.

SIZE.—Of skin about 24 inches. (*See* Blanford's 'Second Yarkand Mission,' p. 60; also plate iii.)

No. 411. LEPUS PALLIPES.

The Pale-footed Hare.

NATIVE NAMES.—*Togh*, *Toshkhen*, Yarkandi, i.e. Mountain Hare.

HABITAT.—Yarkand; Thibet.

DESCRIPTION.—"Fur long, dense and soft, of a pale ochre colour, but on the back of the animal pencilled with black; haunches greyish;

under-parts white, chest of a delicate yellow rufous tint; the front of the fore-legs and the fore-feet nearly of the same hue; tarsus almost white, but somewhat suffused with rufous in front; tail white, excepting along the middle portion of the upper surface, where it is grey."—Waterhouse's 'Mammalia,' vol. ii. p. 62.

SIZE.—Head and body, about 18 inches; tail, with hair about 5 inches.

This hare was first described by Hodgson ('J. A. S. B.,' vol. xi.), who also gave a plate; but there is a full description with an excellent plate in Blanford's 'Scientific Results of the Second Yarkand Mission.'

No. 412. LEPUS TIBETANUS.

The Thibet Hare.

HABITAT.—Little Thibet; Ladakh.

DESCRIPTION.—Ears longer than the head, margined with yellow white internally, externally, with the apex, edged with black and with a narrow edging of black extending about half-way down the hinder margin. The general colour seems to vary, as is the case with most of the mountain hares. According to Waterhouse it is "palish-ashy grey; the back mottled with dusky and yellowish-white; the back of neck pale rufous brown." Two specimens, described by Blanford, are "general colour rufous brown (very dark brownish tawny)," and another, "above dusky brown, with an ashy tinge on the rump." Waterhouse's specimens may have been in the winter dress; the under-parts are white; legs longish and white; tail white, with the upper surface sooty or grey-black. The excellent plate in the Yarkand Report is nearer to Waterhouse's verbal portraiture, being of a mottled ashy grey.

SIZE.—Head and body, about 18 inches; tail, with hair, 4½ inches.

No. 413. LEPUS YARKANDENSIS.

The Yarkand Hare.

NATIVE NAME.—*Toshkhan*, Yarkandi.

HABITAT.—The plains of Yarkand and Kashghar.

DESCRIPTION.—General colour sandy, more or less mixed with dusky; pale isabelline on the sides; no grey on rump; tail dark brown above; ears without black tip; lower parts white; fur soft and long; fore-legs very pale, brown in front; hind-legs still paler, brown outside.

SIZE.—Head and body, about 17 inches; tail, 4 inches.

Mr. Blanford remarks that "one striking peculiarity of this very pale coloured hare is the absence of any black patches, and of all grey

coloration throughout." The specimens were all shot in winter top. (*See* Blanford's 'Scientific Results, Second Yarkand Mission,' p. 65, and plate iv., fig. 1.)

No. 414. LEPUS PAMIRENSIS.

The Pamir Hare.

HABITAT.—Lake Sirikal, Pamir.

DESCRIPTION.—Pale sandy brown; almost isabelline on back and sides; rump greyish-white; tail black above; face and anterior portion of the ears concolorous with back; terminal portion of ears black outside at the edge; breast light rufous; lower parts white; fur fine, close and soft; fore-legs in front, and hind-legs outside, with a light brownish tinge.

SIZE.—Head and body, about 17 inches; tail, 4 inches.

The hare is described and named by Mr. W. T. Blanford, and from his full description I have abridged the above short notice. It is also well figured in the 'Yarkand Report,' plate v., fig. 1.

No. 415. LEPUS STOLICZKANUS.

Stoliczka's Hare.

HABITAT.—Kashghar, Altum Artush district, north-east of Kashghar.

DESCRIPTION.—"General colour light sandy brown, much mixed with black on the back; the rump very little paler; tail rather long, black above; face and anterior portion of ears the same colour as the back; terminal portion of ears black outside; nape and breast light rufous; lower parts white. The skull differs much from that of *L. Yarkandensis* and *L. Pamirensis*, the nasals being much more abruptly truncated behind than in either, and the parietal region or sinciput flatter" (Blanford's 'Scientific Results, Second Yarkand Mission,' p. 69, and plate v. fig. 2, skull plate, Va. fig. 2).

SIZE.—Head and body, about 17 inches; tail, with hair, 5 inches.

This hare was obtained by Dr. Stoliczka, and was first described and named by Mr. W. T. Blanford ('J. A. S. B.' vol. xiv. 1875, part ii. p. 110).

No. 416. LEPUS CRASPEDOTIS.

The Large-eared Hare.

HABITAT.—Baluchistan, Pishin.

DESCRIPTION.—Colour brown above, white below; the fur of the back is very pale French grey at the base, then black, and the tip is pale brown, almost isabelline; the black rings are wanting on the nape, hind

neck and breast, which, like the fore-legs and hinder part of the flanks, are pale rufous brown; ears externally mouse brown, blackish-brown on the posterior portion near the tip, the anterior edges white, with rather longer hairs, except near the tip, where the hair is short and black; the posterior margins inside pale isabelline, the pale edge becoming broader near the tip; tail black above, white on the sides and below; whiskers black near the base, white except in the shorter ones throughout the greater part of their length; a pale line from the nose, including the eye, continued back nearly to the ear (Blanford's 'Eastern Persia,' vol. ii. p. 81, with plate).

SIZE.—Head and body, 15 inches; tail, with hair, 4·5 inches; ear, 6 inches; breadth of ear laid flat, 3·25 inches.

This is a new species, described and named by Mr. W. T. Blanford.

No. 417. LEPUS HISPIDUS.

The Hispid Hare.

HABITAT.—The Terai and low forests at the base of the Himalayas.

DESCRIPTION.—"General colour dark or iron grey, with an embrowned ruddy tinge, and the limbs shaded outside, like the body, with black, instead of being unmixed rufous" (*Hodgson*). The inner fur is soft, downy, and of an ash colour, the outer longer, hispid, harsh and bristly. Some of the hairs ringed black and brown, others are pure black and long, the latter more numerous; ears short and broad.

SIZE.—Head and body, 19½ inches; tail, with hair, 2½ inches; ears, 2¾ inches.

This animal seems to be a link between the hares and the rabbits. Like the latter, it burrows, and has more equal limbs; but, according to Hodgson, it is not gregarious, but lives in pairs. It would greatly help in the identification of its position if some one would procure the young or a gravid female, and see whether the young are born blind and naked as in the rabbits, or open-eyed and clad with fur as in the hares. Jerdon says it is common at Dacca, and is reported to be found also in the Rajmehal hills, and that its flesh is stated to be white, like that of the rabbit.

FAMILY LAGOMYIDÆ—THE PIKAS, OR MOUSE-HARES.

One or two premolars above and below; grinding teeth as in *Leporidæ*; skull depressed; the frontals are contracted, without the wing-like processes of the hares; a single perforation in the facial surface of the maxillaries; a curious prolongation of the posterior angle of the malar into a process extending almost to the ear tube, or auditory meatus; the

basisphenoid is not perforated and separated from the vomer as in *Lepus*; the coronoid process is in the form of a tubercle; the clavicles are complete; ears short; limbs nearly equal; no tail.

GENUS LAGOMYS.

Animals of small size and robust form; short-eared and tailless; two premolars above and below.

No. 418. LAGOMYS ROYLEI.

Royle's Pika (Jerdon's No. 210).

NATIVE NAME.—*Rang-runi*, or *Rang-duni*, in Kunawur.—*Jerdon.*

HABITAT.—The Himalayan range, from Kashmir to Sikim.

DESCRIPTION.—Rabbit grey or brown, with a yellowish-grey tinge, more or less rufous on the head, neck, shoulder and sides of body; a hairy brown muzzle, with pale under-lip; long whiskers, some white, the posterior ones dark; under-parts white; fur soft and fine. The upper lip is lobed as in the hare; ears elliptical, with rounded tops.

SIZE.—From 6 to 8 inches.

The first specimen was sent to England by Dr. Royle, in whose honour Mr. Ogilby named it. It was obtained not far from Simla. It lives in rocky ground or amongst loose stones in burrows, and is the tailless rat described by Turner in his 'Journey to Thibet,' which had perforated the banks of a lake by its holes.

No. 419. LAGOMYS CURZONIÆ.

Curzon's Pika.

HABITAT.—The higher ranges of the Himalayas, from 14,000 to 19,000 feet. It has been found northerly in Ladakh, and easterly in Sikim.

DESCRIPTION.—Pale buff above, tinged with rufous, the sides being more rufescent; head, as far back as the ears, decidedly rufescent; ears large and oval; sides of head and nose dirty fulvous white; under-parts white, with a faint yellow tinge; limbs and soles of feet white; whiskers, some black, some white; fur long, fine and silky.

SIZE.—About 7 inches to 8 inches.

No. 420. LAGOMYS LADACENSIS.

The Ladak Pika.

NATIVE NAMES.—*Zabra*, *Karin*, or *Phisekarin*, Ladakhi.

HABITAT.—High plateaux of Ladakh.

DESCRIPTION.—"General hue of the upper body pale buff, fulvous,

with a very slight rufous tint, and tipped with dark brown; below whitish with translucent dusky blue.—*Stoliczka*, quoted by Blanford.

SIZE.—From 7 inches to 9 inches.

It is as yet doubtful whether this is not identical with the last. Mr. Blanford has separated it, and Dr. Günther, agreeing with him, named this species *L. Ladacensis;* but the skull characteristics of *L. Curzoniæ* have not as yet been compared with this, and the separation has been made on external characters only.

No. 421. LAGOMYS AURITUS.

The Large-eared Pika.

HABITAT.—Lukong, on the Pankong lake.

DESCRIPTION.—General colour above smoky or wood brown; the head, shoulders and rump rather paler and more rufous; lower parts whitish, with the dark basal portion of the hair showing through; fur very soft, moderately long; ears large, round, clothed rather thinly inside near the margin with whitish-brown hairs, and outside with much longer hairs of the same colour; whiskers fine and long, the upper dark brown, the lower white; feet whitish. (*See* Blanford's 'Sc. Res. Second Yarkand Mission,' p. 75, plate vi. fig. 2.)

SIZE.—About 8 inches.

No. 422. LAGOMYS MACROTIS.

This seems to be a doubtful species; it may probably prove to be the same as the last, the skulls being similar. Mr. Blanford remarks: "I am strongly disposed to suspect, indeed, that *L. auritus* is the summer *L. macrotis*, the winter garb of the same species; but there are one or two differences which require explanation. The feet appear larger in *L. macrotis*, and the pads of the toes are black, whilst in *L. auritus* they are pale coloured. In the former the long hair of the forehead is lead black at the base, in the latter pale grey; the feet and lower parts generally are white in *L. macrotis*, buffy white in *L. auritus*, but this may be seasonable."

No. 423. LAGOMYS GRISEUS.

The Grey Pika.

HABITAT.—Yarkand, Kuenlun range, south of Sunju pass.

DESCRIPTION.—General colour dull grey (almost Chinchilla colour), with a slight rufescent tinge on the face and back; lower parts white;

fur very soft, about 0·9 inch long in the middle of the back; glossy leaden black at the base and for about two-thirds of its length, very pale ashy grey towards the end; the extreme tips of many hairs dark brown, and on the back the tips of all the hairs are brownish; the sides are almost pure light ashy; rump still paler; feet white; hair on the face long, light brown on the forehead, greyer on the nose, pure grey on the sides of the head. A few of the upper whiskers black, the rest white; ears large round with rather thin white hairs inside, very short hairs close to the margin, white outside, black inside, outer surface covered with whitish hairs, which become long near the base of the ear. (*See* Blanford's 'Scientific Results, Second Yarkand Mission,' p. 77, and plate vii. fig. 1.)

SIZE.—About 7 inches.

No. 424. LAGOMYS RUFESCENS.

The Red Pika.

HABITAT.—Afghanistan, Persia.

DESCRIPTION.—Pale sandy red, darker on the top of the head, the shoulders and fore part of back; two large patches behind the ears; the feet and the under-parts are pale buff yellow; ears moderately large, subovate and well clad, rusty yellow, paler on the under part; whiskers very long, brown, a few brownish white; toe-pads blackish.

SIZE.—About 8 inches.

This species has been found in the rocky hills of Cabul. *Lagomys Hodgsonii*, from Lahoul, Ladakh and Kulu, is considered to be the same as the above, and *L. Nipalensis*, described by Waterhouse, as synonymous with *L. Roylei*.

Under the systems of older naturalists the thick-skinned animals were lumped together under the order UNGULATA, or *hoofed animals*, subdivided by Cuvier into *Pachydermata*, or thick-skinned non-ruminants, and *Ruminantia*, or ruminating animals; but neither the elephant nor the coney can be called hoofed animals, and in other respects they so entirely differ from the rest that recent systematists have separated them into three distinct orders—*Proboscidea*, *Hyracoidea* and *Ungulata*, which classification I here adopt.

ORDER PROBOSCIDEA.

It seems a strange jump from the order which contains the smallest mammal, the little harvest mouse, to that which contains the gigantic elephant—a step from the ridiculous to the sublime; yet there are points of affinity between the little mouse and the giant tusker to which I will allude further on, and which bring together these two unequal links in the great chain of nature. The order Proboscidea, or animals whose noses are prolonged into a flexible trunk, consists of one genus containing two living species only—the Indian and African Elephants. To this in the fossil world are added two more genera—the *Mastodon* and *Dinotherium*.

The elephant is one of the oldest known of animals. Frequent mention is made in the Scriptures and ancient writings of the use of ivory. In the First Book of Kings and the Second of Chronicles, it is mentioned how Solomon's ships brought every three years from Tarshish gold and silver and ivory (or elephants' teeth) apes and peacocks. In the Apocrypha the animal itself, and its use in war, is mentioned; in the old Sanscrit writings it frequently appears. Aristotle and Pliny were firm believers in the superstition which prevailed, even to more recent times, that it had no joints.

> "The elephant hath joints, but none for courtesy;
> His legs are for necessity, not flexure"—

says Shakespeare. Even down to the last century did this notion prevail, so little did people know of this animal. The supposition that he slept leaning against a tree is to be traced in Thomson's 'Seasons'—

> "Or where the Ganges rolls his sacred waves
> Leans the huge elephant."

Again, Montgomery says—

> "Beneath the palm which he was wont to make
> His prop in slumber."

At a very early period elephants were used in war, not only by the Indian but the African nations. In the first Punic war (B.C. 264–241) they were used considerably by the Carthaginians, and in the second Punic war Hannibal carried thirty-seven of them across the Alps. In the wars of the Moghuls they were used extensively. The domestication of the African elephant has now entirely ceased; there is however no reason why this noble animal should not be made as useful as its Indian brother; it is a bigger animal, and as tractable, judging from the specimens in menageries. It was trained in the time of the Romans for

performances in the arena, and swelled the pomp of military triumphs when, as Macaulay, I think, in his 'Lays of Ancient Rome,' says, the people wondered at—

"The monstrous beast that had
A serpent for a hand."

It seems a cruel shame, when one comes to think of it, that thousands of these noble animals should perish annually by all sorts of ignoble means—pitfalls, hamstringing, poisoned arrows, and a few here and there shot with more or less daring by adventurous sportsmen, only for the sake of their magnificent tusks.

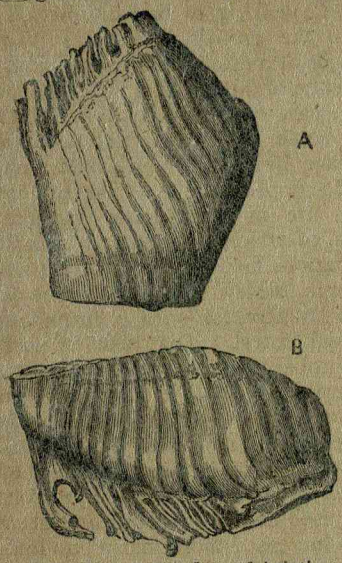
Few people think, as they leisurely cut open the pages of a new book or play with their ivory-handled dessert-knives after dinner, of the life that has once been the lot of that inanimate substance, so beautiful in its texture, so prized from time immemorial; still less do they think, for the majority do not know, of the enormous loss of life entailed in purveying this luxury for the market. An elephant is a long-lived beast; it is difficult to say what is the extent of its individual existence; at fifty years it is in its prime, and its reproduction is in ratio slower than animals of shorter life, yet what countless herds must there be in Central Africa when we consider that the annual requirements of Sheffield alone are reported to be upwards of 46,000 tusks, which represent 23,000 elephants a year for the commerce of one single city! The African elephant must be decreasing, even as it has been extirpated in the north of that continent, where it abounded in the time of the Carthaginians, and the time may come when ivory shall be counted as one of the precious things of the past. Even now the price is going up, and is nearly double what it was a year ago. Now enhanced price means either greater demand or deficient supply, and it is probably to this last we must look for an answer to the question. True it is that if we want ivory animals must be killed to get it, for the notion that some people have gained from obsolete works on natural history, to the effect that elephants shed their tusks, is an erroneous one. It is generally supposed that elephants do not shed their tusks at all, not even milk-teeth, but that they grow *ab initio*, as do the incisors of rodents, from a persistent pulp, and continue growing through life. Mr. G. P. Sanderson, the author of 'Thirteen Years among the Wild Beasts,' whom I have to thank for much and valuable information about the habits of these animals, assured me, when I spoke to him about the popular idea of there being milk-tusks, that he had watched elephants from their birth, and had never known them to shed their tusks, nor had his mahouts ever found a shed tusk; but Mr. Tegetmeier has pointed out that there are skulls in the museum of the Royal College of Surgeons, showing both the milk and permanent tusks, the latter pushing forward the former, which are absorbed to a great extent, and leave nothing but a little blackened

stump, the size of one's finger. This was brought to my notice by a correspondent of *The Asian*, "Smooth-bore," and I have lately had the pleasure of meeting Mr. Tegetmeier, and speaking to him on the subject. There is apparently no limit to the growth of tusks, so that under favourable circumstances they might attain enormous dimensions, owing to the age of the animal, and absence of the attrition which keeps the incisors of rodents down. As in the case of rodents, malformations of whose incisors I have alluded to some time back, the tusks of elephants assume various freaks. I have heard of their overlapping and crossing the trunk in a manner to impede the free use of that organ. The tusks of fossil elephants are in many cases gigantic. There is a head in the Indian Museum, of which the tusks *outside the socket* measure $9\frac{3}{4}$ feet, and are of very curious formation. The two run parallel some distance, and then diverge, which would lead one to suppose that the animal inhabited open country, for such a formation would be extremely uncomfortable in thick forest. That tusks of such magnitude are not found nowadays is probably due to the fact that the elephant has more enemies, the most formidable of all being man, which prevent his reaching the great age of those of the fossil periods. It may be said, by those who disbelieve in the extermination of this animal, that, as elephants have provided ivory for several thousand years, they will go on doing so; but I would remind them that in olden days ivory was an article in limited demand, being used chiefly by kings and great nobles; it is only of late years that it has increased more than a hundredfold. Our forefathers used buck-horn handled knives, and they were without the thousand-and-one little articles of luxury which are now made of ivory; even the requirements of the ancient world drove the elephant away from the coasts, where Solomon, and later still the Romans, got their ivory; and now the girdle round the remaining herds in Central Africa is being narrowed day by day. Mr. Sanderson is of opinion that it is not decreasing in India under the present restrictions, but there is no doubt the reckless slaughter of them in Ceylon has greatly diminished their numbers. Sir Emerson Tennent states that the Government reward was claimed for 3,500 destroyed in part of the northern provinces alone in three years prior to 1848, and between 1851 and 1856, 2000 were killed in the southern provinces.

GENUS ELEPHAS—THE ELEPHANT.

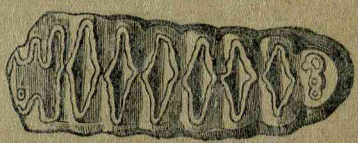
In the writings of older naturalists this animal, so singular in its construction, will be found grouped with the horse, rhinoceros, hippopotamus, tapir, coney, and pig, under the name of pachydermata, the seventh order of Cuvier, but these are now more appropriately divided, as I have said before, into three different orders—Proboscidea, the elephants;

Hyracoidea, the conies; and the rest come under Ungulata. Apparently singular as is the elephant in its anatomy, it bears traces of affinity to both Rodentia and Ungulata. The composition of its massive tusks or incisors, and also of its grinders, resembles that of the Rodents. The tusks grow from a persistent pulp, which forms new ivory coated with enamel, but the grinders are composed of a number of transverse perpendicular plates, or vertical laminæ of dentine, enveloped with enamel, cemented together by layers of a substance called *cortical*. The enamel, by its superior hardness, is less liable to attrition, and, standing above the rest, causes an uneven grinding surface. Each of these plates is joined at the base of the tooth, and on the grinding surface the pattern formed by them distinguishes at once the Indian from the African elephant. In the former, the transverse ridges are in narrow, undulating loops, but in the African they form decided lozenges. These teeth, when worn out, are succeeded by others pushing forward from behind, and not forced up vertically, as in the case of ordinary deciduous teeth, so that it occasionally happens that the elephant has sometimes one and sometimes two grinders on each side, according to age. In the wild state sand and grit, entangled in the roots of plants, help in the work of attrition, and, according to Professor W. Boyd Dawkins, the tame animal, getting cleaner food, and not having such wear and tear of teeth, gets a deformity by the piling over of the plates of which the grinder is composed. An instance of this has come under my notice. An elephant belonging to my brother-in-law, Colonel W. B. Thomson, then Deputy Commissioner



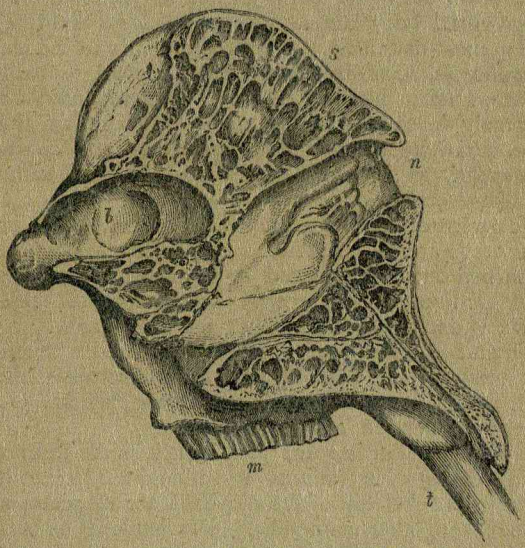
Side view of Grinders of Asiatic Elephant.


Grinder of Asiatic Elephant.


Grinder of African Elephant.

of Seonee, suffered from an aggravated type of this malformation. He was relieved by an ingenious mahout, who managed to saw off the projecting portion of the tooth, which now forms a paper-weight. In my account of Seonee I have given a detailed description of the mode in which the operation was effected.

The skull of the elephant possesses many striking features quite different from any other animal. The brain in bulk does not greatly exceed that of a man, therefore the rest of the enormous head is formed of cellular bone, affording a large space for the attachment of the



Section of Elephant's Skull.

b, Brain; *s*, Skull; *n*, Narial passage; *m*, Molar; *t*, Tusk.

powerful muscles of the trunk, and at the same time combining lightness with strength. This cellular bone grows with the animal, and is in great measure absent at birth. In the young elephant the brain nearly fills the head, and the brain-case increases but little in size during growth, but the cellular portion progresses rapidly with the growth of the animal, and is piled up over the frontals for a considerable height, giving the appearance of a bold forehead, the brain remaining in a small space at the base of the skull, close to its articulation with the neck. According to Professor Flower, the cranial cavity is elongated and depressed, more so in the African than the Indian elephant. The tentorial plane is

nearly vertical, so that the cerebellar fossa is altogether behind the cerebral fossa, or, in plainer terms, the division between the big brain (cerebrum) and the little one (cerebellum) is vertical, the two brains lying on a level plane fore and aft instead of overlapping. The brain itself is highly convoluted. The nasal aperture, or olfactory fossa, is very large, and is placed a little below the brain-case. Few people who are intimate with but the external form of the elephant would suppose that the bump just above the root of the trunk, at which the hunter takes aim for the "front shot," is really the seat of the organ of smell, the channels of which run down the trunk to the orifice at the end. The maxillo-turbinals, or twisted bony laminæ within the nasal aperture, which are to be found in most mammals, are but rudimentary in the elephant—the elongated proboscis, according to Professor Flower, probably supplying their place in warming the inspired air. The premaxillary and maxillary bones are largely developed, and contain the socket of the enormous tusks. The narial aperture is thus pushed up, and is short, with an upward direction, as in the Cetacea and Sirenia, with whom the Proboscidea have certain affinities.

There are no lower incisors (except in a fossil species), and only two of the molar teeth are to be seen on each side of the jaw at a time, which are pushed out and replaced by others which grow from behind. During the life-time of the animal, twenty-four of these teeth are produced, six in each side of the upper and lower jaws.

The elephant has seven cervical vertebræ, the atlas much resembling the human form; of the thoracic and lumbar vertebræ the number is 23, of which 19 or 20 bear ribs; the caudal vertebræ are 31, of a simple character, without chevron bones.

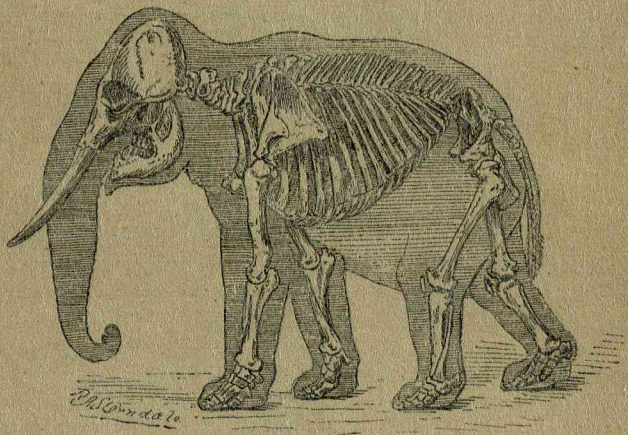
The pelvis is peculiar in some points, such as the form of the ileum and the arrangement of its surfaces, resembling the human pelvis.

The limbs in the skeleton of the elephant are disposed in a manner differing from most other mammalia. The humerus is remarkable for the great development of the supinator ridge. "The ulna and radius are quite distinct and permanently crossed; the upper end of the latter is small, while the ulna not only contributes the principal part of the articular surface for the humerus, but has its lower end actually larger than that of the radius—a condition almost unique among mammals" (*Prof. Flower*).

On looking at the skeleton of the elephant, one of the first things that strikes the student of comparative anatomy is the perpendicular column of the limbs; in all other animals the bones composing these supports are set at certain angles, by which a direct shock in the action of galloping and leaping is avoided. Take the skeleton of a horse, and you will observe that the scapula and humerus are set almost at right angles to each other. It is so in most other animals, but in the elephant,

which requires great solidity and columnar strength, it not being given to bounding about, and having enormous bulk to be supported, the scapula, humerus, ulna and radius are all almost in a perpendicular line. Owing to this rigid formation, the elephant cannot spring. No greater hoax was ever perpetrated on the public than that in one of our illustrated papers, which gave a picture of an elephant hurdle-race. Mr. Sanderson, in his most interesting book, says: "He is physically incapable of making the smallest spring, either in vertical height or horizontal distance. Thus a trench seven feet wide is impassable to an elephant, though the step of a large one in full stride is about six and a half feet."

The hind-limbs are also peculiarly formed, and bear some resemblance

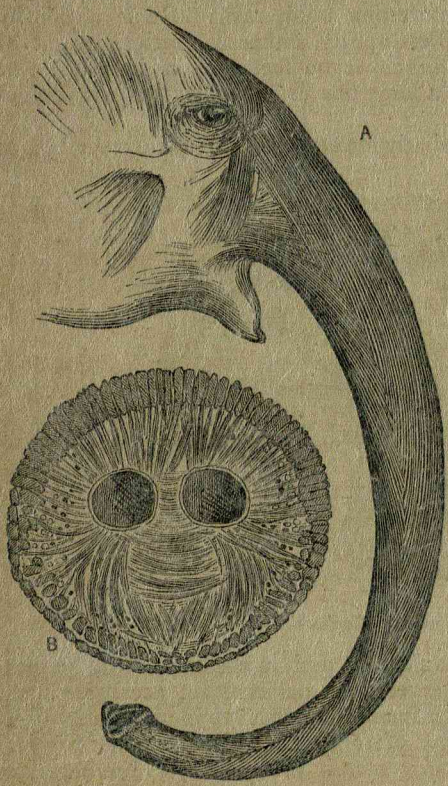


Skeleton of Elephant.

to the arrangement of the human bones, and in these the same perpendicular disposition is to be observed; the pelvis is set nearly vertically to the vertebral column, and the femur and tibia are in an almost direct line. The fibula, or small bone of the leg, which is subject to great variation amongst animals (it being merely rudimentary in the horse, for instance), is distinct in the elephant, and is considerably enlarged at the lower end. The tarsal bones are short, and the digits have the usual number of phalanges, the ungual or nail-bearing ones being small and rounded.

I have thus briefly summarised the osteology of the elephant, as I think the salient points on which I have touched would interest the general reader; but, in now proceeding to the internal anatomy, I shall restrict myself still more, referring only to certain matters affecting

externally visible peculiarities. The trunk of the elephant differs somewhat from other nasal prolongations, such as the snouts of certain insectivora, which are simply development of the nasal cartilages. The nasal cartilages in the Proboscidea serve merely as valves to the entrance of the bony nares, the trunk itself being only a pipe or duct leading to them, composed of powerful muscular and membranous tissue, and consisting of two tubes, separated by a septum. The muscles in front (*levatores proboscidis*), starting from the frontal bone, run along a semicircular line, arching upwards above the nasal bones and between the orbits. They are met at the sides by the lateral longitudinal muscles, which blend, and their fibres run the whole length of the proboscis down to the extremity. The depressing muscles (*depressores proboscidis*), or posterior longitudinals, arise from the anterior surface and lower border of the premaxillaries, and form "two layers of oblique fasciculi along the posterior surface of the proboscis; the fibres of the superficial set are directed downwards and outwards from the middle line. They do not reach the extremity of the trunk, but disappear by curving over the sides a little above the end of the organ. The fibres of the deeper set take the reverse direction, and are attached to a distinct tendinous raphe along the posterior median line" ('Anat. Ind. Elep.,' Miall and Greenwood). These muscles form the outer sheath of other muscles, which radiate from the nasal canals outwards, and which consist of numerous distinct fasciculi. Then there are a set of transverse muscles in two parts—one narrow, forming the septum or partition between the



A. Muscles of Elephant's Trunk.
B. Cross-section of ditto.

nasal passages, and the other broader between the narrow part and the posterior longitudinal muscles.

When we consider the bulk of these well-knit muscles we can no longer wonder at the power of which this organ is capable, although, according to Mr. Sanderson, its capabilities are much exaggerated; and he explodes various popular delusions concerning it. He doubts the possibility of the animal picking up a needle, the common old story which I also disbelieve, having often seen the difficulty with which a coin is picked up, or rather scraped up; but he quite scouts the idea of an elephant being able to lift a heavy weight with his trunk, giving an instance recorded of one of these creatures lifting with his trunk the axle of a field-piece as the wheel was about to pass over a fallen gunner, which he declares to be a physical impossibility. Certainly the story has many elements of improbability about it, and his comments on it are caustic and amusing: *par exemple*, when he asks: "How did the elephant know that a wheel going over the man would not be agreeable to him?" That is the weak point in the story—but, however intelligent the animal might be, Mr. Sanderson says it is physically impossible.

Another thing that strikes every one is the noiseless tread of this huge beast. To describe the mechanism of the foot of the elephant concisely and simply I am going to give a few extracts from the observations of Professor W. Boyd Dawkins and Messrs. Oakley, Miall, and Greenwood: "It stands on the ends of its five toes, each of which is terminated by comparatively small hoofs, and the heel-bone is a little distance from the ground. Beneath comes the wonderful cushion composed, of membranes, fat, nerves, and blood-vessels, besides muscles, which constitutes the sole of the foot" (*W. B. D. and H. O.*). "Of the foot as a whole—and this remark applies to both fore and hind extremities—the separate mobility of the parts is greater than would be suspected from an external inspection, and much greater than in most Ungulates. The palmar and plantar soles, though thick and tough, are not rigid boxes like hoofs, but may be made to bend even by human fingers. The large development of muscles acting upon the carpus and tarsus, and the separate existence of flexors and extensors of individual digits, is further proof that the elephant's foot is far from being a solid unalterable mass. There are, as has been pointed out, tendinous or ligamentous attachments which restrain the independent action of some of these muscles, but anatomical examinations would lead us to suppose that the living animal could at all events accurately direct any part of the circumference of the foot by itself to the ground. The metacarpal and metatarsal bones form a considerable angle with the surface of the sole, while the digits, when supporting the weight of the body, are nearly horizontal" (*M. and G.*). This formation would naturally give

elasticity to the foot, and, with the soft cushion spoken of by Professor Dawkins, would account for the noiselessness of the elephant's tread. On one occasion a friend and myself marched our elephant up to a sleeping tiger without disturbing the latter's slumbers.

It is a curious fact that twice round an elephant's foot is his height; it may be an inch one way or the other, but still sufficiently near to take as an estimate.

Now we come to a third peculiarity in this interesting animal, and that is the power of withdrawing water or a similar fluid from apparently the stomach by the insertion of its trunk into the mouth, which it sprinkles over its body when heated. The operation and the *modus operandi* are familiar to all who have made much use of elephants, but the internal economy by which the water is supplied is as yet a mystery to be solved, although various anatomists have given the subject serious attention. It is generally supposed that the receptacle for the liquid is the stomach, from the quantity that is ejected. An elephant distressed by a long march in the heat of the sun withdraws several quarts of water, but that it is water, and not a secretion produced by salivatory glands, is not I think sufficiently evident. In talking over the matter with Mr. Sanderson, he informed me that an elephant that has drunk a short time before taking an arduous march has a more plentiful supply of liquid at his disposal. Therefore we might conclude that it is water which is regurgitated, and in such quantity as to preclude the idea of its being stored anywhere but in the stomach; but the question is, how it is so stored there without assimulating with the food in the process of digestion. Sir Emerson Tennent, in his popular and well-known, but in some respects incorrect, account of the elephant, has adopted the theory that the cardiac end of the stomach is the receptacle for the water; and he figures a section of it showing a number of transverse circular folds; and he accepts the conclusion arrived at by Camper and Sir Everard Home that this portion can be shut off as a water chamber by the action of the fold nearest to the œsophagus; but these folds are too shallow to serve as water-cells, and it has not been demonstrated that the broadest fold near the œsophagus can be contracted to such an extent as to form a complete diaphragm bisecting the stomach. Messrs. Miall and Greenwood say: "The stomach is smooth, externally elongate, and nearly straight. The cardiac end is much prolonged and tapering. A number of transverse, nearly circular, folds project inwards from the cardiac wall; they almost disappear when the stomach is greatly distended, and are at all times too shallow to serve as water-cells, though they have been figured and described as such."

That the stomach is the reservoir is, I think, open to doubt; but there is no other possible receptacle as yet discovered, though I shall allude to a supposed one presently, which would hold a moderate supply

water, and further research in this direction is desirable. Most of the dissections hitherto made have been of young and immature specimens. Dr. Watson's investigations have thrown some light on the way in which the water is withdrawn, which differs from Dr. Harrison's conclusions, which are quoted by Sir Emerson Tennent. Dr. Watson says regarding this power of withdrawal: "It is evident that were the throat of this animal similar to that of other mammals, this could not be accomplished, as the insertion of a body, such as the trunk, so far into the pharynx as to enable the constrictor muscles of that organ to grasp it, would at once give rise to a paroxysm of coughing; or, were the trunk merely inserted into the mouth, it would be requisite that this cavity be kept constantly filled with water, at the same time that the lips closely encircled the inserted trunk. The formation of the mouth of the elephant, however, is such as to prevent the trunk ever being grasped by the lips so as effectually to stop the entrance of air into the cavity, and thus at once, if I may so express it, the pump action of the trunk is completely paralysed. We find, therefore, that it is to some modification of the throat that we must look for an explanation of the function in question." He then goes on to explain minutely the anatomical details of the apparatus of the throat, which I will endeavour to sketch as simply, though clearly, as I can. The superior aperture of the pharynx is extremely narrow, so much so as to admit, with difficulty, the passage of a closed fist; but immediately behind this the pharynx dilates into a large pouch capable of containing a certain quantity of fluid—according to Dr. Watson a considerable quantity; but this is open to question. Professor Miall states that in the young specimen examined by him and Mr. Greenwood, a pint was the capacity of the pouch. However, according to Dr. Watson, it is capable of distention to a certain extent. The pouch is prolonged forward beneath the root of the tongue, which forms the anterior boundary, whilst the posterior wall is completed by depression of the soft palate; when the latter is elevated the pouch communicates freely with the œsophagus. I omit Dr. Watson's minute description of the anatomy of this part in detail, which the reader who cares to study the matter more deeply can find in his 'Contributions to the Anatomy of the Indian Elephant,' 'Journal of Anatomy and Physiology,' 1871–74, but proceed to quote some of his deductions from the observations made: "An elephant can," he says, "as the quotations sufficiently prove, withdraw water from his stomach in two ways—first, it may be regurgitated directly into the nasal passages by the action of the diaphragm and abdominal muscles, the soft palate being at the same time depressed, so as to prevent the passage of water into the mouth. Having in this manner filled the large nasal passages communicating with the trunk, the water contained in them is then forced through the trunk by means of a powerful

duration; or, in the second place, the water may be withdrawn from the cavity of the mouth by means of the trunk inserted into it."

The second deduction is, I think, the more probable one. Before an elephant spirts water over his body, he invariably puts his trunk into his mouth for the liquid, whatever it may be. Messrs. Miall and Greenwood are also against the former supposition, viz. that the fluid is regurgitated into the nasal passages. They say: "We are disposed to question the normal passage of water along this highly-sensitive tract. Examination of the parts discovers no valve or other provision for preventing water, flowing from behind forward, from gaining free entrance into the olfactory recesses." Mr. Sanderson, in discussing the habits of elephants with me, informed me that, from his observations, he was sure that an elephant, in drawing up water, did not fill more than fifteen to eighteen inches of his trunk at a time, which confirms the opinion of the two last-mentioned authors. Now we go on with Dr. Watson's second deduction:—

"It is manifestly impossible that the water can be contained within the cavity of the mouth itself, as I have already shown that the lips in the elephant are so formed as effectually to prevent this. The water regurgitated is, however, by means of the elevation of the soft palate, forced into the pharyngeal pouch. The superior aperture of this pouch being much narrower than the diameter of the pouch itself, and being completely surrounded by the muscular fibres of the stylo-glossus on each side, and the root of the tongue in front, which is prolonged backwards so as to form a free sharp margin, we have thus, as it were, a narrow aperture surrounded by a sphincter muscle, into which the trunk being inserted, and grasped above its dilated extremity by the sphincter arrangement just referred to, air is thus effectually excluded; and, the nasal passages being then exhausted by the act of inspiration, water is lodged within these passages, to be used as the animal thinks fit, either by throwing it over his body, or again returning it into his mouth."

This is doubtless a correct conclusion. The question still remaining open is, What is the fluid—water or a secretion? If water, where is it stowed in sufficient quantity? The testimony of several eminent anatomists appears to be against stomach complications such as before suggested. Dr. Anderson has told me that he had the opportunity of examining the stomachs of two very large elephants, which were perfectly simple, of enormous size; and he was astonished at the extent of mucous surface. If water were drawn from such a stomach, it would be more or less tainted with half-digested food, besides which, when drunk, it would be rapidly absorbed by the mucous surfaces. I think therefore that we may assume that these yield back a very fluid secretion, which is regurgitated, as before suggested, into the pharyngeal

pouch, to be withdrawn as required. Sir Emerson Tennent figures, on the authority of Dr. Harrison, a portion of the trachea and œsophagus, connected by a muscle which he supposes "might raise the cardiac orifice of the stomach, and so aid this organ to regurgitate a portion of its contents into the œsophagus," but neither Dr. Watson nor Messrs. Miall and Greenwood have found any trace of this muscle.

Before proceeding to a detailed account of the Indian elephant, I will cursorily sketch the difference between it and its African brother.

The African elephant is of larger size as a rule, with enormously developed ears, which quite overlap his withers. The forehead recedes, and the trunk is more coarsely ringed; the tusks are larger, some almost reaching the size of those mentioned above in the fossil head at the museum. An old friend of mine, well known to all the civilised—and a great portion of the uncivilised—world, Sir Samuel Baker, had, and may still have, in his possession a tusk measuring ten feet nine inches. This of course includes the portion within the socket, whereas my measurement of the fossil is from the socket to tip.

The lamination of the molar teeth also is very distinct in the two species, as I have before stated—the African being in acute lozenges, the Indian in wavy undulations.

Another point of divergence is, that the African elephant has only three nails on the hind feet, whereas the Asiatic has four.

No. 425. ELEPHAS INDICUS.

The Indian or Asiatic Elephant (*Jerdon's No.* 211).

NATIVE NAMES.—*Hasti* or *Gaja*, Sanscrit; *Gaj*, Bengali; *Hati*, Hindi; *Ani* in Southern India, i.e. in Tamil, Telegu, Canarese, and Malabari; *Feel*, Persian; *Allia*, Singhalese; *Gadjah*, Malayan; *Shañh*, Burmese.

HABITAT.—India, in most of the large forests at the foot of the Himalayas from Dehra Doon down to the Bhotan Terai; in the Garo hills, Assam; in some parts of Central and Southern India; in Ceylon and in Burmah, from thence extending further to Siam, Sumatra and Borneo.

DESCRIPTION.—Head oblong, with concave forehead; small ears as compared with the African animal; small eyes, lighter colour, and four instead of three nails on the hind foot; the laminations of the molar teeth in wavy undulations instead of sharp lozenges, as in the African, the tusks also being much smaller in the female, instead of almost equal in both sexes.

SIZE.—The maximum height appears to be about 11 feet, in fact the only authentic measurement we have at present is 10 feet 7 inches.

"The huge elephant, wisest of brutes,"

has had a good deal of the romance about it taken away by modern observers. The staid appearance of the animal, with the intellectual aspect contributed by the enormous cranial development, combined with its undoubted docility and aptitude for comprehending signs, have led to exaggerated ideas of its intelligence, which probably does not exceed that of the horse, and is far inferior to that of the dog. But from time immemorial it has been surrounded by a halo of romance and exaggeration. Mr. Sanderson says, however, that the natives of India never speak of it as an intelligent animal, "and it does not figure in their ancient literature for its wisdom, as do the fox, the crow, and the monkey;" but he overlooks the fact that the Hindu god of wisdom, *Gunesh*, is always depicted with the body of a man, but the head of an elephant. However this is apparently an oversight, for both in his book and lecture he alludes to *Gunesh*. The rest of his remarks are so good, and show so much practical knowledge, that I shall take the liberty of quoting *in extenso* from a lecture delivered by him at Simla last year, a printed copy of which he kindly sent me, and also from his interesting book, 'Thirteen Years amongst the Wild Beasts.'

He says: "One of the strongest features in the domesticated elephant's character is its obedience. It may also be readily taught, as it has a large share of the ordinary cultivable intelligence common in a greater or less degree to all animals. But its reasoning faculties are undoubtedly far below those of the dog, and possibly of other animals; and in matters beyond the range of its daily experience it evinces no special discernment. Whilst quick at comprehending anything sought to be taught to it, the elephant is decidedly wanting in originality."

I think one as often sees instances of decided stupidity on the part of elephants as of sagacity, but I think the amount of intelligence varies in individuals. I have known cases where elephants have tried to get their mahouts off their backs—two cases in my own district—in the one the elephant tried shaking and then lying down, both of which proved ineffectual; in the other it tried tearing off the rafters of a hut and throwing them over its back, and finally rubbing against low branches of trees, which proved successful. The second elephant, I think, showed the greatest amount of original thought; but there is no doubt the sagacity of the animal has been greatly overrated. I quote again from Mr. Sanderson, whose remarks are greatly to the point:—

"What an improbable story is that of the elephant and the tailor, wherein the animal, on being pricked with a needle instead of being fed with sweetmeats as usual, is represented as having deliberately gone to

pond, filled its trunk with dirty water, and returned and squirted it over the tailor and his work! This story accredits the elephant with appreciating the fact that throwing dirty water over his work would be the peculiar manner in which to annoy a tailor. How has he acquired the knowledge of the incongruity of the two things, dirty water and clean linen? He delights in water himself, and would therefore be unlikely to imagine it objectionable to another. If the elephant were possessed of the amount of discernment with which he is commonly credited, is it reasonable to suppose that he would continue to labour for man instead of turning into the nearest jungle? The elephant displays less intelligence in its natural state than most wild animals. Whole herds are driven into ill-concealed inclosures which no other forest creatures could be got to enter; and single ones are caught by being bound to trees by men under cover of a couple of tame elephants, the wild one being ignorant of what is going on until he finds himself secured. Escaped elephants are re-taken without trouble; even experience does not bring them wisdom. Though possessed of a proboscis which is capable of guarding it against such dangers, the wild elephant readily falls into pits dug in its path, whilst its fellows flee in terror, making no effort to assist the fallen one, as they might easily do by kicking in the earth around the pit. It commonly happens that a young elephant falls into a pit, in which case the mother will remain until the hunters come, without doing anything to assist her offspring—not even feeding it by throwing in a few branches.

"When a half-trained elephant of recent capture happens to get loose, and the approach of its keeper on foot might cause it to move off, or perhaps even to run away altogether, the mahout calls to his elephant from a distance to kneel, and he then approaches and mounts it. The instinct of obedience is herein shown to be stronger than the animal's intelligence. When a herd of wild elephants is secured within a stockade, or *kheddah*, the mahouts ride trained elephants amongst the wild ones without fear, though any one of the wild ones might, by a movement of its trunk, dislodge the man. This they never do."

On the other hand we do hear of wonderful cases of reasoning on the part of these creatures. I have never seen anything very extraordinary myself; but I had one elephant which almost invariably attempted to get loose at night, and often succeeded, if we were encamped in the vicinity of sugar-cane cultivation—nothing else tempted her; and many a rupee have I had to pay for the damage done. This elephant knew me perfectly after an absence of eighteen months, trumpeted when she saw me, and purred as I came up and stroked her trunk. I then gave her the old sign, and in a moment she lifted me by the trunk on to her head. I never mounted her any other way, and, as I used to slip off by a side rope, the constant kneeling down and getting up was avoided.

Sir Emerson Tennent says: "When free in its native woods the elephant evinces rather simplicity than sagacity, and its intelligence seldom exhibits itself in cunning;" yet in the next page he goes on to relate a story told to him of a wild elephant when captured falling down, and feigning to be dead so successfully that all the fastenings were taken off; "while this was being done he and a gentleman by whom he was accompanied leaned against the body to rest. They had scarcely taken their departure and proceeded a few yards when, to their astonishment, the elephant arose with the utmost alacrity, and fled towards the jungles screaming at the top of its voice, its cries being audible long after it had disappeared in the shades of the forest." If this be correct it shows a considerable amount of cunning.

Both Mr. Sanderson and Sir Emerson Tennent agree on the subject of the rarity of the remains of dead elephants. I have never been in real elephant country; the tracks of such as I have come across have been merely single wanderers from the Bilaspore herds, or probably elephants escaped from captivity. Forsyth once came upon the bones of a small herd of five that had been driven over a precipice from the summit of a hill, on which there was a Hindoo shrine, by the drums and music of a religious procession.

The following taken from Mr. Sanderson's lecture is interesting as regards the constitution of the herds: "Herds of elephants usually consist of from thirty to fifty individuals, but much larger numbers, even upwards of a hundred, are by no means uncommon. A herd is always led by a female, never by a male. In localities where fodder is scarce a large herd usually divides into parties of from ten to twenty. These remain at some little distance from each other, but all take part in any common movement, such as a march into another tract of forest. These separate parties are family groups, consisting of old elephants with their children and grandchildren. It thus happens that, though the gregarious instincts of elephants prompt them to form large gatherings, if circumstances necessitate it a herd breaks up under several leaders. Cases frequently occur when they are being hunted; each party will then take measures for its individual safety. It cannot be said that a large herd has any *supreme* leader. Tuskers never interest themselves in the movement of their herds; they wander much alone, either to visit cultivation, where the females, encumbered with young ones, hesitate to follow, or from a love of solitude. Single elephants found wandering in the forests are usually young males—animals debarred from much intimate association with the herds by stronger rivals; but they usually keep within a few miles of their companions. These wandering tuskers are only biding their time until they are able to meet all comers in a herd. The necessity for the females regulating the movements of a herd is evident, as they must

accommodate the length and time of their marches, and the localities in which they rest and feed at different hours, to the requirements of their young ones."

It is a curious fact that most of the male elephants in Ceylon are what are called *mucknas* in India, that is, tuskless males—not one in a hundred, according to Sir Emerson Tennent, being found with tusks; nearly all, however, are provided with tushes. These, he says, he has observed them "to use in loosening earth, stripping off bark, and snapping asunder small branches and climbing plants, and hence tushes are seldom seen without a groove worn into them near their extremities." Sir Samuel Baker says that the African elephant uses his tusks in ploughing up ground in search of edible roots, and that whole acres may be seen thus ploughed, but I have never seen any use to which the Indian elephant puts his tusks in feeding. I have often watched mine peeling the bark off succulent branches, and the trunk and foot were alone used. Mr. Sanderson, in his 'Thirteen Years,' remarks: "Tusks are not used to assist the elephant in procuring food;" but he says they are formidable weapons of offence in the tusker, the biggest of whom lords it over his inferiors.

The elephant usually brings forth, after a period of gestation of from eighteen to twenty-two months, a single calf, though twins are occasionally born. Mr. Sanderson says: "Elephant calves usually stand exactly thirty-six inches at the shoulder when born, and weigh about 200 lbs. They live entirely upon milk for five or six months, when they begin to eat tender grass. Their chief support, however, is still milk for some months. I have known three cases of elephants having two calves at a birth. It cannot be said that the female elephant evinces any special attachment to her offspring, whilst the belief that all the females of a herd show affection for each other's calves is certainly erroneous. During the catching of elephants many cases occur in which young ones, after losing their mothers by death or separation, are refused assistance by the other females, and are buffeted about as outcasts. I have only known one instance of a very gentle, motherly elephant in captivity, allowing a motherless calf to suck along with her own young one. When a calf is born the mother and the herd usually remain in that place for two days. The calf is then capable of marching. Even at this tender age calves are no encumbrance to the herd's movement; the youngest climb hills and cross rivers, assisted by their dams. In swimming, very young calves are supported by their mothers' trunks, and are held in front of them. When they are a few months old they scramble on to their mother's shoulders, and hold on with their fore-legs, or they swim alone. Though a few calves are born at other seasons, the largest number make their appearance about September, October, and November."

until I read the above I, from my limited experience, had come to the conclusion that elephant mothers are very fussy and jealous of other females. (See Appendix C, p. 527.)

I have only once seen an elephant born in captivity, and that was in 1859, when I was in charge of the Sasseram Levy on the Grand Trunk road. Not far from the lines of my men was an elephant camp; they were mostly Burmese animals, and many of them died; but one little fellow made his appearance one fine morning, and was an object of great interest to us all. On one occasion, some years after, I went out after a tiger on a female elephant which had a very young calf. I repented it after a while, for I lost my tiger and my temper, and very nearly my life. Those who have read 'Seonee,' may remember the ludicrous scene in which I made the doctor figure as the hero. An elephant is full grown at twenty-five, though not in his prime till some years after. Forty years is what mahouts, I think, consider age, but the best elephants live up to one hundred years or even more.*

A propos of my remarks, in the introductory portion of this paper on Proboscidea, regarding the probable gradual extinction of the African elephant, the following reassuring paragraphs from the lecture I have so extensively quoted will prove interesting and satisfactory. Mr. Sanderson has previously alluded to the common belief, strengthened by actual facts in Ceylon, that the elephant was gradually being exterminated in India; but this is not the case, especially since the laws for their protection have come into force: "The elephant-catching records of the past fifty years attest the fact that there is no diminution in the numbers now obtainable in Bengal, whilst in Southern India elephants have become so numerous of late years that they are annually appearing where they had never been heard of before."

He then instances the Billigarungun hills, an isolated range of three hundred square miles on the borders of Mysore, where wild elephants first made their appearance about eighty years ago, the country having relapsed from cultivation into a wilderness owing to the decimation of the inhabitants by three successive visitations of small-pox. He adds: "The strict preservation of wild elephants seems only advantageous or desirable in conjunction with corresponding measures for keeping their numbers within bounds by capture. It is to be presumed that elephants are preserved with a view to their utilisation. With its jungles filled with elephants, the anomalous state of things by which Government, when obliged to go into the market, finds them barely procurable, and then only at prices double those of twenty, and quadruple those of forty years ago, will I trust be considered worthy of inquiry. Whilst it is necessary to maintain stringent restrictions on the wasteful and cruel native modes of hunting, it will I believe be found advantageous to

* See note in Appendix C on this subject.

allow lessees every facility for hunting under conditions that shall insure humane management of their captives. I believe that the price of elephants might be reduced one-half in a year or two by such measures. The most ordinary elephant cannot be bought at present for less than Rs. 2,000. Unless something be done, it is certain that the rifle will have to be called into requisition to protect the ryots of tracts bordering upon elephant jungles. To give an idea of the numbers of wild elephants in some parts of India, I may say that during the past three years 503 elephants have been captured by the Dacca kheddah establishment, in a tract of country forty miles long by twenty broad, in the Garo hills, whilst not less than one thousand more were met with during the hunting operations. Of course these elephants do not confine themselves to that tract alone, but wander into other parts of the hills. There are immense tracts of country in India similarly well stocked with wild elephants.

"I am sure it will be regarded as a matter for hearty congratulation by all who are interested in so fine and harmless an animal as is the elephant that there is no danger of its becoming extinct in India. Though small portions of its haunts have been cleared for tea or coffee cultivation, the present forest area of this country will probably never be practically reduced, for reasons connected with the timber supply and climate of the country; and as long as its haunts remain the elephant must flourish under due regulations for its protection."

Elephants are caught in various ways. The pitfall is now prohibited, so also is the Assam plan of inclosing a herd in a salt lick. Noosing and driving into a *kheddah* or inclosure are now the only legitimate means of capture. The process is too long for description here, but I may conclude this article, which owes so much to Mr. Sanderson's careful observations, with the following interesting account of the mode in which the newly-caught elephant is taught to obey:—

"New elephants are trained as follows: they are first tied between two trees, and are rubbed down by a number of men with long bamboos, to an accompaniment of the most extravagant eulogies of the animal, sung and shouted at it at the top of their voices. The animal of course lashes out furiously at first; but in a few days it ceases to act on the offensive, or, as the native say, 'shurum lugta hai'—'it becomes ashamed of itself,' and it then stands with its trunk curled, shrinking from the men. Ropes are now tied round its body, and it is mounted at its picket for several days. It is then taken out for exercise, secured between two tame elephants. The ropes still remain round its body to enable the mahout to hold on should the elephant try to shake him off. A man precedes it with a spear to teach it to halt when ordered to do so; whilst, as the tame elephants wheel to the right or left, the mahout presses its neck with his knees, and taps it on the head with a

small stick, to train it to turn in the required direction. To teach an elephant to kneel it is taken into water about five feet deep when the sun is hot, and, upon being pricked on the back with a pointed stick it soon lies down, partly to avoid the pain, partly from inclination for a bath. By taking it into shallower water daily, it is soon taught to kneel even on land.

"Elephants are taught to pick up anything from the ground by a rope, with a piece of wood attached, being dangled over their foreheads, near to the ground. The wood strikes against their trunk and fore-feet, and to avoid the discomfort the elephant soon takes it in its trunk, and carries it. It eventually learns to do this without a rope being attached to the object."

Sir Emerson Tennent's account of the practice in Ceylon is similar.

As regards the size of elephants few people agree. The controversy is as strong on this point as on the maximum size of tigers. I quite believe few elephants attain to or exceed ten feet, still there are one or two recorded instances, the most trustworthy of which is Mr. Sanderson's measurement of the Sirmoor Rajah's elephant, which is 10 ft. 7½ in. at the shoulder—a truly enormous animal. I have heard of a tusker at Hyderabad that is over eleven feet, but we must hold this open to doubt till an accurate measurement, for which I have applied, is received. Elephants should be measured like a horse, with a standard and cross bar, and not by means of a piece of string over the rounded muscles of the shoulder. Kellaart, usually a most accurate observer, mentions in his 'Prodromus Faunæ Zeylanicæ' his having measured a Ceylon elephant nearly twelve feet high, but does not say how it was done. Sir Joseph Fayrer has a photograph of an enormous elephant belonging to the late Sir Jung Bahadur, a perfect mountain of flesh.

WE in India have nothing to do with the next order, HYRACOIDEA or Conies, which are small animals, somewhat resembling short-eared rabbits, but which from their dentition and skeleton are allied to the rhinoceros and tapir. The Syrian coney is frequently mentioned in the Old Testament, and was one of the animals prohibited for food to the Jews, "because he cheweth the cud and divideth not the hoof." The chewing of the cud was a mistake, for the coney does not do so, but it has a way of moving its jaws which might lead to the idea that it ruminates. In other parts of Scripture the habits of the animal are more accurately depicted—"The rocks are a refuge for the conies;" and again: "The conies are but a feeble folk, yet make they their houses in the rocks." Solomon says in the Proverbs: "There be four things

which are little upon the earth, but they are exceeding wise." These are the ants, for they prepare their meat in summer, as we see here in India the stores laid up by the large black ant (*Atta providens*); the conies for the reason above given; the locusts, which have no king, yet go forth by bands; and the spider, which maketh her home in kings' palaces.

ORDER UNGULATA.

THESE are animals which possess hoofs; and are divided into two sub-orders—those that have an odd number of toes on the hind-foot, such as the horse, tapir, and rhinoceros, being termed the PERISSODACTYLA; and the others, with an even number of toes, such as the pig, sheep, ox, deer, &c., the ARTIODACTYLA; both words being taken from the Greek *perissos* and *artios*, uneven or overmuch, and even; and *daktulos*, a finger or toe. We begin with the uneven-toed group.

SUB-ORDER PERISSODACTYLA.

This consists of three living and two extinct families—the living ones being horses, tapirs, and rhinoceroses, and the extinct the *Palæotheridæ* and the *Macrauchenidæ*. I quote from Professor Boyd Dawkins and Mr. H. W. Oakley the following brief yet clear description of the characteristics of this sub-order:—

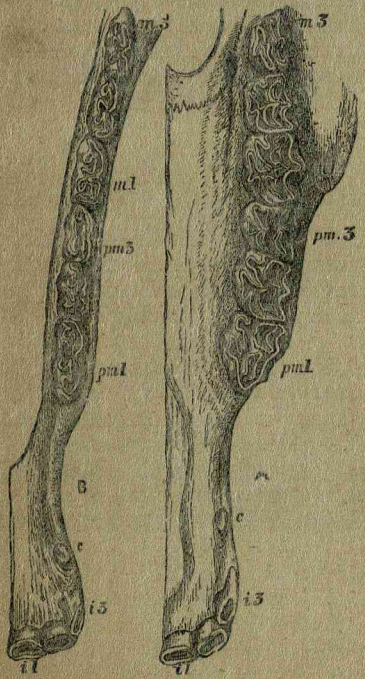
"In all the animals belonging to the group the number of dorso-lumbar vertebræ is not fewer than twenty-two; the third or middle digit of each foot is symmetrical; the femur or thigh-bone has a third trochanter, or knob of bone, on the outer side; and the two facets on the front of the astragalus or ankle-bone are very unequal. When the head is provided with horns they are skin deep only, without a core of bone, and they are always placed in the middle line of the skull, as in the rhinoceros.

"In the *Perissodactyla* the number of toes is reduced to a minimum. Supposing, for example, we compare the foot of a horse with one of our own hands, we shall see that those parts which correspond with the thumb and little finger are altogether absent, while that which corresponds with the middle finger is largely developed, and with its hoof, the equivalent to our nail, constitutes the whole foot. The small splint bones, however, resting behind the principal bone of the foot represent those portions (metacarpals) of the second and third digits which extend from the wrist to the fingers properly so-called, and are to be

viewed as traces of a foot composed of three toes in an ancestral form of the horse, which we shall discuss presently. In the tapir the hind foot is composed of three well-developed toes, corresponding to the first three toes in man, and in the rhinoceros both feet are provided with three toes, formed of the same three digits. In the extinct *Paleotherium* also the foot is constituted very much as in the rhinoceros."

FAMILY EQUIDÆ—THE HORSE.

This family consists of the true horses and the asses, which latter also include the zebra and quagga. Apart from the decided external differences between the horse and ass, they have one marked divergence, viz. that the horse has corns or callosities on the inner side of both fore and hind limbs, whilst the asses have them only on the fore limbs; but this is a very trifling difference, and how closely the two animals are allied is proved by the facility with which they interbreed. It is, therefore, proper to include them both in one genus, although Dr. Gray has made a separation, calling the latter *Asinus*, and Hamilton Smith proposed *Hippotigris* as a generic name for the zebras.



Dentition of Horse.

We have no wild horse in India; in fact there are no truly wild horses in the world as far as we know. The tarpan or wild horse of Tartary, and the mustang of South America, though *de facto* wild horses, are supposed to be descended from domesticated forms. In Australia too horses sometimes grow wild from being left long in the bush. These are known as *brumbies*, and are generally shot by the stock farmer, as they are of deteriorated quality, and by enticing away his mares spoil his more carefully selected breeds. According to Mr. Anthony Trollope they are marvels of ugliness.

The Indian species of this genus are properly asses; there are two kinds, although it has been asserted by many—and some of them good naturalists, such as Blyth—that the *Kiang* of Thibet and the *Ghor-khur* of Sind and Baluchistan are the same animal.

GENUS EQUUS.

Incisors, $\frac{6}{6}$; canines, $\frac{1-1}{1-1}$; molars, $\frac{6-6}{6-6}$; these last are complex, with square crowns marked by wavy folds of enamel. The incisors are grooved, and are composed of folds of enamel and cement, aptly described by Professor Boyd Dawkins and Mr. Oakley as being folded in from the top, after the manner of the finger of a glove the top of which has been pulled in. The marks left by the attrition of the surface give an approximate idea of the age of the animal. The stomach is simple—the intestinal canal very long and cæcum enormous.

No. 426. EQUUS ONAGER.

The Wild Ass of Kutch (Jerdon's No. 214).

NATIVE NAMES.—*Ghor-khur*, Hindi; *Ghour*, or *Kherdecht*, Persian; *Koulan* of the Kirghiz.

HABITAT.—Sind, Baluchistan, Persia.

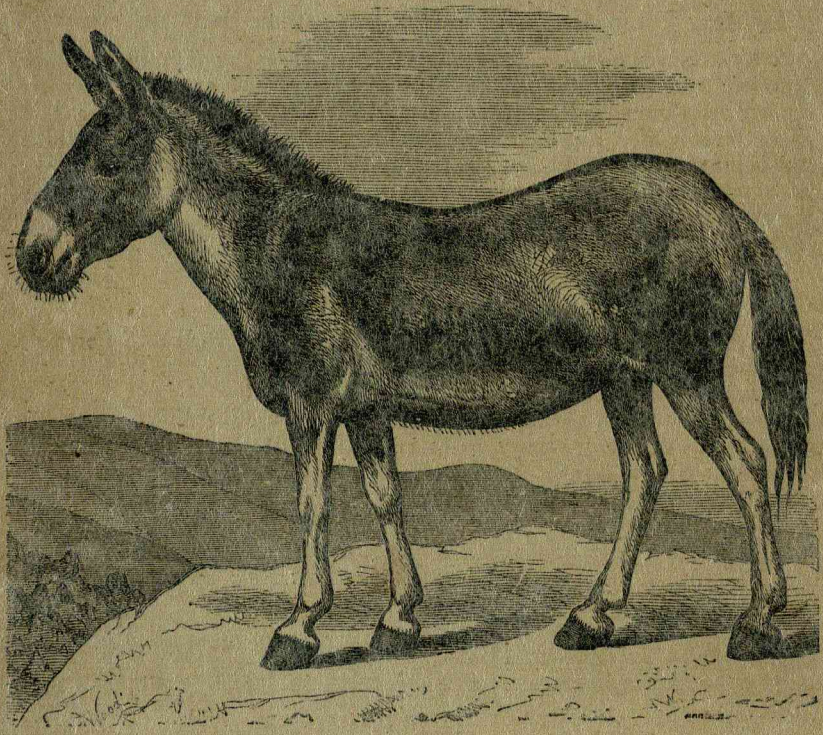
DESCRIPTION.—Pale sandy colour above, with a slight rufescent tinge; muzzle, breast, lower parts and inside of limbs white; a dark chocolate brown dorsal stripe from mane to tail, with a cross on the shoulder, sometimes a double one; and the legs are also occasionally barred. The mane and tail-tuft are dark brown or black; a narrow dark band over the hoof; ears longish, white inside, concolorous with the body outside, the tip and outer border blackish; head heavy; neck short; croup higher than the withers.

SIZE.—Height about 11 to 12 hands.

The following account I extract from Jerdon's 'Mammals of India,' p. 238, which epitomises much of what has been written on the subject:—

"The *ghor-khur* is found sparingly in Cutch, Guzerat, Jeysulmeer and Bikaneer, not being found further south, it is said, than Deesa, or east of 75° east longitude. It also occurs in Sind, and more abundantly west of the Indus river, in Baluchistan, extending into Persia and Turkestan, as far north as north latitude 48°. It appears that the Bikaneer herd consists at most of about 150 individuals, which frequent an oasis a little elevated above the surrounding desert, and commanding an extensive view around. A writer in the *Indian Sporting Review*, writing of this species as it occurs in the Pât, a desert country

tween Asnee and the hills west of the Indus, above Mithunkote, says: 'They 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 (which are here terrific), the greater number, if not all, of the *ghor-khurs* migrate to the hills for grass and water. The foaling season is in June, July, and August, when the



Equus onager.

Beluchis ride down and catch numbers of foals, finding a ready sale in the cantonments for them, as they are taken down on speculation to Hindustan. They also shoot great numbers of full-grown ones for food, the ground in places in the desert being very favourable for stalking.' In Bikaneer too, according to information given by Major Tytler to Mr. Blyth: 'Once only in the year, when the foals are young, a party of five or six native hunters, mounted on hardy Sindh mares, chase down

as many foals as they succeed in tiring, which lie down when utterly fatigued, and suffer themselves to be bound and carried off. In general they refuse sustenance at first, and about one-third only of those taken are reared; but these command high prices, and find a ready sale with the native princes. The profits are shared by the party, who do not attempt a second chase in the same year, lest they should scare the herd from the district, as these men regard the sale of a few ghor-khurs annually as a regular source of subsistence.'

"This wild ass is very shy and difficult to approach, and has great speed. A full-grown one has, however, been run down fairly and speared more than once."

I remember we had a pair of these asses in the Zoological Gardens at Lahore in 1868; they were to a certain extent tame, but very skittish, and would whinny and kick on being approached. I never heard of their being mounted.

It is closely allied to, if not identical with, the wild ass of Assyria (*Equus hemippus*). The Hon. Charles Murray, who presented one of the pair in the London Zoological Gardens in 1862, wrote the following account of it to Dr. Sclater: "The ghour or kherdecht of the Persians is doubtless the onager of the ancients. Your specimen was caught when a foal on the range of mountains which stretch from Kermanshah on the west in a south-easterly direction to Shiraz; these are inhabited by several wild and half-independent tribes, the most powerful of which are the Buchtzari. The ghour is a remarkably fleet animal, and moreover so shy and enduring that he can rarely be overtaken by the best mounted horsemen in Persia. For this reason they chase them now, as they did in the time of Xenophon, by placing relays of horsemen at intervals of eight or ten miles. These relays take up the chase successively and tire down the ghour. The flesh of the ghour is esteemed a great delicacy, not being held unclean by the Moslem, as it was in the Mosaic code. I do not know whether this species is ever known to bray like the ordinary domestic ass. Your animal, whilst under my care, used to emit short squeaks and sometimes snorts not unlike those of a deer, but she was so young at the time that her voice may not have acquired its mature intonation."

No. 427. EQUUS HEMIONUS.

The Kiang or Wild Ass of Thibet.

NATIVE NAMES.—*Kiang* or *Dizighlai*, Thibetan.

HABITAT.—Thibet and Central Asia; Ladakh.

DESCRIPTION.—Darker in hue than the *ghor-khur*, especially on the flanks, contrasting abruptly with the white of the under-parts. It has

dark line along the back, but not the cross band on the shoulders; ears shorter.

SIZE.—About 12 to 14 hands in height.

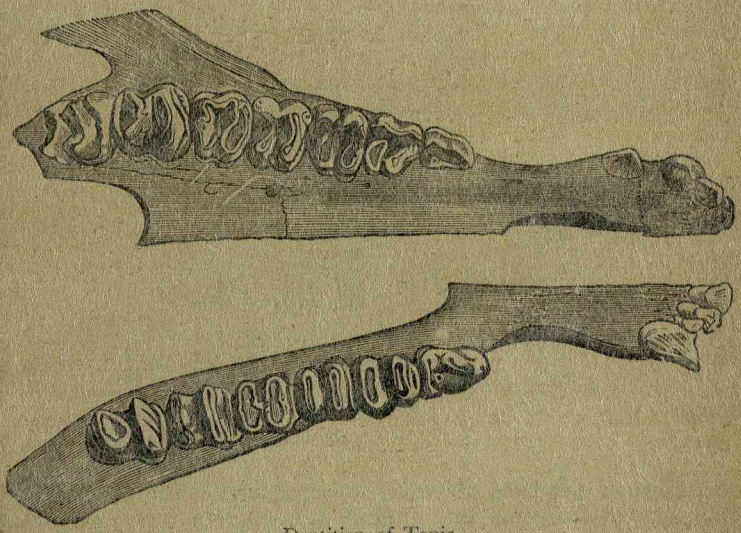
From its larger size, shorter ears, and its shrill bray, which has been mistaken for a neigh, this animal has at times been taken for a horse, and described as such. The kiang, of which there is a living specimen in the London Zoological Gardens, inhabits the high plateaux of Thibet, ranging up to fifteen and sixteen thousand feet above the sea level. It is very swift and wary.

The late Brigadier-General McMaster, in his 'Notes on Jerdon,' page 248, says: "An excellent sportsman and very close observer, who, being a cavalry officer, should be able to give a sound opinion on the matter, assured me that the voice of the wild horse of the snowy Himalayas is 'an unmistakeable *neigh, not a bray*,' and that he certainly looked on them as horses. He had seen several of these animals, and killed one." Captain (now General) R. Strachey wrote of it: "My impression as to the voice of the *kyang* is that it is a shrieking bray and not a neigh;" and again: "the *kyang*, so far as external aspect is concerned, is obviously an ass and not an horse." Of this there is but little doubt. Moorcroft, in his travels, vol. i. p. 312, states: "In the eastern parts of Ladakh is a nondescript wild variety of horse which I may call *Equus kiang*. It is perhaps more of an ass than a horse, but its ears are shorter, and it is certainly not the gur-khor or wild ass of Sind." Further on, at page 442, he adds: "We saw many herds of the kyang, and I made numerous attempts to bring one down, but with invariably bad success. Some were wounded, but not sufficiently to check their speed, and they quickly bounded up the rocks, where it was impossible to follow. They would afford excellent sport to four or five men well mounted, but a single individual has no chance. The kyang allows his pursuer to approach no nearer than five or six hundred yards; he then trots off, turns, looks and waits till you are almost within distance, when he is off again. If fired at he is frightened, and scampers off altogether. The Chanthan people sometimes catch them by snares—sometimes shoot them. From all I have seen of the animal I should pronounce him to be neither a horse nor an ass. His shape is as much like that of the one as the other, but his cry is more like braying than neighing. The prevailing colour is a light reddish-chestnut, but the nose, the under-part of the jaw and neck, the belly and the legs are white, the mane is dun and erect, the ears are moderately long, the tail bare and reaching a little below the hock. The height is about fourteen hands. The form, from the fore to the hind leg and feet to a level with the back is more square than that of an ass. His back is less straight, and there is a dip behind the withers and a rounding of the crupper which is more like the shape of the

horse; his neck also is more erect and arched than that of the ass. He is perhaps more allied to the quagga, but without stripes, except a reported one along each side of the back to the tail. These were seen distinctly in a foal, but were not distinguished in the adults."

FAMILY TAPIRIDÆ—THE TAPIRS.

These are somewhat hog-like animals, with elongated snouts, possessing four toes on their fore-feet, and three on the hinder ones. They live in dense forests, are nocturnal in habit, and live exclusively on a



Dentition of Tapir.

vegetable diet. The Indian tapir has a more powerful and extensile trunk than the American, and its skull shows in consequence a greater space for the attachment of the muscles. The dentition is as follows:—Inc., $\frac{3-3}{3-3}$; can., $\frac{1-1}{1-1}$; premolars, $\frac{4-4}{4-4}$; molars, $\frac{3-3}{3-3}$. The outer incisors somewhat resemble canines, whilst the others are very small. The canines themselves are not large.

The tapir is not found in India proper, but the Malayan species is occasionally to be come across in Burmah, having been killed in Tenasserim.

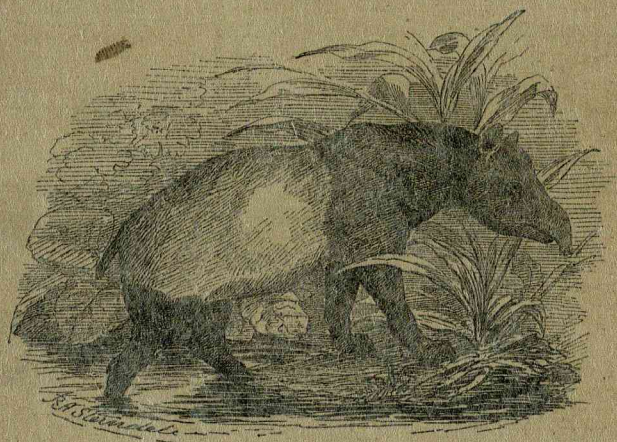
No. 428. TAPIRUS MALAYANUS.

The Malay Tapir.

NATIVE NAMES.—*Ta-ra-shu*, Burmese; *Kuda-ayer*, Malayan; *Sala-dang* of the Limuns in Sumatra; *Gindol* of the Mannas in Sumatra; *Babi-alu* in Bencoolen; *Tennu* in Malacca.

HABITAT.—Tenasserim provinces, as high as the fifteenth degree north latitude; Lower Siam; the Malayan peninsula; Sumatra and Borneo.

DESCRIPTION.—General colour glossy black, but with the back, rump,



Tapirus Malayanus.

and sides of the belly white. The young are beautifully variegated, being striped and spotted with yellow fawn on the upper parts of the body, and with white below.

Mr. Mason writes: "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. It has never been heard of north of the valley of the Tavoy river."

The tapir is naturally all the world over a very shy, retiring animal, but it is capable of being tamed when taken young, and of showing great attachment.

FAMILY RHINOCEROTIDÆ.

"The skeleton of the rhinoceros viewed generally has a resemblance to that of the little hyrax, the tapir, and the horse. The skull is very much elevated at the base, being somewhat of a pyramidal form, and the nasal bones curve upwards and downwards, and are of such a size and thickness, in order to support one or more immense horns, that they are quite unparalleled for their development in any other existing quadruped. The nasal bones, together with the premaxillary and maxillary bones, form the general contour for the external apertures of the nostrils. This is peculiar, and found in no other animal with the exception of the tapir."—*Prof. W. Boyd Dawkins and Mr. Oakley.*

The external appearance of this animal is familiar to most—a large ungainly creature, with a long head, a massive horn on its nose, sometimes two horns; a round unwieldly body covered with an immensely thick hide arranged in heavy folds; short tail and short legs, with three toes covered with broad nails or hoofs.

The stomach is simple; the intestines about eight times the length of the body, and the cæcum is large and sacculated. The horn is a mere agglutinated mass of hair or fibre superimposed on the skin, and has no bony core. The females have two inguinal mammæ.

The dentition is peculiar; "the grinders are implanted by distinct roots, and in the upper jaw their crowns are traversed by two deep folds of enamel which constitute open valleys. In the lower jaw they are composed of two crescent-shaped lobes, also open. The covering of cement is thin, and never fills up the valleys, as in the case of the more complex dental system in the horse. The normal number of grinders is seven in each jaw, while the incisors, as we have already remarked, vary not only in form but also are sometimes absent, and canines are not developed in any of the living or fossil members of the family."—*Boyd Dawkins and Oakley.*

The Rhinocerotidæ are divided into two groups—the Asiatic and the African; and the former consist of two genera—RHINOCEROS and CERATORHINUS, the former with one and the latter with two horns.

It is a moot point whether the rhinoceros is or is not the unicorn of Scripture, though it is by no means clear that the animal in question was a one-horned creature, but according to some might have been the great wild ox or urus of Macedonia. An Indian single-horned rhinoceros was sent from India to the king of Portugal in 1513, and from it various most distorted pictures were disseminated throughout Europe. It was represented as covered with a wondrous suit of armour beautifully decorated, and with a second horn on its shoulders!

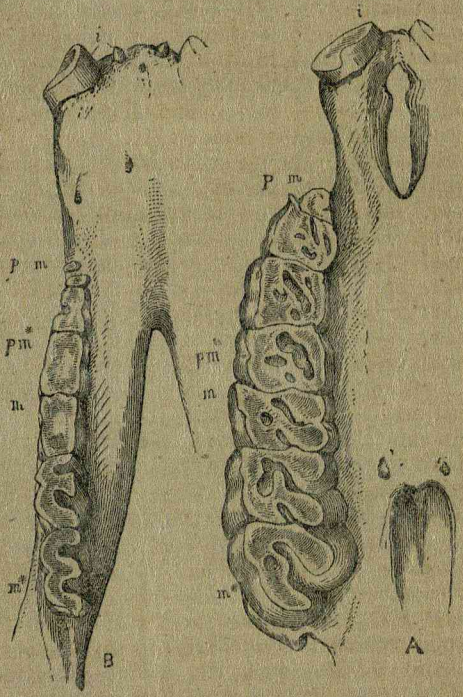
The first one brought alive to England was in 1685. Parsons

describes and figures one brought to Europe in 1739, and another in 1741 ('Philosophical Transactions,' xlii.).

The Asiatic rhinoceroses differ from the African in having the skin divided into shields by well-marked folds, long upper cutting teeth, the African having none, and by the produced conical nasal bones of the skull instead of broad and rounded ones. There are one or two other minor yet well-marked differences which we need not mention here.

GENUS RHINOCEROS.

"The skin divided into shields by well-marked folds, lumbar and neck-folds well developed; horn single, anterior; part of occipital bone



Lower Jaw. Upper Jaw.

Dentition of Rhinoceros.

near the occipital condyle and the condyles themselves prominent."
—*Gray*.

There are two species in India, viz. *Rhinoceros Indicus* and *R. Sondaicus*, the latter being the Javan species.

For the following description of the former I have to thank Mr. J. Cockburn, who, with most unselfish kindness, kept back the article he was about to publish, and gave it to me to incorporate in this work. The following remarks on dentition are also his:*—

"The normal dentition of *R. Indicus* is: Inc., $\frac{1-1}{2-2}$; premolars, $\frac{4-4}{4-4}$; molars, $\frac{3-3}{3-3}$; but the dentition varies to a great extent; for example, in a specimen of *R. Sondaicus* it stood: Inc., $\frac{1-1}{2-2}$; molars, $\frac{6-7}{6-6}$. The first premolar in both *Indicus* and *Sondaicus* is a deciduous tooth, which is not usually replaced, and gradually drops out with age, but it may be retained till extreme old age. In the majority of cases it is either lost or worn down before the last molar is in wear. The incisors also vary greatly in the adult animal; they are $\frac{1-1}{2-2}$, the outer pair below being the formidable dagger-shaped tushes, with which they inflict the terrible gashes they can produce. The median pair lower are usually lost or absorbed by advancing age, having no functions, and the incisive tusks themselves are subject to very rapid wear, being often worn down before the animal has reached middle age. Occasionally *R. Indicus* has six incisors in the lower jaw (the normal number in other mammalia), and four in the upper, but this is very exceptional."—*J. Cockburn*, MS.

No. 429. RHINOCEROS INDICUS.

(*Jerdon's No.* 212).

NATIVE NAMES.—*Genda, Gonda, Ganda,* or *Genra*, Hindi; *Gor*, Assamese.

HABITAT.—Himalayan Terai, from Central Nepal to the extreme eastern corner of the valley of Assam.

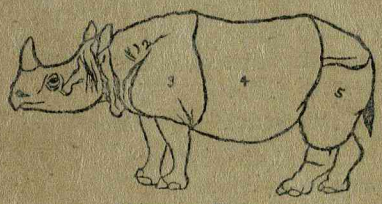
"About three centuries ago this animal existed on the banks of the Indus. The Indian rhinoceros inhabits by preference heavy grass jungle, rarely entering forest. In this respect it differs from its ally *Sondaicus*, which is a forest-loving species, and even frequents mountainous countries. It is still numerous in the mighty grass jungles which extend along the foot of the Eastern Himalayas from their slopes to the banks of the Brahmaputra. It is yearly becoming more scarce

* There are some interesting notes on the dentition of the rhinoceros, especially in abnormal conditions, by Mr. Lydekker in the 'J. A. S. B.' for 1880, vol. xlix., part ii.

in the Nepal Terai, but is found there from Rohilkund to the Bhootan Doars."

DESCRIPTION.—The accompanying outline sketch, taken from *Nature* for April 1874, will give a better idea of the animal than a mere verbal description :—

"For convenience of description I will divide the body into five segments—the head, the cervical, the scapular, the abdominal, and the gluteal. At the junction of the head with the neck is a large deep collar or ruff or fold of skin, which gives a very peculiar appearance to the animal. Behind this is a second similar but smaller ruff, which does not hang so low down from the throat as the first. On the dorsal surface it transversely crosses the nape. It is then continued down angularly to about the centre of the anterior edge of the scapular shield, where it forms an obtuse angle with its posterior but major half. It is at the point where it forms this angle that it gives off what I call the cervical fold, which forms the boundary of the top front edge of the scapular shield, but is lost at a point in the shoulder nearly over the centre of the fore limb.



Rhinoceros Indicus.

"The scapular shield is a thick cuirass-like plate of skin, studded with round projections about the size of a shilling, and bearing much resemblance to the heads of bolts by which the shield was riveted to the body, and hence called 'boiler-bolt tubercules.' This shield is often removed from the carcase of a slain rhinoceros as a trophy, 'and it is in its centre, but slightly low, that the fatal spot lies which will take him in the heart' (*Pollock*).

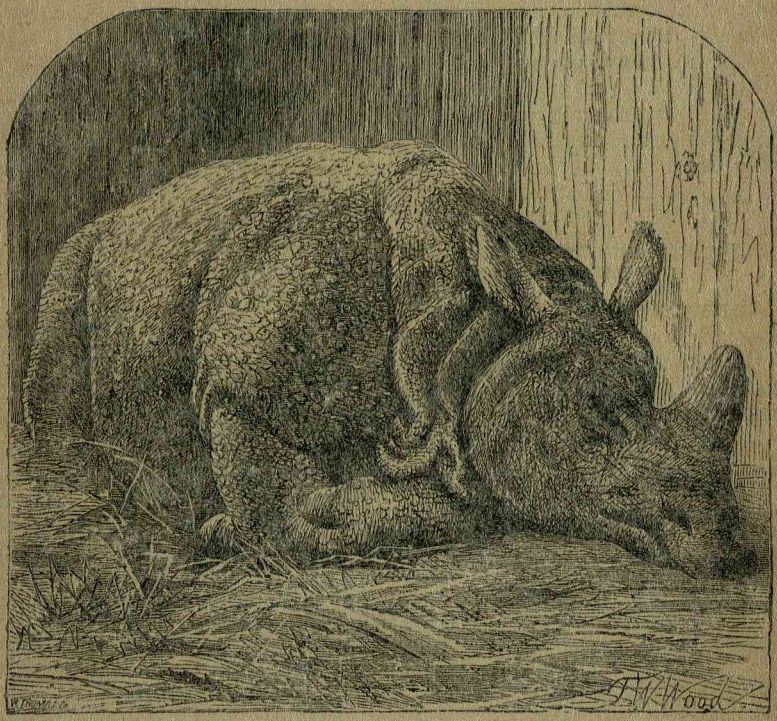
"Between the scapular and the gluteal shields lies the abdominal segment. It calls for no particular description, except that the tubercles here are very much flatter and smaller than on either segments three and four. They are here about the size of a four-anna piece, and they seem to be crowded along the centre line of the body, while the dorsal surface is nearly free from them, and smooth.

"We next come to the gluteal segment. It is in this portion that the boiler-bolt tubercles attain their greatest development, some of them being perhaps three-tenths of an inch high.

"The gluteal segment is laterally crossed by three ridges of skin. The first, which is the only one indicated in the drawing, goes right across the buttock. In some animals there is an indication of a second below this, and about fourteen inches lower down a third, which only goes about a quarter of the way across. The tail is almost concealed in

deep groove, in which lie the perineum, &c. Both the front and hind limbs from the point at which they project from the body are finely covered with reticulated skin, forming pentagonal and hexagonal scales, very much as in *R. Sondaicus*, only much finer and less prominent.

"The Indian rhinoceros has the same habit as the African species of depositing its droppings in one spot till they form huge mounds, which



Rhinoceros Indicus.

the animal levels with its horns. It is probable that this rhinoceros was found throughout the plains of the N.W. Provinces in unreclaimed spots as late as the fifth or sixth century. According to the observation of Dr. Andrew Smith in South Africa these huge pachyderms do not absolutely require for their support the dense tropical vegetation we should think necessary to supply food to such huge beasts. This gentleman saw over fifty of them in one day in an open country covered

with short grass and thorn-bushes about four feet high. From the affinities of the fauna of the N.W. Provinces, which are strongly African, it is probable that the plains of the N.W. Provinces were rather covered with scrubby open jungles and grass than with tropical primeval forests.

"Here and there belts of Dhak (*Butea frondosa*) were found, and in favoured spots doubtless other tree jungle, but it is improbable that primeval forest has existed since the depression of the Indo-Gangetic plain."—*J. Cockburn*, M.S.

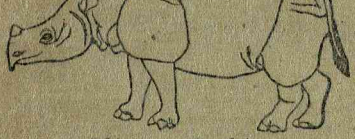
The rhinoceros is supposed to be a very long-lived animal. Dr. Gray ('P. Z. S.' 1867, p. 1011) states on the authority of Mr. Blyth that a pair lived in the Barrackpore Park for forty-five years. They were exactly alike in size and general appearance; they never bred. There is no difference in the horns or form of the skull in the two sexes (*Blyth*, 'J. A. S. B.' vol. xxxi. p. 155).

No. 430. RHINOCEROS SONDAICUS.

The Javan Rhinoceros (*Jerdon's No.* 213).

NATIVE NAMES.—The same as last in Hindi; *Khyen-hsen*, Burmese; *Warak*, Javanese; *Badak*, Malayan.

HABITAT.—"The Bengal Sunderbunds, Tipperah, the swamps at the base of the Garo, Khasia, and Naga Hills" (*Pollock*). "Munipurf, extending into the western provinces of China, southward into Burmah, the Malayan peninsula, Sumatra, Java, and Borneo" (*J. Cockburn*, MS.).



Rhinoceros Sondaicus.

DESCRIPTION.—"Folds somewhat on the same plan as in *Indicus*, one marked distinction being that the lateral shoulder fold is continued upward over the back of the neck to form an independent saddle-shaped shield on the nape. The whole body covered with pentagonal or hexagonal warty insulæ. Females hornless" (*J. Cockburn*, MS.). Males with one horn.

SIZE.—Mr. Cockburn gives the following measurements of a female, which he states is the largest recorded specimen: "Length of body (head and body?), 12 feet 3 inches; tail, 2 feet 4½ inches; height, 5 feet 6 inches." Dr. Jerdon gives: "Length 7 to 8 feet; height, 3½ to 3¾ feet;" and he calls the animal "the lesser Indian rhinoceros," whereas Mr. Cockburn's measurement gives an animal somewhat longer, though not so high as the largest recorded specimen of *Indicus*. Blyth again writes ('Mammals of Burmah,' *see* 'J. A. S. B.' vol. xliv. part ii. 1875, p. 50):

It is about a third smaller than *R. Indicus*, from which it is readily distinguished by having the tubercles of the hide uniformly of the same small size, and also by having a fold or plait of the skin crossing the nape in addition to that behind the shoulder-blades."

This rhinoceros seems to be found at all elevations, like the Sumatran one which was found by General Fytche at an altitude of 4000 feet; it is much more of a forester than the last. Blyth and Jerdon suppose it to be the same as the species hunted by the Moghul Emperor Baber on the banks of the Indus.

GENUS CERATORHINUS.

"The skin divided into shields by deep folds; the lumbar fold rudimentary, short, only occupying the middle of the space between the groin and the back; horns two, the front longer, curved backward, the hinder small; conical skull; forehead narrow, flat; the upper part of the nose on each side of the horns narrow, rounded, sub-cylindrical; the occipital region erect, the part near the condyles rather concave; the occipital condyle short, broad, oblong, placed obliquely inferior, scarcely prominent; lachrymal bone very large, irregular shaped."—*Dr. Gray*, 'P. Z. S.' 1867, p. 1021.

No. 431. RHINOCEROS *vel* CERATORHINUS (CROSSI?) LASIOTIS.

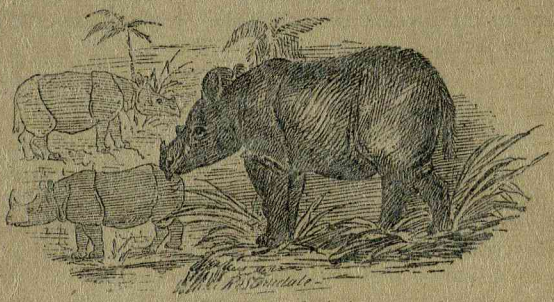
The Ear-fringed Rhinoceros.

HABITAT.—Arakan, Tenasserim provinces; one was caught near Chittagong in 1868.

DESCRIPTION.—A thinner hide than with the preceding, and not tuberculated; the folds also are fewer in number; there is one great groove behind the shoulder-blades, and a less conspicuous one on the flank, and some slight folds about the neck and top of the limbs; the horns are two in number, the posterior one being the centre of the nose behind the anterior one, and almost over the anterior corner of the eye; the body (of a young specimen) is covered with long, fine, reddish hair, and the posterior margins of the ears have very long fringes of the same; the tail is short and hairy.

A young specimen of this animal (of which there is an excellent coloured plate in 'P. Z. S.' 1872, p. 494) was captured in 1868 in Chittagong. She had got into a quicksand, and had exhausted herself by floundering about. The natives contrived to attach two ropes to her neck, and, hauling her out, managed to make her fast to a tree. Next morning they found her so refreshed and vigorous that they were afraid to do anything more to her, and so sent messengers to the magistrate

of Chittagong to report the capture. The same evening Captain Hood and Mr. Wickes started with eight elephants to secure the prize, and after a march of sixteen hours to the south of Chittagong, they came up to the animal. The elephants at first sight bolted, but were brought back by considerable exertion, and the rhinoceros was made fast to one by a rope. The poor creature roared with fright, and a second



Rhinoceros lasiotis.
(*R. Indicus* and *R. Sondaicus* in the distance.)

stampede ensued, in which luckily the rope slipped off the leg of the rhinoceros to which it was attached. Ultimately she was secured between two elephants and marched into Chittagong, where she soon got very tame. Eventually she was sent to England, and was purchased by the Zoological Society for £1250—a very handsome price, owing doubtless to the rarity of the specimen.

No. 432. RHINOCEROS *vel* CERATORHINUS SUMATRENSIS.

The Sumatran Rhinoceros.

NATIVE NAMES.—*Kyen-shan*, Burmese; *Bodok*, Malayan.

HABITAT.—Tenasserim provinces; Burmah, extending into Siam; the Malayan peninsula and Sumatra.

DESCRIPTION.—A smaller animal than the preceding, with a hard, black, rough, bristly skin; a deep fold behind the shoulder; ears set closer than in the last species, and filled with black hair internally; the muzzle in front of the first horn is broader; the horns are two in number, and attain a good size, curving, but slightly, backward; the tail is conspicuously longer than in *R. lasiotis*, and is tapering and not tufted. There is a well drawn and coloured plate of this species in the 'Proceedings of the Zoological Society' for 1872, p. 794, as also several engravings showing the heads of the two animals in juxtaposition.

SIZE.—About 3 feet 8 inches in height at the shoulder.

At first it was considered that *R. lasiotis* was of this species, and as

such it was described and sent to England; but on the subsequent arrival of a genuine *R. Sumatrensis* from Malacca it was apparent that *R. lasiotis* was quite distinct. The latter is of larger size, lighter colour, with wide-set ears and a tufted tail. The former is smaller, darker, with narrow-set ears and a long tapering semi-nude tail.* The Society paid Mr. Jamrach £600 in 1872 for the female specimen from Malacca, which settled the question of separate species. A young *R. Sumatrensis* was born in the Victoria Docks in London on December 7th, 1872, on board the steamship *Orchis*. There is a coloured sketch of the little one in the 'P. Z. S.' for 1873, and an interesting account of it and the mother by Mr. Bartlett, the Superintendent of the Society's Gardens. From the circumstances of the capture of the mother it appears that the period of gestation of the rhinoceros is about the same as that of the hippopotamus, viz. seven months.

Although the number of species of living rhinoceros is but few, there are a great many fossil species which show that the animal was more plentiful and in greater variety in prehistoric times.

Remains of the woolly rhinoceros (*R. trichorhinus*) have been found, like those of the mammoth, imbedded in ice; it was about eleven and a-half feet in length, and its body was covered with woolly hair. A specimen found in 1771 or 1772 was entire, and clothed with skin, but so far decomposed as to prevent more than the head and feet being preserved; remains of other fossil species are found throughout Europe, including Great Britain, and also in India. In 'A Sketch of the History of the Fossil Vertebrata of India' by Mr. R. Lydekker, published in the 'Journal of the Asiatic Society of Bengal,' vol. xlix., 1880, will be found the names of eight species of fossil rhinoceros, inclusive of *R. Indicus*, which is found in *recent alluvia*—it is found with two others in the Pleistocene formation, and five others are from the Pleiomiocene.

SUB-ORDER ARTIODACTYLA.

We now come to the second division, and a very large one, of the UNGULATA, which in itself is again subdivided into non-ruminants and ruminants. The former comprises the pigs of the Old and the peccaries of the New World and the hippopotami; the latter contains the camels, llamas, deerlets, oxen, antelope, and deer. In the *Artiodactyla* the toes are even on all feet, being normally four (perfect and rudimentary) with the exception of the camel, giraffe and a few antelope, in which two only are present. To understand the subject thoroughly one must

* There is a very interesting letter in *The Asian* for July 20, 1880, p. 109, from Mr. J. Cockburn, about *R. Sumatrensis*, of which he considers *R. lasiotis* merely a variety. He says it has been shot in Cachar.—R. A. S.

Compare the fore-foot of a deer or pig with our own hand; what we call the knee of the former is merely our wrist. The bones which run through the palm of the hand to the knuckles are the metacarpals; they are five in number, corresponding with the thumb and four fingers. In the *Artiodactyla*—or, I should say, in the *Ungulata* generally—the thumb is entirely wanting; in the *Artiodactyla* the fore and little fingers are shorter, rudimentary, or entirely wanting, and the two centre metacarpals, the middle and ring fingers are prolonged into what we call the leg below the knee in these animals, which consist of separate or fused bones terminated by the usual three joints of the finger, on the last of which is placed the hoof.

Bones of a Pig's foot. (See also p. 528.)

The two halves are always symmetrical, and from this we may affirm that it is the thumb and not the little finger which is absent, for we know that, counting from the knuckles, our fingers have three joints, whereas the thumb has only two; so in the digits of the *Artiodactyla* are three joints at the end of each metacarpal. In the pig the metacarpals of the fore and little fingers are produced from the carpus or wrist, or, as is popularly termed in the case of these animals, the knee. They are more attenuated in the chevrotains or deerlets, of which our Indian mouse-deer is an example; in the *Cervidæ* they are more rudimentary, detached from the carpus, and are suspended free and low down, forming the little hoof-points behind; and a little above the proper hoofs in these the two large metacarpals are more or less joined or fused into one bone, and they are still more so in the camel, in which the fore and little finger bones are entirely absent. In the giraffe and prong-horn antelope they are also wanting. The hind feet are similarly constructed.*

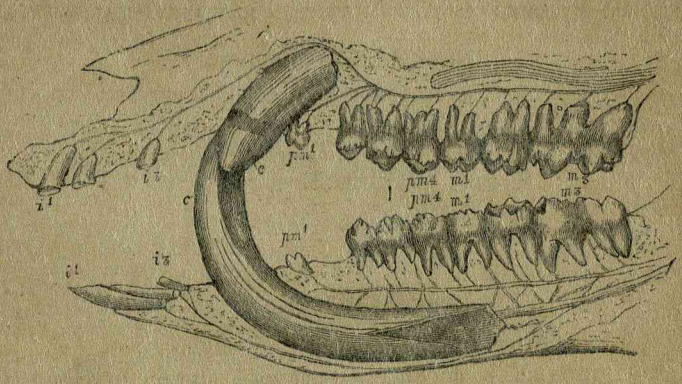
Of the non-ruminantia we have only the Suidæ—the peccaries belonging to America, and the hippopotami to Africa.

FAMILY SUIDÆ—THE HOGS.

These have incisors in both jaws, which vary in number, the lower ones slanting forward. Their canines are very large and directed outwards and upwards in a curve, grinding against each other to a sharp edge and fine point. Their metacarpal bones are four in number, and are all distinct, in which respect they differ from the peccaries, in which

* See notes in Appendix C.

the central metacarpals and metatarsals are fused into a solid bone. The hogs have a prolonged snout, flexible at the end, with a firm cartilaginous tip, with which they are enabled to plough up the ground



Dentition of Wild Boar.

in search of roots. They have also a very keen sense of smell. The normal dentition of the true hogs is as follows:—

Inc., $\frac{6}{6}$; can., $\frac{1-1}{1-1}$; premolars, $\frac{4-4}{4-4}$; molars, $\frac{3-3}{3-3}$ = 44.

The hogs, unlike other pachyderms, are noted for their fecundity.

GENUS SUS.

Incisors, $\frac{4}{6}$ or $\frac{6}{6}$; the lower ones slanted; the canines large and curved outwards and upwards; molars tuberculate; four toes on each foot—that is, two major and two minor, each hoofed.

No. 433. SUS SCROFA.

The European Wild Boar.

NATIVE NAMES.—*Guraz* or *Kuk*, Persian.

HABITAT.—Persia and the Thian Shan mountains near Kashgar.

DESCRIPTION.—Body dusky or greyish-brown, with a tendency to black, with black spots; large mouth with long projecting tusks; the hairs of the body coarse, mixed with a downy wool; bristles on the neck and shoulders. The young are marked with longitudinal stripes of reddish colour.

The wild boar of Europe apparently extends to the limits sometimes reached by Indian sportsmen. It is found in Persia, and specimens were brought back from Kashgar by the Yarkand Mission in 1873–74. The only divergence which these specimens showed from the European boar was the darker colour of the feet and legs, which were nearly black.

No. 434. SUS INDICUS.

The Indian Boar (Jerdon's No. 215).

NATIVE NAMES.—*Soor* or *Suar*, *Bura-janwar*, or *Bad-janwar*, *Barha*, Hindi; *Dukar*, Mahratti; *Paddi*, Gondi; *Pandi*, Telegu; *Handi*, *Mikka*, *Jewadi*, Canarese; *Kis* of the Bhaugulpore hill-tribes; *Tan-wet*, Burmese; *Walura*, Singhalese.

Sus Indicus.

HABITAT.—Throughout India, from a considerable elevation (12,000 feet according to Jerdon) down to the sea level. It is also common in Burmah and in Ceylon.

DESCRIPTION.—The head of the Indian wild boar differs considerably from the German one. Sir Walter Elliot says: "The head of the former is larger and more pointed, and the plane of the forehead straight, while it is concave in the European, the ears of the former are small and pointed; in the latter larger and not so erect. The Indian is altogether a more active-looking animal, the German has a stronger, heavier appearance."

Jerdon, who has in some measure adopted these remarks, adds that the tail is more tufted, and the malar beard is well marked.

The colour of the full-grown animal is brownish-black, sparsely clad with black hair; the ears are scantily covered with black hairs

externally, but more abundantly inside. A crest of stiff black bristles extends from the occiput over the neck and shoulders and down the back; the bristles of the throat and breast are reversed, growing forwards instead of backwards, the tips being sometimes white; the limbs, which are well covered with bristly hair outside, are nearly naked within, and the tail is short, slightly hairy, and with a flat tip fringed with lateral bristles set like the barbs of a feather. The young are more hairy, and are striped with brown and fulvous yellow.

SIZE.—Head and body, about 5 feet; tail, 1 foot; height, from 30 to 36 inches.

This species is so well known to residents in India, not only from personal experience but from the numerous accounts of its chase—one of the most exciting of Indian field sports—that it would be almost superfluous to add anything more to the already redundant porcine literature, so I will confine myself to the habits of the animal in the jungles. It is gregarious, living in herds, usually called *sounders*, the derivation of which has often puzzled me as well as others; but McMaster says it is to be found in Bailey's English Dictionary, of which the fifteenth edition was published in 1753 as (among hunters) *a herd or company of swine*. An old boar is generally the chief, but occasionally he gets driven from the herd, and wanders solitary and morose, and is in such a case an awkward customer to tackle. An old boar of this kind is generally a match for a tiger; in fact few tigers, unless young and inexperienced, would attack one. I have known two instances of tigers being killed by boars; one happened a few miles from the station of Seonee, to which place we had the animal carried. (See Appendix C.) On another occasion, whilst on tour in the district, a deputation from a distant village came into my camp to beg of me to visit them, and shoot a large boar which had taken possession of a small rocky hill, and from it made his nightly forays into their rice fields, and was given to attacking those who approached him. I went and got the boar out and shot him, but lost a tiger, which also sneaked out and broke through a line of beaters; these two were the sole occupants of this small isolated knoll, and lived evidently on terms of mutual respect. The boar was the largest I had ever seen or killed, but, as the sun was getting fierce, and I had far to ride to camp, I regret I left him to the villagers without taking any measurements. It is allowable to shoot hogs in some hilly parts of India where riding is out of the question, otherwise the shooting of a boar in riding country is deservedly looked upon as the crime of vulpecide would be in Leicestershire—a thing not to be spoken of. The boar possesses a singular amount of courage; he is probably the most courageous of all animals, much more so than the tiger, but unless irritated he is not prone to attack at first sight, except in a few cases of solitary individuals, like

one above mentioned. I was once rather ludicrously and very uncomfortably held at bay by a boar who covered the retreat of his family. One evening, after dismissing my *amlah*, I took up a shot gun, and, ordering the elephant to follow, strolled across some fields to a low scrub-covered hill where I thought I might pick up a few partridges or a peafowl before dusk. On entering the bush which skirted the base of the hill I was suddenly brought up by a savage grunt, and there in front of me stood an old boar with his bristles up, whilst the rest of his family scampered off into the thicket. I remembered Shakespeare's (the poet's—not the gallant shikari general's) opinion :—

> "To fly the boar before the boar pursues
> Were to incense the boar to follow us,"

and therefore stood my ground, undergoing the stern scrutiny of my bristly friend, who cocked his head on one side and eyed me in a doubtful sort of way, whilst he made up his mind whether to go for me or not, whilst I on my part cogitated on the probable effect at close quarters of two barrels of No. 6 shot. However, he backed a bit, and then sidled to the rear for a few paces, when he brought up with another grunt, but, finding I had not moved, he finally turned round and dashed after his spouse and little ones. (See also Appendix C, p. 528.)

Colonel (now General) Shakespear winds up a thrilling account of a fight with one with the following paragraph, which will give a good idea of the endurance of these creatures :—

"There he was with a broken spear in his withers, the shaft sticking up a foot and a-half from the blade, knocking over a horseman and wounding his horse ; receiving two bullets—ten to the pound each—the first in his neck and throat, a very deadly part in all animals ; the second breaking his jaw, and fired within a few feet of the muzzle ; making good his charge, cutting down his enemy like grass, wounding him, knocking over a second man armed with a spear, defying the dogs, and then, when in the act of charging again, shot to the brain and dying without a groan."

Although I had not intended giving any shikar stories, I cannot resist quoting one from General McMaster's 'Notes on Jerdon.' He writes :—

"In further proof of the savage courage of a boar I may mention the following instance which is recorded in the 'Hunt Annals' of the 25th December, 1869. A large *unwounded* boar had succeeded in getting into some thick bushes. On being bullied by a terrier he charged the nearest hunter, and ripped the horse very badly. Two other sportsmen who were not riding then tried to tempt the boar to charge, one by firing No. 10 or quail shot into the bush, the other by riding a camel into it.

last was successful, for, charging straight at the camel's legs (receiving some shot in his face on his way) he completely routed the whole arrangement, knocked over and ripped the camel, which broke its leg in falling, and then made away across the fields; he was followed and twice speared, but he was as cunning as courageous, and managed to give his pursuers the slip in some long grass and thick bushes. This boar's savage charge at the camel was within a few yards of all of us, for every one was trying to entice him to come forth; after his headlong rush out of the bush he reared so upright in his attempt to reach his clumsy disturber, which was quite frantic from deadly fear, that he succeeded in ripping it in what in a horse would be termed the stifle joint. The poor brute rolled over in its agony, smashed one of its legs in the fall, and was of course shot. Luckily the rider, one of the best known among the Nagpore Hunt, was not hurt."

I believe a wild pig will charge at anything when enraged. I had an elephant who, though perfectly staunch with tigers, would bolt from a wild boar. The period of gestation is four months, and it produces twice a year; it is supposed to live to the age of twenty years, and, as its fecundity is proverbial, we might reasonably suppose that these animals would be continually on the increase, but they have many enemies, whilst young, amongst the felines, and the sows frequently fall a prey to tigers and panthers. Occasionally I have come across in the jungles a heap of branches and grass, and at first could not make out what it was, but the Gonds soon informed me that these heaps were the nests or lairs of the wild pigs, and they invariably turned them over to look for squeakers. These are funny little things, of a tortoiseshell colour, being striped reddish yellow and dark brown. There is an old writer on Indian field sports, Williamson, who makes some correct observations on the habits of the wild hog, although much in his book (now, I fancy, out of print) is open to question. He writes: "The wild hog delights in cultivated situations, but he will not remain where water is not at hand, in which he may, unobserved, quench his thirst and wallow at his ease; nor will he resort for a second season to a spot which does not afford ample cover, whether of heavy grass or of underwood jungle, within a certain distance, for him to fly to in case of molestation, and especially to serve as a retreat during the hot season, as otherwise he would find no shelter. The sugar-cane is his great delight, both as being his favourite food and as affording a high, impervious, and unfrequented situation. These hogs commit great devastation, especially the breeding sows, which not only devour, but cut the canes for litter, and throw them up into little huts, which they do with much art, leaving a small entrance which they stop up at pleasure. Sows never quit their young pigs without completely shutting them up. This is, indeed, requisite only for a few days, as the young brood may be

seen following the mother at a round pace when not more than a week or ten days old." The fields of *urhur* or *ruhur dâl* (*Cajanus Indicus*) also afford good shelter to pigs. They feed chiefly at night, and in Central India numbers are shot by native shikaries in moonlight nights over water and favourite crops or in particular runs. Many castes of Hindus, who would turn with abhorrence from the village pig, will not scruple to eat the flesh of the wild boar. On the whole it is probably a cleaner feeder, but it will not hesitate to devour carrion if it should come across a dead animal in its wanderings.

No. 435. SUS ANDAMANENSIS.

The Andaman Island Pig.

HABITAT.—Andaman islands; Nicobars (?)

DESCRIPTION.—Much smaller than the last. "The concavity of the cheeks in front of the orbit deeply concave." Tail short, a mere tubercle in fact; the body well clad with somewhat shaggy black hair, probably allied to *Sus Papuensis*.

Dr. Gray was of opinion (*see* his article on the *Suidæ*, 'P. Z. S.' 1868) that the skull of this species is more allied to the *Babirussa* than any others of the pigs, the front of the canines being rather more produced than in other species, but not nearly so much so as in *Babirussa*.

No. 436. SUS MOUPINENSIS.

HABITAT.—Thibet.

A description of this, which I have not by me at present, will be found in Professor Milne Edwards's 'Recherches sur les Mammifères,' p. 377.

GENUS PORCULA.

Head conical, moderate; ears small, erect, hairy; cheeks without any tubercles; tail very short, rudimentary; cutting teeth $\frac{6}{6}$, the two upper front largest, the lateral lower small; intermaxillary moderate, not produced; canines small, scarcely elevated above the other teeth, the upper one rather spread out, but not reflexed; premolars, $\frac{4-4}{4-4}$ (*Gray*); molars, $\frac{3-3}{3-3}$; the fourth toe on all the feet small and unequal. Jerdon observes: "This genus, it will be remarked, makes an approach to the American peccaries in the non-excerted canines, the short tail, and the small fourth toe." Hodgson's dental formula shows one premolar less, viz. teeth: $\frac{6}{6}, \frac{1-1}{1-1}, \frac{6-6}{6-6}$.

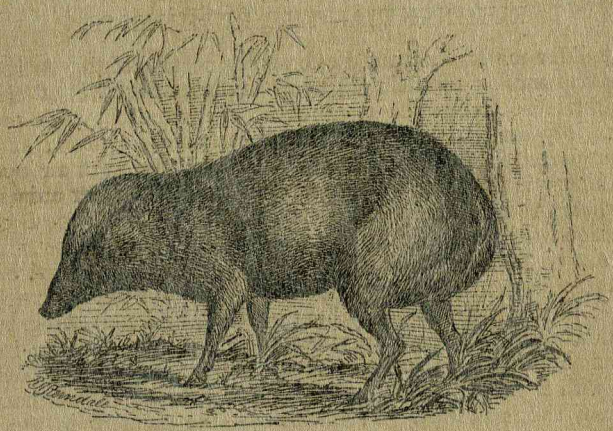
No. 437. PORCULA SALVANIA.

The Pigmy Hog of the Saul Forests (*Jerdon's No.* 216).

NATIVE NAMES.—*Sano-banel*, Nepalese; *Chota-suar*, Hindi.

HABITAT.—The Saul forests of the Sikim and Nepal Terai.

DESCRIPTION.—According to Mr. Hodgson "the pigmy hog is about the size of a large hare, and extremely resembles both in form and size a young pig of the ordinary wild kind of about a month old, except in its dark and unstriped pelage. The likeness of the limbs and members to those of the common hog is so close that every purpose of general description of the pigmy hog is served by pointing to that



Porcula Salvania.

resemblance, desiring only that heed should be taken by the observer of the shorter jaws, and eye consequently placed midway between the snout and ear; of the much shorter tail, nude, straight, and not extending so far as the bristles of the rump, and lastly of the smallness of the inner hind toe. The ears also are quite nude, and the abdominal surface of the neck, as well as the insides of the limbs and the belly, are nearly so, but the upper and lateral external parts are covered thickly with bristles, even longer and more abundant than those of the wild or tame hog—save upon the ridge of the neck, where the common hog has more or less of, and generally a conspicuous mane, but the pigmy hog little or none"—"the colour of the animal is a black brown, shaded vaguely with dirty amber or rusty red."

SIZE.—Head and body, from 18 to 20 inches; height, 8 to 10 inches; weight, 7 to 10 lbs.

This little animal, according to Hodgson's account of it (a most interesting one, which will be found in the 'Journal of the Asiatic Society of Bengal,' vol. xvi. May 1847), seems to have the disposition of the peccary as well as the resemblance; it goes, he says, in herds, and the males fearlessly attack intruders, "charging and cutting the naked legs of their human or other attackers with a speed that baffles the eyesight, and a spirit which their straight sharp laniaries renders really perplexing, if not dangerous."

RUMINANTIA—THE RUMINANTS

These differ materially from the foregoing section of the Artiodactyla by the construction of their digestive organs. Instead of the food being masticated and passed at once into the stomach, each mouthful is but slightly bruised and passed into the paunch, whence at leisure it is regurgitated into the mouth to be chewed. For such an operation the machinery is of course more complicated than in other animals, and I must therefore attempt to describe briefly and as clearly as I can the construction of the ruminating stomach. Taking the ox as a typical specimen, we find four well-defined chambers varying in size. The first of these is the rumen or paunch, in which the unmasticated food is stored; it is a large sac partly bent on itself, and narrowing towards its junction with the œsophagus or gullet, and the entrance into the second chamber. It is lined with a mucous membrane, which is covered with a pile or villous surface, and this membrane is what is sold in butchers' shops as tripe. From this bag (the paunch) in the act of rumination a certain portion of the food is ejected into the second chamber, which is termed the reticulum (i.e. a little net) from the peculiar arrangement of its inner or mucous surface, which is lined with a network of shallow hexagonal cells. The functions of this receptacle are probably the forming of the food into a bolus, and by a spasmodic contraction the forcing of it back through the gullet into the mouth for mastication. Here it is well chewed, and, being thoroughly mixed with saliva passes back; on being swallowed in a soft pulpy state it passes the groove or valve communicating with the chamber from which it issued, and goes straight into the psalterium or manyplies, as the third chamber is called. This is globular, but most of its interior is filled up with folds like the leaves of a book, more or less unequal. It is not quite clear what the peculiar functions of this chamber are, but the semi-liquid food, passing through it, goes into the proper stomach (abomasum

reed) and is here acted upon by the gastric juice. Professor Garrod thus describes the probable order of events in the act of rumination: "The paunch contracts, and in so doing forces some of the food into the honeycomb bag, where it is formed into a bolus by the movement of its walls, and then forced into the gullet, from which by a reverse action it reaches the mouth, where it is chewed and mixed with the saliva until it becomes quite pulpy, whereupon it is again swallowed. But now, because it is soft and semi-fluid, it does not devaricate the walls of the groove communicating with the manyplies, and so, continuing on along its tubular interior, it finds its way direct into the third stomach, most of it filtering between the membrous laminæ on its way to the fourth stomach, where it becomes acted on by the gastric juice. After the remasticated food has reached the manyplies, the groove in the reticulum is pushed open by a fresh bolus, and so the process is repeated until the food consumed has all passed on towards the abomasum or true digestive stomach."

The ruminants are peculiar also in their dentition; in the so-called true ruminants there are no incisors or cutting teeth in the upper jaw, but the teeth of the lower jaw are opposed to a hard callous pad; the herbage is cropped by being nipped between these teeth and the pad, and detached by an upward motion; in some few, such as the musk deer, Chinese water deer and the rib-faced deer or muntjac the upper canines exist, and are largely developed.

The camels and llamas possess two cutting teeth in the upper jaw, and in this respect they differ from the true ruminants, as also in some internal features.

The grinding teeth are six on each side of the jaw, and are composed of alternate convolutions of enamel, dentine and cement, which wear unequally by the lateral motion of grinding, and so form the necessary inequality of surface.

The centre metacarpal bones in the Ruminantia are fused into one common bone, except in the deerlets, which also have the two outer fore and little finger metacarpals distinct, whereas they are but rudimentary in the rest of the true ruminants, and totally absent in the camels.

The following is the classification at present adopted: SUB-ORDER *Ruminantia*, containing two sections, viz. True Ruminants and the Camels (*Tylopoda*). SECTION *True Ruminants*, containing two divisions, viz. Horned Ruminants and Hornless Ruminants, such as the chevrotains or deerlets (*Tragulidæ*). DIVISION Horned Ruminants, containing two groups, viz. Hollow-horned Ruminants (*Bovidæ*), and Solid-horned Ruminants (*Cervidæ*). The deerlets possess no psalterium or third stomach, except in a rudimentary form, and their feet approximate to those of the pigs, and they are destitute of horns. The hollow-horned

ruminants are those which bear a persistent sheath of horn on a bony core; the others bear solid antlers which are periodically shed, and grow afresh.

FAMILY BOVIDÆ—HOLLOW-HORNED RUMINANTS.

In these there is an elongated process of bone on the frontals, termed the "horn cores," which are covered with a horny sheath which is never shed, but continues to grow till full adult life, and probably whilst life lasts, the growth being from the base. In some of these the females are horned, but the majority are hornless. These have all the typical organs of rumination and digestion, and they consist of the goats, sheep, antelope, oxen, and buffalos.

SUB FAMILY CAPRINÆ—GOATS AND SHEEP.

These are noted for having, as a general rule, horns in both sexes, though of varying quality; they are usually compressed, triangular, rugose, with transverse ridges, and curving backwards or spirally; no canines. Feet pits in some; sub-orbital gland small or absent.

GENUS OVIS—THE SHEEP.

Horns in both sexes; in the male very large, angular, deeply wrinkled, turned downwards in a bold circle, with the point curved outwards; the nasal bones are arched; small feet pits; two mammæ.

No. 438. OVIS POLII.

Marco Polo's Sheep.

NATIVE NAMES.—*Rass* or *Roosh* on the Pamir; *Kuch-kar* (male), *Mesh* (female), in Wakhan.

HABITAT.—Thian Shan mountains, north of Kashgar, and Yarkand, at elevations exceeding 9000 feet.

DESCRIPTION.—During winter light greyish-brown on the sides of the body, with a dark line down the middle of the back, white below. In summer the grey changes to dark brown. The horns describe a circle of about one and a quarter when viewed from the side, and point directly outwards. One of the finest specimens I have seen, which was exhibited at a meeting of the Asiatic Society in December

1879, and is now in the Indian Museum, measures over sixty-seven inches from base to tip along the curve, with a circumference at base of sixteen inches and a width from tip to tip in a straight line of fifty-three inches; one in the British Museum measures sixty-three inches, but is wider in its spread, being fifty-four inches across at the tips. Major Biddulph, who presented the head to our museum, remarked

Ovis Polii.

that the strength of the neck muscles must be enormous to allow of so great a weight being easily carried, and it was doubtless owing to this weight that the *Ovis Polii* and other great sheep that he had observed had a very erect carriage, which has also been noticed by others of the *Ovis Ammon*.

I have never seen this animal in the flesh, and can only therefore

give what I gather from others about it, which is not much, as it is not very well known.

SIZE.—Stands nearly four feet at the shoulder.

In the article on Asiatic sheep by Sir Victor Brooke and Mr. B. Brooke in the 'Proceedings of the Zoological Society' in 1875, there is an excellent series of engravings of horns of these animals, amongst which are two of *Ovis Polii*. The description of the animal itself appears to be faulty, for it is stated that around the neck is a pure white mane, whereas Mr. Blanford wrote to the Society a few months later to the effect that he had examined a series of skins brought from Kashgar, and found that none possess a trace of a mane along the neck, as represented in a plate of the animal, there being some long hair behind the horns and a little between the shoulders, but none on the back of the neck. The animal has a very short tail also—so short it

Horns of *Ovis Polii*.

can hardly be seen in life. According to M. Severtzoff there is a dark line above the spinal column from the shoulders to the loins; a white anal disc surrounds the tail; this disc above is bordered by a rather dark line, but below it extends largely over the hinder parts of the thighs, shading gradually into the brown colour of the legs. The light greyish-brown of the sides shades off into white towards the belly.

He gives the following particulars concerning its habits: "It is not a regular inhabitant of the mountains, but of high situated hilly plains, where *Festuca*, *Artemisia*, and even *Salsolæ* form its principal food. It only takes to the mountains for purposes of concealment, avoiding even then the more rocky localities. It keeps to the same localities summer and winter. Its speed is very great, but the difficulty in overtaking wounded specimens may be partly attributed to the distressing effect of the rarefied air upon the horses, which has apparently no effect whatever on the sheep. The weight of an old specimen killed and gralloched by

M. Severtzoff was too much for a strong mountain camel, the animal requiring four hours to do four versts (2·6 miles), and being obliged to lie down several times during the journey. He reckons the entire weight of a male *Ovis Polii* to be not less than 16 or 17 poods (576 to 612 lbs.); the head and horns alone weigh over two poods (72 lbs.)." *

I have before me a beautiful photograph by Mr. Oscar Malitte, of Dehra Doon, of a very large skull of this sheep, with the measurements given. The photograph is an excellent one of a magnificent head, and I should say if the measurements have been correctly made, that the horns are the longest, though not the thickest, on record.

The dimensions given are as follows:—

	Inches.
Round the curve	73
From tip to tip	48
Girth at base	14

The next largest head to this is the very fine one in the Indian Museum, presented by Major Biddulph:—

	Inches.
Round the curve	67
From tip to tip	53
Girth at base	16

There is another in the British Museum:—

	Inches.
Round the curve	63
From tip to tip	54
Girth at base	16

From the above measurements it will be seen that the horns in the photograph before me are of greater length, but not so massive as the other two. They are also more compressed in their curvature than the others, and so the tip to tip measurement is less. The skull appears to be that of a very old animal; the horns are quite joined at the base, and from the incrustation on the bones I should say it had been picked up, and was not a shikar trophy. Anyhow it is a valuable specimen.†

No. 439. OVIS HODGSONI.

The Argali or Ovis Ammon of Thibet.

NATIVE NAMES.—*Hyan, Nuan, Nyan, Niar, Nyaud* or *Gnow.*

HABITAT.—The Thibetan Himalayas at 15,000 feet and upwards.

DESCRIPTION.—The following description was given by a correspondent of the *Civil and Military Gazette* in the issue of the 21st October,

* It must be remembered that at such great elevations a camel is unable to bear a very heavy load.

† See notes to *Ovis Polii* in Appendix C, p. 528.

Ovis Hodgsoni.

1880": "The male dark earthy brown above, lighter below; rump lighter coloured; tail one inch; white ruff of long hairs on throat and chin; hair of body short, brittle, and close-set. The female darker coloured than the male, and may often be distinguished, when too far to see the horns, by the dark hue of the neck." Both male and female are horned; the horns of the former are very large, some are reported as being as much as four feet long, and 22 inches in circumference at the base. Dr. Jerdon quotes Colonel Markham in giving 24 inches as the circumference of one pair. They are deeply rugose, triangular, and compressed, deeper than broad at the base, forming a bold sweep of about four-fifths of a circle, the points turning outwards, and ending obtusely. The horns of the female are mentioned by various writers as being from 18 to 22 inches, slightly curved; but the correspondent of the *Civil and Military Gazette* above quoted gives 24 inches as his experience.

Ovis Hodgsoni.

SIZE.—From 10 to 12 hands, sometimes an inch over.

A very interesting account of this animal, with a good photograph of the head, is given in Kinloch's 'Large Game-shooting in Thibet and the North-west.' He says: "In winter the *Ovis Ammon* inhabits the lower and more sheltered valleys, where the snow does not lie in any great quantity. As summer advances, the males separate from the females, and betake themselves to higher and more secluded places. They appear to be particular in their choice of a locality, repairing year after year to the same places, where they may always be found, and entirely neglecting other hills which apparently possess equal advantages as regards pasturage and water. Without a knowledge of their haunts a sportsman might wander for days and never meet with old rams, although perhaps never very far from them. I have myself experienced this, having hunted for days over likely ground without seeing even the track of a ram, and afterwards, under the guidance of an intelligent Tartar, found plenty of them on exactly similar ground a mile or two from where I had been. The flesh of the *Ovis Ammon*, like that of all the Thibetan ruminants, is excellent; it is always tender, even on the day it is killed, and of very good flavour, possibly caused by the aromatic herbs which constitute so large a portion of the scanty vegetation of those arid regions.

No animal is more wary than the *Ovis Ammon*, and this, combined with the open nature of the ground which it usually inhabits, renders it perhaps the most difficult of all beasts to approach. It is however, of course, sometimes found on ground where it can be stalked, but even then it is most difficult to obtain a quiet shot, as the instant one's head is raised one of the herd is nearly sure to give the alarm, and one only gets a running shot.

"*Ovis Ammon* shooting requires a great deal of patience. In the first place, unless the sportsman has very good information regarding the ground, he may wander for days before he discovers the haunts of the old rams; and, secondly, he may find them on ground where it is hopeless to approach them. In the latter case all that can be done is to wait, watch them until they move to better ground, and if they will not do this the same day, they must be left till the next. Sooner or later they will move to ground where they can be stalked, and then, if proper care is exercised, they are not much more difficult to get near than other animals; but the greatest precautions must be taken to prevent being seen before one fires. Some men may think this sort of shooting too troublesome, and resort to driving, but this is very uncertain work, and frightens the animals away, when, by the exercise of patience, a quiet shot might be obtained."

A writer in *The Asian*, whose 'Sportsman's Guide to Kashmir and Ladakh' contains most valuable information, writes thus in the issue of August 30, 1881, of the keen sense of smell possessed by this animal, and I take the liberty of quoting a paragraph:—

"The *Ovis Ammon* is possessed of the sense of smell to a remarkable degree, and, as every one who has stalked in Ladakh is aware, the wind is treacherous. If the stalker feels a puff of wind on his back when within 700 or 800 yards of the game, he well knows that it is 'all up.' On the tops of the mountains and in the vicinity of glaciers these puffs of wind are of frequent occurrence; often they will only last for a few seconds, but that is sufficiently long to ruin the chance of getting a shot at the *Ovis*. Except for this one fact, we cannot admit that the nyan is harder to approach than any other hill sheep."

No. 440. OVIS KARELINI.

Karelin's Wild Sheep.

NATIVE NAMES.—*Ar* or *Ghuljar* (male); *Arka* (female), Khirghiz; *Kulja*, Turki of Kashgar.

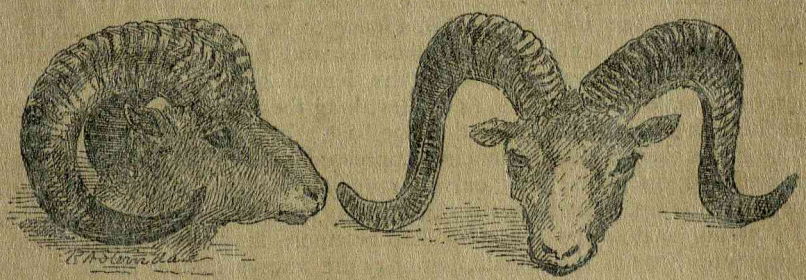
HABITAT.—Mountains north-west of Kashgar, and thence northwards beyond the Thian Shan mountains on to the Semiretchinsk Altai.

DESCRIPTION (by Sir Victor Brooke and Mr. Brooke, translated and abstracted from Severtzoff, *see* 'P. Z. S.' 1875, p. 512).—"The horns

moderately thick, with rather rounded edges; frontal surface very prominent, orbital surface rather flat, narrowing only in the last third of its length. The horns are three times as long as the skull. The basal and terminal axis of the horns rise parallel with each other; the median axis parallel with the axis of the skull. The neck is covered by a white mane, shaded with greyish-brown. The light brown of the back and sides is separated from the yellowish-white of the belly by a wide dark line. The light brown of the upper parts gets gradually lighter towards the tail, where it becomes greyish-white, but does not form a sharply marked anal disc. On the back there is a sharply marked dark line running from the shoulders to the loins. I did not find any soft hair under the long winter hair in October."

SIZE.—Height at the shoulder, 3 feet 6 inches; length of the horns, from 44 to 45 inches.

The following is a description by Dr. Stoliczka of this animal, which



Horns of *Ovis Karelini*.

he took to be *Ovis Polii*, and described it as such in the 'P. Z. S.' for 1874, page 425. In the same volume is a plate which, however, is shewn by Mr. Blanford ('Sc. Res. Second Yarkand Mission,' p. 83) to be inaccurate:—

"*Male in winter dress.*—General colour above hoary brown, distinctly rufescent or fawn on the upper hind neck and above the shoulders, darker on the loins, with a dark line extending along the ridge of tail to the tip. Head above and at the sides a greyish-brown, darkest on the hind head, where the central hairs are from four to five inches long, while between the shoulders somewhat elongated hairs indicate a short mane. Middle of upper neck hoary white, generally tinged with fawn; sides of body and the upper part of the limbs shading from brown to white, the hair becoming more and more tipped with the latter colour. Face, all the lower parts, limbs, tail, and all the hinder parts, extending well above towards the loins, pure white.

"The hairs on the lower neck are very much lengthened, being from

five to six inches long. Ears hoary brown externally, almost white internally. Pits in front of the eye distinct, of moderate size and depth, and the hair round them generally somewhat darker brown than the rest of sides of the head. The nose is slightly arched and the muzzle sloping. The hair is strong, wiry, and very thickly set, and at the base intermixed with scanty, very fine fleece; the average length of the hairs on the back is 2 to 2½ inches. The iris is brown. The horns are subtriangular, touching each other at the base, curving gradually with a long sweep backwards and outwards; and, after completing a full circle, the compressed points again curve backwards and outwards; their surface is more or less closely transversely ridged.

"The colour of full-grown females does not differ essentially from that of the males, except that the former have much less white on the middle of the upper neck. The snout is sometimes brown, sometimes almost entirely white, the dark eye-pits becoming then particularly conspicuous. The dark ridge along the tail is also scarcely traceable. In size, both sexes of *Ovis Polii* appear to be very nearly equal, but the head of the female is less massive, and the horns, as in allied species, are comparatively small: the length of horn of one of the largest females obtained is 14 inches along the periphery, the distance at the tips being 15 inches, and at the base a little more than one inch. The horns themselves are much compressed; the upper anterior ridge is wanting on them; they curve gradually backwards and outwards towards the tip, though they do not nearly complete even a semicircle. In young males, the horns at first resemble in direction and slight curvature those of the female, but they are always thicker at the base and distinctly triangular.

"The length of the biggest horn of male along the periphery of curve was 56 inches, and the greatest circumference of a horn of a male specimen at the base 18½ inches.

"Mr. Blyth, the original describer of *Ovis Polii*, from its horns, was justified in expecting, from their enormous size, a correspondingly large-bodied animal; but in reality such does not appear to exist. Although the distance between the tips of the horns seems to be generally about equal to the length of the body, and although the horns are very much larger, but not thicker or equally massive, with those of the *Ovis Ammon* of the Himalayas, the body of the latter seems to be comparatively higher. Still it is possible that the *Ovis Polii* of the Pamir may stand higher than the specimens described, which were obtained from the Tian Shan range.

"Large flocks of *Ovis Polii* were observed on the undulating high plateau to the south of the Chadow-Kul, where grass vegetation is abundant. At the time the officers of the Mission visited this ground, i.e. in the beginning of January, it was the rutting season. The

characters of the ground upon the Pamir and upon the part of the Tian Shan inhabited by these wild sheep are exactly similar."

The following remarks on the habits of this species are from Sir Victor Brooke's abstract of Servertzoff's description: "*Ovis Karelini*, like other sheep, does not live exclusively amongst the rocks, as is the case with the different species of *Capra*. It is not satisfied, like the latter, with small tufts of grass growing in the clefts of the rocks, but requires more extensive feeding grounds; it is, therefore, more easily driven from certain districts than is the case with *Capra*. In the neighbourhood of Kopal, for instance, the goats are abundant in the central parts of the steppes of Kara, whilst the sheep have been partially driven from these places, only visiting them in autumn.

"On the southern ranges of the Semiretchinsk Altai, in the vicinity of the river Ili, wherever good meadows and rocky places are found, *Ovis Karelini* occurs at elevations of from 2000 to 3000 feet; at the sources of the rivers Lepsa, Sarkan, Kora, Karatala, and Koksa it goes as high as 10,000, and even to 12,000 feet in the neighbourhood of the Upper Narin. In winter it is found at much lower elevations."

In a paper by Captain H. Trotter, R.E., read before the Royal Geographical Society on the 13th of May, 1878, on the geographical results of the mission to Kashgar under Sir Douglas Forsyth ('Journal R. G. S.' vol. xlviii., 1878, p. 193), I find the following account referring to this sheep, there mentioned under the name of *Ovis Polii*: "For twenty-five miles above Chakmák the road continues gently ascending along the course of the frozen stream, passing through volcanic rocks to Turgat Bela, a little short of which the nature of the country alters, and the precipitous hills are replaced by gently undulating grassy slopes, abounding with the *Ovis Polii*.*

"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 guljar, in one of which Dr. Stoliczka counted no less than eighty-five."

The Chakmák and Turgat Bela spoken of are on the southern slopes of the Thian Shan mountains, which form the boundary between Russia and Eastern Turkestan, separating the provinces of Semiretchinsk and Kashghar. The Turgat pass, about 12,760 feet, lies between the Kashgharian fort of Chakmák and the Russian fort Naryn or Narin. Captain Trotter mentions in a foot-note that these sheep, as well as ibex, abound in these hills in such large quantities that they form the principal food of the garrisons of the outposts. At Chakmák they saw a large shed piled up to the roof with the frozen carcases of these

* *Ovis Heinsi* and *Ovis nigromontana* are doubtful species allied to the foregoing, and are not found within the limits assigned to this work.

animals. (A most valuable map of the country is published in the 'Journal' with this paper.)

The chief difference between this species and *Ovis Polii* consists in the much greater length and divergence of horns of the latter and the longer hair on the neck.

No. 441. OVIS BROOKEI.

Brooke's Wild Sheep.

HABITAT.—Ladakh, or probably the Kuenluen range north of Ladakh.

DESCRIPTION.—This species is founded on a single specimen, which, in the opinion of Mr. Blyth, Mr. Edwin Ward, F.Z.S., Sir Victor Brooke and others, differed materially from all other wild sheep, but, as they had only a head to go upon, further investigation in this direction is

Ovis Brookei.

necessary. It is not even certain where the animal was shot, but it is believed to have been obtained in the vicinity of Leh in Ladakh. It is apparently allied to the *O. Ammon* of Thibet, which Sir Victor and Mr. B. Brooke term in their paper *O. Hodgsonii*, but it differs in its much smaller size, in its deeply sulcated horns, the angles of which are very much rounded, and the terminal curve but slightly developed. It differs also from *O. Vignei* and *O. Karelini*. The orbits project less, with greater width between them, the length of the molar teeth also exceeds the others. There are two wood-cuts of the skull and horns in the 'P. Z. S.' 1874, page 143, illustrating Mr. Edwin Ward's paper on the subject.

The following are the dimensions of the specimen :—

	Inches.
Length of skull	11
Smallest breadth between orbits	$4\frac{5}{8}$
Length of horns, round curve	$33\frac{1}{2}$
Circumference of horns	$13\frac{3}{8}$

No. 442. OVIS VIGNEI.

Vigne's Wild Sheep.

NATIVE NAMES.—*Sha* or *Shapoo.*

HABITAT.—Little Thibet; Ladakh, from 12,000 to 14,000 feet.

DESCRIPTION.—General colour brownish-grey, beneath paler; belly white; a short beard of stiffish brown hair; the horns of the male are sub-triangular, rather compressed laterally and rounded posteriorly, deeply sulcated, curving outward and backward from the skull; points divergent. The female is beardless, with small horns. The male horns run from 25 to 35 inches, but larger have been recorded.

This sheep was for some time, and is still by some, confounded with the oorial (*Ovis cycloceros*), but there are distinct differences, as will be seen further on, when I sum up the evidence. It inhabits the elevated ranges of Ladakh, and is found in Baltistan, where it is called the *oorin*.

No. 443. OVIS CYCLOCEROS.

The Punjab Wild Sheep (Jerdon's No. 236).

NATIVE NAMES.—*Oorial* or *Ooria*, in the Punjab; *Koch* or *Kuch*, in the Suleiman range.

HABITAT.—The Salt range of the Punjab; on the Suleiman range; the Hazarah hills; and the vicinity of Peshawar.

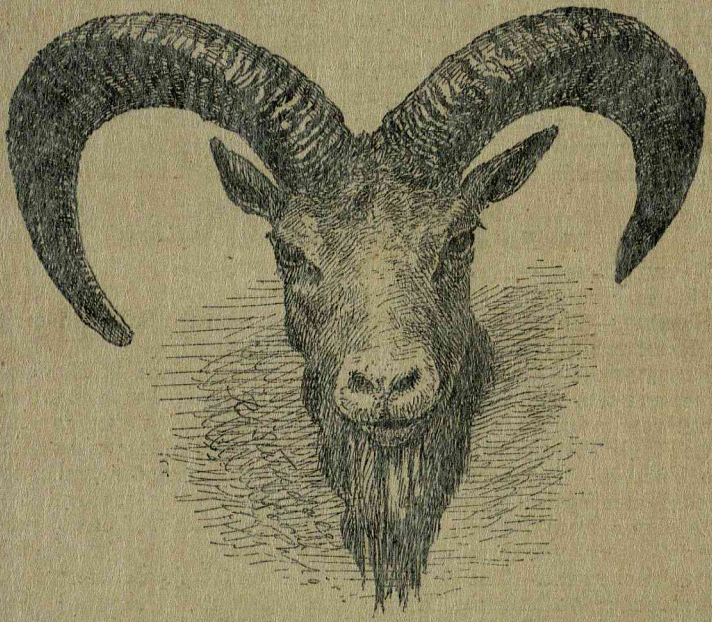
DESCRIPTION.—General colour rufous brown; face livid, side of mouth and chin white; a long thick black beard mixed with white hairs from throat to breast, reaching to the knees; legs below knees and feet white; belly white, a blotch on the flanks; outside of legs and a lateral line blackish. The horns of the male are sub-triangular, much compressed laterally and posteriorly; in fact one may say concave at the sides, that is, from the base of the horn to about one half; transversely sulcated; curving outwards, and returning inward towards the face; points convergent. The female is more uniform pale brown, with whitish belly; no beard, and short straight horns.

SIZE.—About 5 feet in length, and 3 feet high; horns from 25 to 30 inches round the curve.* The marked distinctions between the two species may be thus briefly summed up :—

Ovis Vignei.	*Ovis cycloceros.*
Horn rather compressed laterally.	Much compressed laterally.
Rounded posteriorly.	Much compressed posteriorly.
Curving outward and backward.	Curving outward and inward.
Points divergent.	Points convergent.
General colour, brownish-grey.	General colour, rufous brown, with blotch on flanks and lateral line blackish.
Beard short, of stiffish brown hairs.	Beard profuse, reaching to knees, black intermixed with white hairs.

* See also Appendix C, p. 529.

Dr. Sclater, with reference to the two in his paper on the Punjab Sheep living in the Zoological Society's Garden in 1860 ('P. Z. S.' 1860, page 126), says: "On comparing the skull (of *O. cycloceros*) with that of the shapoo we observe a general resemblance. But it may be noted that the sub-orbital pits in the present species are smaller, deeper, and more rounded; the nasal bones are considerably shorter and more pointed, and the series of molar teeth (formed in each skull of three



Ovis cycloceros.

premolars and three molars) measures only 2·85 instead of 3·20 inches in total length."

There is a fine coloured plate of this animal in that magnificent folio work—Wolf's 'Zoological Sketches,' showing the male, female, and lambs; and in that valuable book of Kinloch's, 'Large Game-shooting in Thibet and the North-west' is a very clear photograph of the oorial's head, from which I give the above sketch. He gives the following account of its habits: "The oorial is found among low stony hills and ravines, which are generally more or less covered with thin jungle, consisting principally of thorny bushes. During the heat of the day the

burial conceal themselves a good deal, retiring to the most secluded places, but often coming down to feed in the evening on the crops surrounding the villages. Where not much disturbed, they will stay all day in the neighbourhood of their feeding grounds, and allow sheep and cattle to feed amongst them without concern; but where they have been much fired at they usually go a long distance before settling themselves for the day. They are generally found on capital ground for stalking, the chief drawback being the stony nature of the hills, which renders it difficult to walk silently. When fired at, oorial usually go leisurely away, stopping to gaze every now and then, so that several shots may often be fired at one herd."

Dr. Leith Adams says regarding it, that it "frequents bleak and barren mountains, composed of low ranges intersected by ravines and dry river courses, where vegetation is scanty at all seasons, and goats and sheep are seldom driven to pasture. It is found in small herds, and, being fond of salt, is generally most abundant in the neighbourhood of salt mines. Shy and watchful, it is difficult to approach, and possesses in an eminent degree the senses of sight and smell. It is seldom seen in the day-time, being secreted among rocks, whence it issues at dusk to feed in the fields and valleys, returning to its retreat at daybreak.

"When suddenly alarmed the males gives a loud shrill whistle, like the ibex. This is an invariable signal for the departure of the herd, which keeps moving all the rest of the day until dusk. Their bleat is like that of the tame species; and the males fight in the same way, but the form of the body and infra-orbital pits simulate the deer, hence it is often called the 'deer-sheep.' It equals the deer in speed and activity. The female gestates seven months. The rutting season is in September."

According to Captain Hutton the flesh is good and well-flavoured, "while the horns are placed as trophies of success and proofs of skill upon tombs and temples."

This sheep has bred in the Gardens of the Zoological Society in London. (*See* notes to *Oorial* in Appendix C.)

No. 444. OVIS BLANFORDII.

Blanford's Wild Sheep.

HABITAT.—Central hills of Khelat.

DESCRIPTION.—The horns of this species are longer and more slender than those of *Ovis Vignei*, *O. cycloceros*, or *O. Gmelini*. Mr. Hume says ('J. A. S. B.' 1877, p. 327): "In all these three species, as far as I can make out, each horn lies in one plane, whereas in the present species the horn twists out in a capital-S fashion. There is, in fact, much the same difference between the horns of the present species and of *O. cycloceros*, that there is between those of *O. Karelini* and *O. Hodgsoni*.

the lower part of the forehead at the nasal suture, and the whole of the frontals, are more raised and convex than in either *O. cycloceros* or *O. Vignei*.

The frontal ridge between the bases of the horns is less developed in *O. Blanfordii*, and in this latter the posterior convex margin of the bony palate is differently shaped, being more pointed, and not nearly semi-circular as in *O. cycloceros*."

The dimensions of the skull are given in detail by Mr. Hume in the paper above quoted, out of which I extract those of the horns :—

	Inches.
Length along curve	35·75
Circumference at base	9·0
Width from tip to tip	16·5
Greatest breadth of horn at base	2·25
Greatest depth of ditto	3·25

The horns of a specimen of *O. cycloceros* of about the same age were 29·5 in length and 10 inches in circumference at base, so that the greater length and slenderness of the horns of *Ovis Blanfordii* are apparent. Mr. Hume writes to me that there is a living specimen of this sheep at present in the London Zoological Gardens.

No. 445. OVIS NAHURA *vel* BURHEL.

The Blue Wild Sheep (*Jerdon's No.* 237).

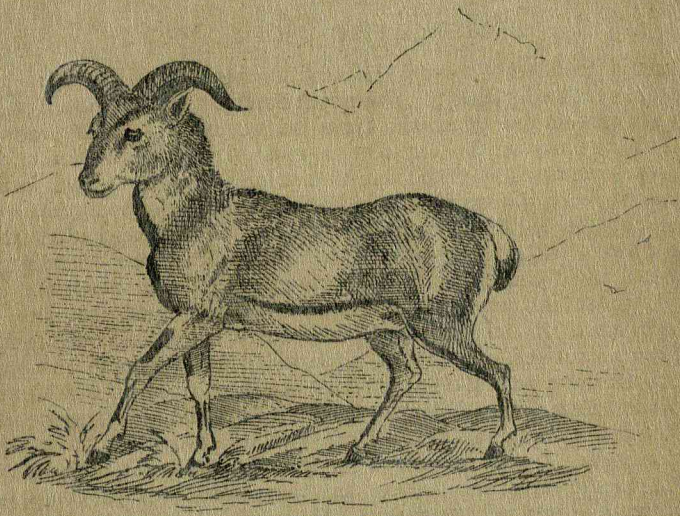
NATIVE NAMES.—*Burhel*, *Buroot*, in the Himalayas; *Napu*, *Na*, or *Sna*, Thibet and Ladakh; *Nervati*, in Nepal. *Wa'* or *War* on the Sutlej.

HABITAT.—This animal has a wide range; it is found from Sikim, and, as Jerdon says, probably Bhotan, right away through Thibet, as Père David found it in Moupin, and it extends up to the Kuenluen mountains north of Ladakh, and in Ladakh itself, and it has been obtained by Prejevalski on the Altyn-Tagh, therefore the limits assigned by Jerdon must be considerably extended.

DESCRIPTION.—General colour a dull slaty blue, slightly tinged with fawn; the belly, edge of buttocks, and tail, white; throat, chest, front of fore-arm and cannon bone, a line along the flank dividing the darker tint from the belly; the edge of the hind limbs and the tip of the tail deep black; horns moderately smooth, with few wrinkles, rounded, nearly touching at the base, directed upwards, backwards and outwards, the points being turned forwards and inwards. The female is smaller, the black marks smaller and of less extent; small, straight, slightly recurved horns; nose straighter. The young are darker and browner.

SIZE.—Length of head and body, 4½ to 5 feet; height, 30 to 36 inches; tail, 7 inches; horns, 2 to 2½ feet round the curve; circumference at base, 12 to 13 inches.

An excellent coloured plate is to be found in Blanford's 'Scientific Results of the Second Yarkand Mission' and a life-like photograph of the head in Kinloch's 'Large Game-shooting.' According to the latter author the burrel prefers bare rocky hills, and when inhabiting those which are clothed with forest, rarely or never descends to the limits of the trees. "The favourite resorts of burrel are those hills which have slopes well covered with grass in the immediate vicinity of steep precipices, to which they can at once betake themselves in case of alarm. Females and young ones frequently wander to more rounded and accessible hills, but I have never met with old males very far from some rocky stronghold. The males and females do not appear to



Ovis nahura.

separate entirely during the summer, as I have found mixed flocks at all seasons, though, as a rule, the old males form themselves into small herds and live apart. In my opinion the flesh of the burrel surpasses in flavour the best mutton, and has moreover the advantage of being generally tender soon after the animal is killed."

According to Jerdon the burrel is fattest in September and October. In the 'Indian Sporting Review' a writer, "Mountaineer," states that in winter, when they get snowed in, they actually browse the hair off each other, and come out miserably thin.

The name *Ovis nahura* is not a felicitous one, as it was given under a mistake by Hodgson, the nahoor being quite another animal. I think

Blyth's name of *Ovis burhel* should be adopted to the exclusion of the other, which, however, is in general use.

There is a very interesting paper on this animal by Mr. R. Lydekker in the 'Journal of the Asiatic Society of Bengal,' vol. xlix., 1880, in which he points out its affinity to the goats from the absence of eye-pits and their larminal depression in the lachrymal bone—from the similarity of the basi-occipital and in the structure and colour of its horns. On the other hand it agrees with *Ovis* in the form of its lower jaw, in the absence of beard and any odour, and in the possession of interdigital pores in all feet.

GENUS CAPRA—THE GOATS.

Horns in both sexes curving backwards, angular and flattened, or in some cases twisted spirally. The nose is arched, and the chin of both sexes is more or less bearded; there are no eye-pits or inguinal pits, and feet-pits only in the fore-feet in most, and none in some. Mr. Blyth some years ago pointed out that a hind-quarter of goat with the foot attached can always be told from the same piece of mutton by the absence of the feet-pits in the goat. The males especially emit a strong odour. In other respects there is little difference between goats and sheep, and by interbreeding they produce a fertile offspring. Our domestic goat is supposed to have descended from the ibex, but certainly some of our Indian varieties may claim descent from the markhor. I noticed in 1880 at Simla herds of goats with horns quite of the markhor type, and one old fellow in a herd of about one hundred, which was being driven through the station to some rajah's place in the vicinity, had a remarkably fine head, with the broad flat twist of the markhor horn. I tried in vain to get a similar one; several heads were brought to me from the bazaar, but they were poor in comparison. Goats are more prolific than sheep. The power of gestation commences at the early age of seven months; the period is five months, and the female produces sometimes twice a year, and from two to occasionally four at a birth. The goat is a hardy animal, subsisting on the coarsest herbage, but its flesh and milk can be immensely improved by a selected diet. Some of the small domestic goats of Bengal are wonderful milkers. I have kept them for years in Calcutta for the use of my children, and once took two of them with me to Marseilles by the 'Messageries' Steamers. I prefer them to the larger goats of the North-west. My children have been singularly free from ailments during their infancy, and I attribute the immunity chiefly to the use of goats' milk drawn fresh as required. Of the wild goats, to which I must now confine my attention, there are two groups, viz. the true

goats and the antelope goats. Of the former there is a sub-genus—*Hemitragus*—which have no feet-pits, but have a muffle and occasionally four mammæ, which form a connecting link with the *Cervidæ*. In all other respects *Hemitragus* is distinctly caprine.

No. 446. CAPRA MEGACEROS.

The Markhor (Jerdon's No. 234).

NATIVE NAMES.—*Mar-khor* (i.e. snake-eater), in Afghanistan, Kashmir, &c.; *Rá-che*, or *Ra-pho-che*, Ladakhi.

HABITAT.—The mountain districts of Afghanistan, and the highest parts of the Thibetan Himalayas. On the Pir Panjal, in Kashmir, the Hazarah hills, the hills north of the Jhelum, the Wurdwan hills west of the Beas river, on the Suleiman range, and in Ladakh.

DESCRIPTION.—General colour a dirty light-blue gray, with a darker beard; in summer with a reddish tinge; the neck and breast clad with long dark hair, reaching to the knees; hair long and shaggy; fore-legs brown. The females are redder, with shorter hair, short black beard, but no mane, and with small horns slightly twisted.

The horns of an old male are a magnificent trophy. Kinloch records having seen a pair, of which the unbroken horn measured sixty-three inches, and its fellow, which had got damaged, had fifty-seven inches left. Forty to fifty inches is, however, a fair average. According to Kinloch the very long horns are not so thick and massive as those of average length. Jerdon says the longest horns have three complete spiral twists.

The horns of certain varieties differ so much that I may say species have been settled with less to go upon. Kinloch notes four varieties. I have hitherto reckoned only two, but he gives—

No. 1.—Pir Panjal markhor; heavy, flat horns, twisted like a corkscrew.

No. 2.—Trans-Indus markhor; perfectly straight horns, with a spiral flange or ridge running up them.

No. 3.—Hazarah markhor; a slight corkscrew, as well as a twist.

No. 4.—Astor and Baltistan markhor; large, flat horns, branching out very widely, and then going up nearly straight with only a half turn.

Of the two kinds I have seen, the one has the broad flat horn twisted like a corkscrew; the other a perfectly straight core, with the worm of a screw turned round it. Nothing could be more dissimilar than these horns, yet, in other respects the animal being the same, it has not been considered necessary to separate the two as distinct species.*

* Colonel Kinloch writes on my remarks as above, and gives the following interesting information: "I cannot consider the spiral-horned and the straight-

SIZE.—Height, about 46 inches.

There is a life-like photograph of No. 1 variety in Kinloch's 'Large Game of Thibet,' and of No. 3 a very fine coloured plate in Wolf's folio of 'Zoological Sketches.'

Capra megaceros. No. 1 variety.

The markhor frequents steep and rocky ground above the forests in summer, but descending in the winter. I cannot do better than quote

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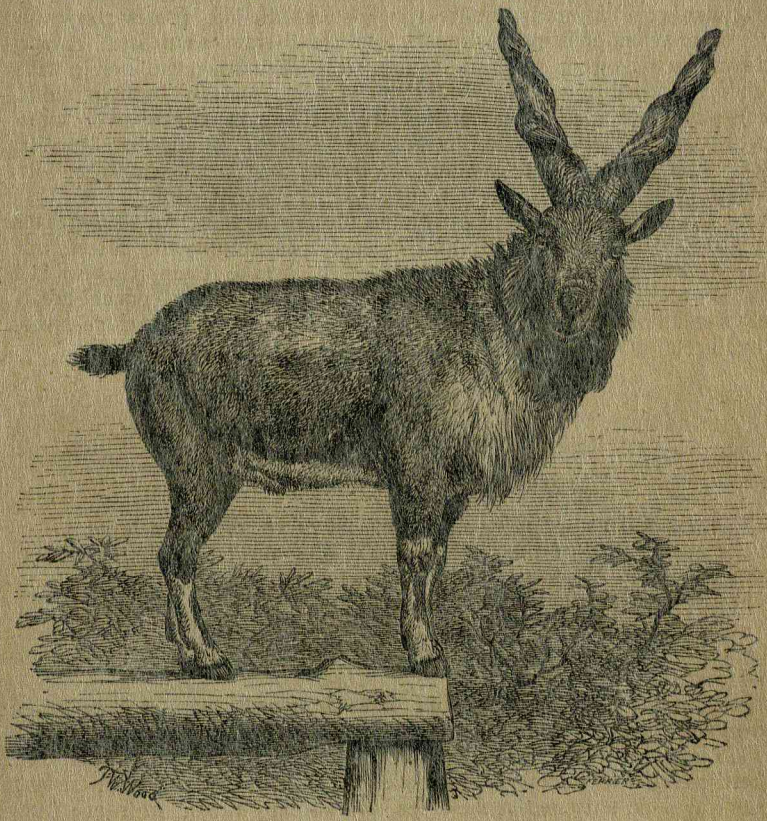
horned markhor to be one species, any more than the Himalayan and Sindh ibex. The animals differ much in size, habits, and coat, as well as in the shape of their horns. Mr. Sterndale considers that the markhor is probably the origin of some of our breeds of domestic goats, and states that he has seen tame goats with horns

Kinloch, who gives the following graphic little description: "The markhor inhabits the most precipitous and difficult ground, where nearly perpendicular faces of rock alternate with steep grassy slopes and



Capra megaceros. No. 2 variety.

patches of forest. It is very shy and secluded in its habits, remaining concealed in the densest thickets during the day-time, and only coming

quite of the markhor type. Has he ever observed that (as far as my experience goes) the horns of domestic goats invariably twist the *reverse way* to those of markhor? I have observed that the horns of not only markhor, but also antelope, always twist one way; those of domestic goats the other."

to feed in the mornings and evenings. No animal's pursuit leads the sportsman over such dangerous ground as that of the markhor. Living so much in the forest, it must be followed over steep inclines of short grass, which the melting snow has left with all the blades flattened downwards; and amid pine-trees, whose needle-like spines strew the ground and render it more slippery and treacherous than ice. If one falls on such ground, one instantly begins to slide down the incline with rapidly increasing velocity, and, unless some friendly bush or stone arrests one's progress, the chances are that one is carried over some precipice, and either killed or severely injured. Many hair-breadth escapes occur, and the only wonder is that fatal accidents so seldom happen.

"Early in the season the males and females may be found together on the open grassy patches and clear slopes among the forest, but during the summer the females generally betake themselves to the highest rocky ridges above the forest, while the males conceal themselves still more constantly in the jungle, very rarely showing themselves. They are always very wary, and require great care in stalking them."

No. 447. CAPRA SIBIRICA.

The Himalayan Ibex (Jerdon's No. 235).

NATIVE NAMES.—*Sakin*, *Iskin*, or *Skeen* of the Himalayas; *Buz*, in the upper part of the Sutlej; *Kale*, Kashmiri; *Tangrol*, in Kulu; *Skin*, the male, *L'Damuo* the female, in Ladakh.

HABITAT.—Throughout the Himalayas from Kashmir to Nepal. The localities given by Kinloch are Kunawar, Kulu, Lahoul, Spiti, Kashmir, Baltistan, and various parts of Thibet; also Ladakh according to Horsfield.

DESCRIPTION.—General colour light brownish, with a dark stripe down the back in summer, dirty yellowish-white in winter; the beard, which is about six to eight inches long, is black; the horns, which are like those of the European ibex, are long and scimitar-shaped, curving over the neck, flattened at the sides, and strongly ridged in front; from forty to fifty inches in length. A pair is recorded in the 'Proceedings of the Zoological Society' for 1840 of fifty-one inches in length. The females have thin slightly curved horns about a foot long.

Under the hair, which is about two inches long, is a soft down, and is highly prized for the fine soft cloth called *tusi*.

SIZE.—Height at shoulder, about 44 inches.

According to Colonel Markham the ibex "frequents the highest ground near the snows where food is to be obtained. The sexes live

apart generally, often in flocks of one hundred and more. In October the males descend and mix with the females, which have generally twins in June and July. It is an extremely wary and timid animal, and can make its way in an almost miraculous manner over the most

Capra Sibirica.

inaccessible-looking ground. No animal can exceed the ibex in endurance and agility."

Kinloch writes as follows concerning it :—

"The ibex inhabits the most precipitous ground in the highest parts

of the ranges where it is found, keeping above the forest (when there is any), unless driven down by severe weather. In the day-time it generally betakes itself to the most inaccessible crags, where it may sleep and rest in undisturbed security, merely coming down to the grassy feeding grounds in the mornings and evenings. Occasionally, in very remote and secluded places, the ibex will stay all day on their feeding grounds, but this is not common. In summer, as the snows melt, the old males retire to the highest and most unfrequented mountains, and it is then generally useless to hunt for them, as they have such a vast range, and can find food in places perfectly inaccessible to man. The females and young ones may be met with all the year round, and often at no very great elevation.

"Although an excessively wary animal, the ibex is usually found on such broken ground that, if due care be taken, it is not very difficult to obtain a shot. The grand rule, as in all other hill stalking, is to keep well above the herd, whose vigilance is chiefly directed beneath them. In places where they have been much disturbed, one or two of the herd usually keep a sharp look-out while the rest are feeding, and on the slightest suspicion of danger the sentries utter a loud whistle, which is a signal for a general rush to the nearest rocks. Should the sportsman succeed in obtaining a shot before he is observed by the ibex, he may often have time to fire several shots before they are out of range, as they appear to be completely stupefied and confused by the sudden noise, the cause of which they are unable to account for if they neither see nor smell their enemy."

Jerdon states that Major Strutt killed in the Balti valley an ibex of a rich hair-brown colour, with a yellowish-white saddle in the middle of its back, and a dark mesial line; the head, neck and limbs being of a dark sepia brown, with a darker line on the front of the legs; others were seen in the same locality by Major Strutt of a still darker colour. These seem to be peculiar to Balti; the horns are the same as the others. Kinloch remarks that a nearly black male ibex has been shot to the north of Iskardo.

No. 448. CAPRA ÆGAGRUS.

The Wild Goat of Asia Minor.

NATIVE NAMES.—*Pasang* (male), *Boz* (female), generally *Boz-Pasang*, Persian (*Blanford*); *Kayeck* in Asia Minor (*Danford*).

HABITAT.—Throughout Asia Minor from the Taurus mountains; through Persia into Sindh and Baluchistan; and in Afghanistan. M. Pierre de Tchihatchef, late a distinguished member of the Russian Diplomatic Service, and well known as an author and a man of science, whose acquaintance I had the pleasure of making some time ago in

Florence, found these goats most abundant on the Aladagh, Boulgerdagh and Hussandagh ranges of the Taurus. He made a very good collection of horns and skulls there, which are now in the Imperial Museum, St. Petersburg. Captain Hutton found it in Afghanistan.

DESCRIPTION.—Hair short and brown, becoming lighter in summer; a dark, almost black line down the back; the males have a black beard; the young and females are lighter, with fainter markings; the horns are of the usual ibex type, but there is a striking difference between those of this species and all the others. As a rule the ibex horn is triangular in section, that is, the front part of the horn is square, with transverse knobs at short intervals all the way up, for about three-fourths of the length, whereas the horn of *C. ægagrus* is more scimitar-like, flattish on the inner side and rounded on the outer, with an edge in front; the sides are wavily corrugated, and on the outer edge are knobs at considerable distances apart. It is believed that an estimate of the age of the animal can be made by these protuberances—after the third year a fresh knob is made in each succeeding one. Mr. Danford says: "The yearly growths seem to be greatest from the third to the sixth year, the subsequent additions being successively smaller." The horns sometimes curve inwards and sometimes outwards at the tips. Mr. Danford figures a pair, the tips of which, turning inwards, cross each other. The female horns are shorter and less characteristic. The size of the male horns run to probably a maximum of 50 inches. There is a pair in the British Museum 48½ inches on the curve. Mr. Danford's best specimen was 47½, the chord of which was 22½, basal circumference 9¾, weight 10¼ lbs. Captain Hutton's living specimen had horns 40½ inches in length.

SIZE.—According to Herr Kotschy "it attains not unfrequently a length of 6½ feet." Mr. Danford measured one 5 feet 5½ inches from nose to tip of tail, 2 feet 9½ inches at shoulder. (See also p. 529)

I have not had an opportunity of measuring a very well-stuffed specimen in the Indian Museum, but I should say that the Sind variety was much smaller. Standing, as it does, beside a specimen of *Capra Sibirica*, it looks not much bigger than some of the Jumnapari goats. (See Appendix C, p. 529.)

The *ægagrus* is commonly supposed to be the parent stock from which the domestic goat descended, and certainly the European and many Asiatic forms show a similarity of construction in the horn, but the common goat descended from more than one wild stock, for, as I have before stated, there are goats in India, which show unmistakable signs of descent from the markhor, *Capra megaceros*. In the article on *Capra ægagrus* in the 'P. Z. S.' for 1875, p. 458, by Mr. C. G. Danford, F.Z.S., written after a recent visit to Asia Minor, it is stated that the late Captain Hutton found it common in Afghanistan, in the Suleiman

and Pishin hills, and in the Hazarah and western ranges. I confess I had thought the ibex of these parts to be identical with *C. Sibirica*. Mr. Danford, describing where he met with it, says :—

"The picturesque town of Adalia is situated at the head of the gulf of the same name, and is the principal place in the once populous district of Pamphylia. It is surrounded on its landward side by a wide brushwood-covered plain, bounded on the north and north-east by the Gok and other mountains of the Taurus, and on the west by the Suleiman, a lofty spur of the same range, in which latter the present specimens were collected.

"These mountains, the principal summit of which, the Akdagh (white mountain), attains a height of 10,000 feet (*Hoskyn*), rise abruptly from the plain and sea, and are of very imposing and rugged forms. The pure grey tints of the marble and marble-limestone, of which they are principally composed, show beautifully between the snowy summits, and the bright green of the pines and darker shades of the undergrowth of oak, myrtle and bay, which clothe their lower slopes.

"The wild goat is here found either solitary or in small parties and herds, which number sometimes as many as 100; the largest which I saw contained 28. It is called by the natives *kayeek*, which word, though applied in other parts of the country to the stag, and sometimes even the roe, is here only used to designate the *ægagrus*, the fallow deer of this district being properly known as *jamoorcha*. The old males of the *ægagrus* inhabit during summer the higher mountains, being often met with on the snow, while the females and young frequent the lower and easier ridges; in winter, however, they all seem to live pretty much together among the rocks, scattered pines, and bushy ground, generally preferring elevations of from 2000 to 5000 feet. Herr Kotschy says they never descend below 4000 feet in Cilicia; but his observations were made in summer.

"Like all the ibex tribe, the *ægagrus* is extremely shy and wary at ordinary times, though, as in the case with many other animals, they may be easily approached during the rutting season. I was told that they were often brought within shot at that time by the hunter secreting himself, and rolling a few small stones down the rocks. When suddenly disturbed they utter a short angry snort, and make off at a canter rather than a gallop. Though their agility among the rocks is marvellous, they do not, according to Mr. Hutton ('Calcutta Journ.' vii. p. 524), possess sufficient speed to enable them to escape from the dogs which are employed to hunt them in the low lands of Afghanistan. It is interesting to see how, when danger is dreaded, the party is always led by the oldest male, who advances with great caution, and carefully surveys the suspected ground before the others are allowed to follow; their food consists principally of mountain grasses, shoots of different small species

oak and cedar, and various berries. The young are dropped in May, and are one or two (Kotschy says sometimes three) in number. The horns appear very early, as shown in a kid of the year procured in the beginning of January."

It appears to be very much troubled with ticks, and an *œstrus* or bot which deposits its larvæ in the frontal sinuses and cavities of the horns.

SUB-GENUS HEMITRAGUS.

Some naturalists do not separate this from *Capra*, but the majority do on the following characteristics, viz. that they possess a small muffle, and one of the two species has four mammæ. The horns are trigonal, laterally compressed and knotted on the upper edge.

No. 449. CAPRA *vel* HEMITRAGUS JEMLAICUS.

The Tahr (Jerdon's No 232).

NATIVE NAMES.—*Tehr, Jehr*, near Simla; *Jharal*, in Nepal; *Kras* and *Jagla*, in Kashmir; *Kart*, in Kulu; *Jhula* the male, and *Thar* or *Tharni* the female, in Kunawur; *Esbu* and *Esbi*, male and female, on the Sutlej above Chini (*Jerdon*).

HABITAT.—Throughout the entire range of the Himalayas, at high elevations between the forest and snow limits. According to Dr. Leith Adams it is very common on the Pir Panjal, and more so near Kishtwar.

DESCRIPTION.—The male is of various shades of brown, varying in tint from dark to yellowish, the front part and mane being ashy with a bluish tinge, the upper part of the limbs rusty brown, the fronts of legs and belly being darker. There is no beard, the face being smooth and dark ashy, but on the fore-quarters and neck the hair lengthens into a magnificent mane, which sometimes reaches to the knees. There is a dark mesial line; the tail is short and nude underneath; the horns are triangular, the sharp edge being to the front; they are about ten or eleven inches in circumference at the base where they touch, then, sweeping like a demi-crescent backwards, they taper to a fine point in a length of about 12 to 14 inches. The male has at times a very strong odour. The female is smaller, and of a reddish-brown or fulvous drab above, with a dark streak down the back, whitish below; the horns are also much smaller.

SIZE.—Length of head and body, about 4½ feet. Height, 36 to 40 inches.

Col. Kinloch, whose two volumes are most valuable, both as

regards interesting details and perfect illustrations, speaks thus of this species:—

"The tahr is a fine-looking beast, although his horns are small, and he cannot compare with his majestic relatives, the ibex and the markhor. The male tahr is about the same size as the ibex, but rather more heavily made. The general colour is a reddish-brown, deepening into a much darker tint on the hind-quarters, but individuals vary a good deal, and I have shot one which was of a yellowish-white. The face is covered with smooth short hair, and is nearly black; the hair of the body is long and coarse, attaining its greatest length on the neck, chest and shoulders, where it forms a fine flowing mane reaching below the animal's knees. The horns are curious, being triangular, with the sharp edge to the front; they are very thick at the base, and taper rapidly to a fine point, curving right back on to the neck. The largest horns attain a length of about 14 inches, and are 10 or 11 inches in circumference at the base.

Hemitragus Jemlaicus.

"The female tahr is very much smaller than the male; the hair is short, and the horns diminutive. The colour is a lightish red, with a dark stripe down the back.

"The tahr is like the markhor, a forest-loving animal, and, 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 be frequently 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 ringall 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. Tahr ground indeed is about the worst walking I know, almost rivalling markhor ground; the only advantage being that, bad as it is, there are generally some bushes or grass to hold on to.

Owing to the ground it inhabits being so covered with jungle, the pursuit of the tahr is attended with a great deal of labour and uncertainty. Forcing one's way for hours through tangled bushes is very fatiguing, and, as it is impossible to do so without noise, chances are often lost which would be easy enough if the ground was more open. Frequently, although the tracks show that old tahr must be near, and in spite of the utmost care and caution, the first intimation one has of the presence of the game is a rush through the bushes, a clatter of falling stones, and perhaps a glimpse of the shaggy hind-quarters of the last of the herd as he vanishes over some precipice where it is perfectly impossible to follow him.

"Early in the spring, when grass and leaves are scarce, and again in the rutting season, are the best times for tahr shooting, as the old males then come out on open slopes.

"The tahr is very tenacious of life, and, even when mortally wounded, he will frequently make his escape into utterly impracticable ground. In autumn the tahr becomes immensely fat and heavy, and his flesh is then in high favour with the natives, the rank flavour suiting their not very delicate palates. An Englishman would rather not be within one hundred yards to leeward of him, the perfume being equal to treble-distilled 'bouquet de bouc.' Ibex is bad enough, but tahr is 'a caution.' The flesh of the female is, however, excellent."

Colonel Markham says: "Seen at a distance it looks like a great wild hog, but when near it is a noble beast." According to Hodgson, it has interbred with a female spotted deer, and the offspring, which more resembled the mother, grew up a fine animal. There is a beautifully clear photograph in Kinloch's 'Large Game of Thibet,' and a large coloured plate in Wolf's 'Zoological Sketches.'

No. 450. CAPRA *vel* HEMITRAGUS HYLOCRIUS.

The Nailgherry Wild Goat, or Ibex of Madras Sportsmen
(*Jerdon's No.* 233).

NATIVE NAMES.—*Warra-adu* or *Warri-atu*, Tamil.

HABITAT.—The Western Ghâts, southerly towards Cape Comorin.

DESCRIPTION.—According to Jerdon, "the adult male, dark sepia brown, with a pale reddish-brown saddle, more or less marked, and paler brown on the sides and beneath; legs somewhat grizzled with white, dark brown in front, and paler posteriorly; the head is dark, grizzled with yellowish-brown, and the eye is surrounded by a pale fawn-coloured spot; horns short, much curved, nearly in contact at the base, gradually diverging, strongly keeled internally, round externally, with numerous close rings not so prominent as in the last species. There is a large callous spot on the knees surrounded by a fringe of

hair, and the male has a short stiff mane on the neck and withers. The hair is short, thick, and coarse."

Colonel Douglas Hamilton, writing to the late Brigadier-General McMaster, says: "I think Jerdon's description is good, but I should call the saddles of the old males grizzled with white, and not pale reddish-brown. A real old 'saddle-back' has a white saddle and amost jet-black points. He makes a mistake about the length of the tail, 6 or 7 inches; it is not more than 3 inches."

SIZE.—Height at shoulder, 41 to 42 inches. Jerdon gives 32 to 34, but he appears to have under-estimated the animal, unless it be a misprint for 42 and 44; although he questions Colonel W. Campbell's measurements of length and height, the former of which does seem excessive (6 feet 5 inches, including tail, probably taken from a skin), but the latter, 42 inches, is corroborated by Colonel Hamilton and several others.

The size of the horns is given by Jerdon as occasionally 15 inches, rarely more than 12. Colonel Douglas Hamilton says, 9 inches in circumference and 15 to 15½ or 15¾ in length is the average of a large horn. General McMaster writes, referring to the latter opinion: "Both he and I know of one 16 inches in length, shot by a well-known South Indian sportsman of the Madras Civil Service, and in February 1869 at Ootacamund, he and I measured the horn of a magnificent buck ibex, shot within 15 or 20 miles of that place. The exact measurements of this mighty horn were 17 inches in length, and 9¾ in circumference at the base."

Jerdon states that this goat chiefly frequents the northern and western slopes of the Neilgherries, where the hills run down in a succession of steep stony slopes or rocky ridges to the high table-land of Mysore and the Wynaad, both of which districts are themselves hilly. It is occasionally seen on the summit of the northern and western faces, but more generally some distance down, at an elevation of 4000 to 6000 feet, and, if carefully looked for, the herd may be seen feeding on an open grassy glade at the foot of some precipice. "I have," he adds, "seen above twenty individuals in a flock occasionally, but more generally not more than six or seven. With the large herds there is almost always one very large old male conspicuous by his nearly black colour."

Colonel D. Hamilton says he has seen 120 pass out of one valley, which he thinks were probably the aggregate of several herds, but he has counted sixty and sixty-five in a herd, and thirty-five in another, without a single adult buck amongst them. In the *South of India Observer* for the 3rd and 17th of September, 1868, will be found most interesting descriptions of ibex-shooting by "Hawkeye" whose letters are largely quoted by McMaster; but I can only find space for one extract here, interesting to both sportsman and naturalist:—

"It is a pleasant sight to watch a herd of ibex, when undisturbed, the kids frisking here and there on pinnacles or ledges of rocks and beetling cliffs, where there seems scarcely safe foothold for anything much larger than the grasshopper or a fly; the old mother looking calmly on or grazing steadily while the day is young, cropping the soft moss or tender herbs and sweet short grass springing from the crevices of the craggy precipices in rich abundance. Then, again, to see the caution observed in taking up their resting or abiding places for the day, where they may be warmed by the sun, listening to the roar of many waters, and figuratively, we may say, chewing the cud of contentment, and giving themselves up to the full enjoyment of their nomadic life and its romantic haunts. Usually before reposing one of the herd, generally an old doe, may be observed intently gazing below, apparently scanning every spot in the range of her vision, sometimes for half an hour or more before she is satisfied that 'all is well;' strange to say, seldom or ever looking up to the rocks above. Then, being satisfied on the one side, she observes the same process on the other, eventually calmly lying down, contented with the precautions she has taken that all is safe. Her post as sentinel is generally a prominent one, on the edge and corner perhaps of some ledge, to be well sheltered from the wind and warmed by the sun, along which the rest of the herd dispose themselves as inclined, fully trusting in the watchful guardian, whose manœuvres I have been describing. Should the sentinel be joined by another, or her kid come and lie down by her, they invariably place themselves back to back, or in such a manner that they can keep a look-out on either side. A solitary male goes through all this by himself, and wonderfully careful he is, but when with the herd he reposes in security, leaving it to the females to take precautions for their mutual safety. I have stated that these animals seldom look above them, except when any cause of alarm leads them to do so. I recollect an instance which I will relate, partly to show the advantage of a good colour for a stalker's dress, and to illustrate what I have mentioned above. I had disturbed a buck ibex accidentally one morning, and, after watching him a long distance with the glass, observed him to take up a position and commence the vigilant process previously mentioned. By this I knew he was preparing to lie down. He was a long time about it, but eventually he was satisfied, and took up his post on a prominent rock, from which, as lying with his back to the mountain, he held a clear view in front and on both sides. I approached from above, the wind all right, and the ibex reposing comfortably in fancied security. I had to pass a large rock to clear an intervening impediment, and gain a full view of the buck, as I could at first only see his horns. I had taken the precaution to remove my shoes, the grass being very dry and noisy. The crunching of the dry grass as I moved attracted the notice of the ibex, and suddenly he

looked back and up towards me. He was not more than eighty or ninety yards below. I leaned against the rock, my shikar dress blending with the dark grey of the stone and burnt-up grass so completely as to deceive even my lynx-eyed prey. Long, long he looked, till my very knees trembled with anxiety. At last he turned his head, but I knew better than to move, being sure he would have another look. He did so and it proved to be his last, for, when he again turned his head away, I quietly subsided, and in another moment the buck died on his rocky bed."

There is an illustration by Wolf of the animal in Colonel Walter Campbell's 'My Indian Journal.'

The female has only two mammæ, and usually produces two young at a time.

THE GOAT ANTELOPES, OR CAPRICORNS.

These animals form the link between the goats and the antelopes; their general characteristics are short, conical horns, ringed at the base, upright and curving backwards, and of nearly equal size in both sexes. The body is heavier than is usual amongst antelopes; the feet are large, and have false hoofs.

GENUS NEMORHŒDUS.

"Horns in both sexes round, black and ringed; a small muffle; eye-pits wanting or small; large feet-pits in all feet; no inguinal pits nor calcic tufts; tails short, hairy; four mammæ" (*Jerdon*).

No. 451. NEMORHŒDUS BUBALINA.

The Serow, or Forest Goat (*Jerdon's No.* 230).

NATIVE NAMES.—*Serow*, or *Serowa*, Pahari; *Eimu*, on the Sutlej; *Ramu*, *Halj*, *Salabhir*, Kashmiri; *Nga*, Leesaws of the Sanda valley; *Paypa*, of the Shans; *Shanli*, Chinese of the Burmo-Chinese frontier.

HABITAT.—The whole of the wooded ranges of the Himalayas from Kashmir down past Sikim on to the ranges dividing China from Burmah.

DESCRIPTION.—I have before me several descriptions of this animal, of which I have little personal knowledge. The best of all is that of Colonel Kinloch, which has been, to some extent, quoted by Professor Garrod in Cassell's Natural History. I give it *in extenso*:—

"The serow is an ungainly-looking animal, combining the characteristics of the cow, the donkey, the pig, and the goat! It is a large and

powerful beast, considerably larger than a tahr, and longer in the leg. The body is covered with very coarse hair, which assumes the form of a bristly mane on the neck and shoulders, and gives the beast a ferocious appearance, which does not belie its disposition. The colour is a dull black on the back, bright red on the sides, and white underneath, the legs also being dirty white. The ears are very large, the muzzle is coarse, and two singular circular orifices are situated two or three inches below the eyes. The horns are stout at the base, are ringed nearly to the tips, and curve back close to the neck, growing to the length of from nine to fourteen inches; they are very sharp-pointed, and the serow is said to be able to make good use of them.

"The sexes vary very little, less than in any ruminating animal with which I am acquainted; both are furnished with horns of nearly the same size, those of an old male being rather thicker than those of the female.

"The serow 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 hill-sides, and its favourite resting-places are in caves, under the shelter of overhanging rocks, or at the foot of shady trees. It constantly repairs to the same spots, as testified to by the large heaps of its droppings which are to be found in the localities above alluded to. Although very shy and difficult to find, the serow is a fierce and dangerous brute when wounded and brought to bay. I have even heard of an unwounded male charging when his mate had been shot.

Nemorhœdus bubalina.

"It is said that the serow will sometimes beat off a pack of wild dogs, and I believe that serow and dogs have been found lying dead together. It is therefore advisable to be cautious when approaching a wounded one.

"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."

Colonel Markham says of it that it is something in appearance between a jackass and a *thar*, with long stout legs, and a strong neck. Jerdon's description is not clear; it is: "above black, more or less grizzled and mixed on the flanks with deep clay colour; a black dorsal stripe; forearms and thighs anteriorly reddish brown; the rest of the limbs hoary; beneath whitish." The deep clay colour is indefinite, as there are many sorts of clay, and people's ideas may differ as to the shade by the particular clay to which they are most accustomed. Dr. Anderson found it in the Western provinces of Yunnan; and General McMaster, in his 'Notes' (page 143), says that when he was quartered at Shuaygheen, on the Sitang river, in Burmah, a female of this species was brought alive to Major Berdmore by some Burmans, who had caught it in the river, by which it had probably been washed down from the Karanee mountains. He adds that even in its exhausted and dying state it was exceedingly savage, butting at every one who approached it.

SIZE.—Height, about 3 feet, or an inch or two over; length, about 5 to 5½ feet; weight, about 200 lbs.; horns, about a foot long as an average, varying from 9 to 14 inches.

The female usually produces one kid in the autumn, about September or October, and the period of gestation is about seven months.

No. 452. NEMORHŒDUS RUBIDA *vel* SUMATRENSIS.

The Arakanese Capricorn.

NATIVE NAME.—*Tan-Kseik*, Arakanese.

HABITAT.—Arakan, through Pegu to (according to Blyth) the extremity of the Malayan peninsula, and occurs in Siam and Formosa, and also in Sumatra. Has been shot near Shillong in Assam.

DESCRIPTION.—Blyth is of opinion ('Cat. Mam. British Burmah,' 'J. A. S. B.' 1875) that his *N. rubida* is identical with *Sumatrensis* and *Swinhoei*, and he could detect no difference in their skulls and skins. I therefore take the following description of *Capricornis Swinhoei* from the 'P. Z. S.' 1862, page 263, where it is also figured, plate xxxv.:—

"The fur harsh and crisp, brown, with a narrow streak down the back of the neck; a spot on the knee and the front of the fore-legs below the knee black; the hind-legs are bay; the sides of the chin pale yellowish; the under-side of the neck yellow bay, this colour being separated from the darker colour of the upper part of the neck by a ridge of longer, more rigid hairs; the ears are long, brown, paler internally; the horns are short and conical; the skull has a deep and wide concavity in front of the orbits, and a keeled ridge on the cheek."

Blyth says: "This species varies much in colour from red to black,

and the black sometimes with a white nape, or the hairs of the nape may be white at the base only." Lieut. Bevan described one ('P. Z. S.' 1866) shot on the Zwagaben mountain, near Moulmein, as being of a mingled black and ferruginous colour.

No. 453. NEMORHŒDUS EDWARDSII.

The Thibetan Capricorn.

HABITAT.—Thibet.

DESCRIPTION.—This differs from the Indian *N. bubalina* by the uniform blackish brown of the upper parts tending to ferruginous on the thighs, and the red colour in place of the grey on the lower parts of the legs.

It was discovered by the Abbé David, who named it after the well-known Professor A. Milne-Edwards.

No. 454. NEMORHŒDUS GORAL.

The Small Himalayan Capricorn (*Jerdon's No.* 231).

NATIVE NAMES.—*Goral*, Pahari; *Pijur*, Kashmiri (*Jerdon*); *Rein* or *Rom*, Kashmiri (*Kinloch*); *Sah* or *Sarr*, in the Sutlej valley; *Suh-ging*, Lepcha; *Ra-giyu*, Bhotia.

HABITAT.—The whole range of the Himalayas from Bhotan to Kashmir.

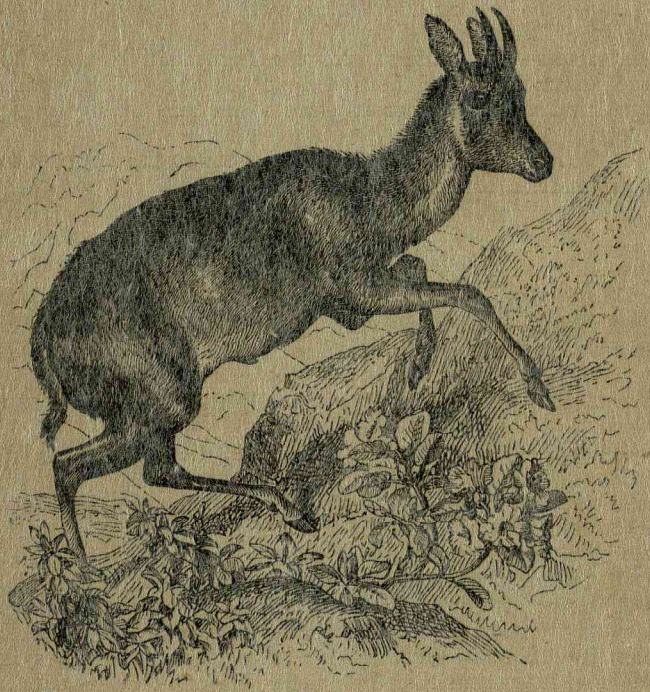
DESCRIPTION.—Dull brownish-grey above, with a dark mesial line, paler below; a large white spot under the throat; chest and front of fore-legs dark brown; female paler. The general appearance is that of a high, or arched-backed goat. The females and young are lighter coloured; the horns spring from the crest of the frontals and incline backward, and are slightly curved and very sharp pointed, ringed at the base, and smooth for the apical half or third; some have more rings than others. Jerdon says from twenty to twenty-five rings, but a specimen from Bhutan, which I have before me as I write (a female, I think) has but ten annuli, or little more than one-third ringed.

The following description is from Kinloch's 'Large Game of Thibet':—

"Gooral are not gregarious, like the true goats, all of which frequently assemble in large flocks, but are usually scattered about the hills, three or four being occasionally found close together, but more commonly they feed alone or in pairs. They are to be found in all sorts of ground, from bare crags to thick undulating forests, but their favourite resorts are steep rocky hills, thinly sprinkled with forest, especially where it consists of the Kolin pine. In bright weather they conceal themselves

shady places during the day-time, and only come out to feed on the open slopes in the morning and evening; but when the weather is cloudy they sometimes feed nearly all day.

"From living so near human habitations, and constantly seeing shepherds and wood-cutters, gooral are not alarmed by seeing men at a distance, and where the ground is much broken they are not difficult to stalk. Where they are at all plentiful they afford very good sport, and



Nemorhœdus goral.

their pursuit is a capital school for the young sportsman. Gooral-shooting is in fact like miniature ibex-shooting. The ground they inhabit is frequently difficult walking; the animals are quite sufficiently wary to test the generalship of the stalker; and as they do not present a very large mark, good shooting is required.

"The best way to hunt them is (having discovered a good hill) to be on the ground by daylight and work along the face of the hill, keeping

high up as possible. Every slope should be carefully examined, and on reaching the edge of each ravine it should be thoroughly reconnoitred. Being good climbers, the gooral may be found in all sorts of places—on narrow ledges, on the face of steep precipices, on gentle slopes of young grass, and among scattered bushes or forest trees. As little noise as possible should be made; talking should never be allowed, for nothing frightens game so much. Frequently after firing a shot or two on a hill-side, other animals may be found quietly feeding a little further on, whereas if there has been any shouting or talking the beasts will have been driven away. Shooting over a hill does not appear to have the effect of frightening gooral away; when disturbed they seldom go far, and may be found again on their old ground in the course of a day or two. On detecting the presence of danger, the gooral generally stands still, and utters several sharp hisses before moving away."

SIZE.—Height, 28 to 30 inches; length, about 4 feet; horns, from 6 to 9 inches.

I must here include one of the most curious animals in India, a creature resembling at first sight the African gnu. About a couple of years ago, a friend of mine, who hails from the "land o' cakes," called to ask me about a strange animal he had noticed in the Museum. "They call it a 'takin,'" said he; "and if I did not think they were above jokes in such a dry-bone establishment, I should say in the language of my native country, that it is a 'tak' in,' for it does not look natural at all." I turned up Hodgson's account of the creature for him, to prove that it was not a hoax. It was first brought to notice by the above naturalist about thirty years ago, and he gave it the name *Budorcas*, from the two Greek words signifying ox and gazelle.

His account of it appears in the 'Journal of the Asiatic Society,' vol. xix., 1850. It is again mentioned in the 'P. Z. S.' for 1853, with a plate (No. xxxvi.), and a further account of it, with several plates, will be found in Professor Milne-Edwards's 'Recherches sur les Mammifères' (pp. 367 to 377).

As my time has been very much occupied lately, I have not been able to go through all that has been written on this singular antelope, but I have been fortunate enough to find a willing helper in Mr. J. Cockburn, who, always ready to assist in the study to which he has devoted himself, has given me the following notes, which I have given in the following notice, as they stand under the heading DESCRIPTION.

GENUS BUDORCAS.

A heavily-built, somewhat cow-shaped animal, with curiously bent horns, which spring upwards, but soon bend laterally outward and then upwards and backwards with angular curves; a front view resembles a trident with the centre prong removed. The chevron is highly arched, and the false hoofs are very large.

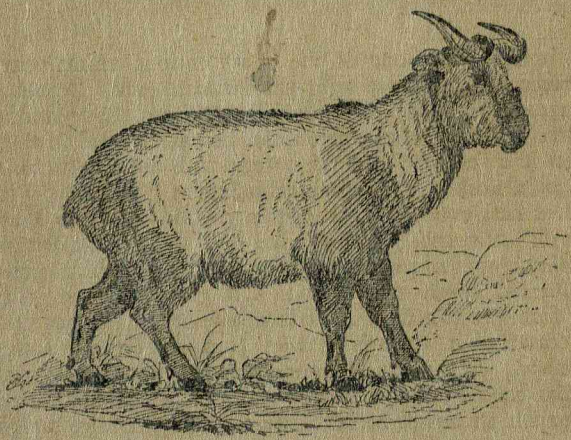
No. 455. BUDORCAS TAXICOLOR.

The Takin.

NATIVE NAMES.—*Takin* or *Takhon*, pronounced nasally.

HABITAT.—The Mishmi hills, Assam, Thibet.

DESCRIPTION.—"The takin is a large, heavily-built ruminant, about



Budorcas taxicolor.

3 feet 6 inches high at the shoulder and 6 feet in total length. The external peculiarities of the animal are: first, peculiar angularly curved horns in both sexes; second, the enormously arched chevron; third, the very great development of the spurious hoofs, which are obtusely conical, and about 1½ inches in length in a small specimen.

"The colour of the adult in one stage is fulvous throughout, some of the hairs being dark tipped. Legs, tail, muzzle and dorsal stripe black.

"Old bulls appear to become of an uniform brownish-black at times,

but the colour doubtless depends on the season, as each hair has the basal two-thirds yellow, and its apical third black, and the young its hair brown with a dark tint. The takin, pronounced takhon (nasally), is found just outside British limits in the Mishmi and Akha hills, north of Assam. It extends into the mountainous parts of Chinese Thibet, whence it has lately been procured by the adventurous Abbé David, and has been described by the great French naturalist A. Milne-Edwards, in his work 'Recherches sur les Mammifères,' with some osteological details which were hitherto wanting, but no more than the limb bones appear to have been obtained.

"The horns of the takin have been considered to bear some likeness to those of the gnu (*Catoblepas*), but I fail to trace a resemblance. Hodgson's description of the horns is as follows:—

"'The horns of the takin are inserted on the highest part of the forehead. The horns are nearly in contact at their bases. Their direction is first vertically upwards, then horizontally outwards, or to the sides, and then almost as horizontally backwards. The length of each horn is about 20 inches along the curves, but their thickness is great. The tail is about three inches long.'

"This remarkable animal was originally described by Brian Hodgson in 1850, from specimens procured by Major Jenkins from the Mishmis, north-east of Sadya. Skulls and skins are fairly common among the residents of Debroogurh, and two perfect skins of adults were lately presented by Colonel Graham to the Indian Museum.

"It is to be regretted that the skeleton of the animal remains unknown to science; from information collected by myself from the Mishmis, it was apparent that they might easily be procured.

"The animal would appear to range from about 8000 feet to the Alpine region, which is stated to be its habitat.

"While at Sadya a Mishmi chief pointed me out various spurs of the Himalayas, tantalisingly close, where he stated that he had hunted the animal.

"Hodgson's paper on the takin was published in the 'Jour. As. Soc.' vol. xix., pp. 65, 75, with three plates, a drawing of the animal, and two views of the skull.

"The next figure was by Wolf, in the 'Proc. of the Zool. Soc.' for 1853, pt. xxxvi., and is perhaps the worst he has ever done. Neither of these drawings are correct; and it is to be hoped that Professor Milne-Edwards has more materials for his picture than flat skins and limb bones.

"Professor Milne-Edwards was inclined to consider his specimens a distinct variety from the Mishmi animal, and calls it *Budorcas taxicola* (*sic*) var. *Tibetana*.

"The difference the professor points out, namely the fulvous colour

and the thinner undeveloped horns, exist in various specimens of the Mishmi takin, and there can be no question but that the animals are identical.

"The slaty colour of Wolf's drawing is probably due to an incorrect conception of Hodgson's term grey, which he defines as a yellowish-grey.

"The takin is essentially a serow (*Nemorhœdus*), with affinities to the bovines through the musk ox (*Ovibos moschata*), and other relationship to the sheep, goat and antelope. The development of the spurious hoofs would indicate that it frequents very steep ground."—*J. C.*

GENUS GAZELLA—THE GAZELLES.

These are small animals of slender frame; bóvine muzzle; of sandy colour above and white underneath; small annulated horns, curved gracefully backwards, and in some species so elegantly formed as to take the shape of a lyre on looking at them full in front. The females of some have smaller, smoother horns, but others are hornless. The skull has an anteorbital vacuity, with a small anteorbital fossa. The auditory bullæ are large; "eye-pits small; groin-pits distinct; large feet-pits in all feet; knees tufted" (*Jerdon*). The face has a white band running from the outer side of the base of each horn down to the muzzle, the space between forming a dark triangular patch bordered with a deeper tint. Sir Victor Brooke classifies the twenty or so known species as follows:—

I.—BACK UNSTRIPED.

Dentition:—Inc. $\frac{0}{3}$; can. $\frac{0}{1}$; prem. $\frac{3}{3}$; molars, $\frac{3}{3}$.

A.—*The white colour of the rump not encroaching on the fawn of the haunches.*

a. BOTH SEXES WITH HORNS.

Horns lyrate or semi-lyrate: *Gazella dorcas; G. Isabella; G. rufifrons; G. lœvipes; G. melanura.*

Horns non-lyrate: *Gazella Cuvieri; G. leptoceros; G. Spekii; G. Arabica; G. Bennetti; G. fuscifrons.*

b. FEMALES HORNLESS.

Gazella subgutterosa; G. gutterosa; G. picticaudata.

B.—*White of rump projecting forwards in an angle into the fawn colour of the haunches.*

Gazella dama; G. mohr; G. Sœmmerringii; G. Granti.

II.—BACK WITH A WHITE MEDIAN STRIPE.

One premolar less in the lower jaw: *Gazella euchore.*

Of the above species the following come under the scope of this work: *Gazella Bennetti*; *G. fuscifrons*; *G. subgutterosa*; *G. picticaudata.*

No. 456. GAZELLA BENNETTI.

The Indian Gazelle (*Jerdon's No.* 229).

NATIVE NAMES.—*Chikara*, Hindi; *Kal-punch*, Hindi; *Kal-sipi*, Mahratti; *Hirni*, in the Punjab; *Tiska*, also *Budari* and *Mudari*, Canarese; *Barudu-jinka*, Telegu; *Porsya* (male) and *Chari* (female), of Baoris.

HABITAT.—Mr. W. Blanford defines the limits of this species as follows ('P. Z. S.,' 1873, p. 315)—the italics are mine: "It is found throughout the Punjab, North-west Provinces, Rajputana, Sind (unless in part replaced by the next species), Kachh, Kathiawar, Guzerat, and the whole Bombay Presidency, *with the exception of the Western Ghâts and the low land on Konkan, along the western coast, south of the neighbourhood of Daman.* It is also met with in the Narbada and Tapti valleys, Bandelkand, the Son valley, and Rewah, in the Nagpur and Chanda country, Berar, the Hyderabad territories, and other parts of Southern India, *with the complete exception of the Malabar coast and the adjacent hills.*" He adds that from the evidence of Colonel McMaster and Colonel Douglas Hamilton, both good authorities, it is not known to occur much south of the Krishna river, nor is it found in the Ganges valley east of

Gazella Bennetti (male and female).

Benares, in Eastern Behar, the Santal Pergunnahs, Chotia Nagpur, Manbhum, &c., Chhatisgurh, the Mahanadi valley, Orissa, Bastar, and the east coast, generally north of the river Krishna. He says it is met with in the Narbada valley, but I have also found it common on the plateaux of the Satpura range.

DESCRIPTION.—"Fawn brown above, darker where it joins the white of the sides and buttocks; chin, breast, lower parts and buttocks behind white; tail, knee-tufts and fetlocks behind black; a dark brown spot on the nose, and a dark line from the eyes to the mouth, bordered by a light one above" (*Jerdon*).

SIZE.—Length, 3½ feet; height, 26 inches at shoulder, 28 inches at croup.

The horns run from 10 to 14 inches in the male, but, in fact, few exceed a foot. The longest of six pairs in my collection measure 12 inches, and the head is looked upon as a fine one. I agree with Jerdon that there must be some mistake about 18-inch horns recorded from the Punjab.

This pretty little creature, miscalled "ravine-deer," is familiar to most shikaris. How it got called a *deer* it is difficult to say, except on the principle of "rats and mice, and such small deer." The Madras term of "goat-antelope" is more appropriate. I remember once, when out on field service with the late Dr. Jerdon during the Indian Mutiny, a few *chikara* crossed our line of march. A young and somewhat bumptious ensign, who knew not of the fame of the doctor as a naturalist, called out: "There are some deer, there are some deer." "Those are not deer," quietly remarked Jerdon. "Oh, I say," exclaimed the boy, thinking he had got a rise out of the doctor; "Jerdon says those are not deer!" "No more they are, young man—no more they are; much more of the goat—much more of the goat."

This gazelle frequents broken ground, with sandy nullahs bordered by scrub jungle, and is most common in dry climates. It is unknown, I believe, in Bengal and, according to Jerdon, on the Malabar coast, but is, I think, found almost everywhere else in India. It abounds in the Central provinces, and I have found it in parts of the Punjab, and it is common throughout the North-west. It is a wary, restless little beast, and requires good shooting, for it does not afford much of a mark. When disturbed they keep constantly shifting, not going far, but hovering about in a most tantalising way. Natives it cares little for, unless it be a shikari with a gun, of which it seems to have intuitive perception; but the ordinary cultivator, with his load of wood and grass, may approach within easy shot; therefore it is not a bad plan, when there is no available cover, to get one of these men to walk alongside of you, whilst, with a horse-cloth or blanket over you, you make yourself look as like your guide as you can. A horse or bullock is also a great help. I

had a little bullock which formed part of some loot at Banda—a very handsome little bull, easy to ride and steady under fire—and I found him most useful in stalking black buck and gazelle.

When alarmed, the *chikara* stamps its foot and gives a sharp little hiss. It is generally found in small herds of four or five, but often singly. Jerdon, however, says that in the extreme North-west he had seen twenty or more together, and this is corroborated by Kinloch.

They are sometimes hunted by hawks and dogs combined, the *churrug* (*Falco sacer*) being the hawk ususally employed, as mentioned both by Kinloch and Hodgson, writing of opposite ends of the great Himalayan chain. The hawk stoops at the head of its quarry and confuses it, whilst the dogs, who would otherwise have no chance, run up and seize it.

The poor little gazelle has also many other enemies — jackals and wolves being amongst the number. Captain Baldwin, in his interesting book, writes: "Like other antelopes, the little ravine-deer has many enemies besides man. One day, when out with my rifle, I noticed an old female gazelle stamping her feet, and every now and then making that hiss which is the alarm note of the animal. It was not I that was the cause of her terror, for I had passed close to her only a few minutes before, and she seemed to understand by my manner that I meant no harm; no, there was something else. I turned back, and, on looking down a ravine close by, saw a crafty wolf attempting a stalk on the mother and young one. Another day, at Agra, a pair of jackals joined in the chase of a wounded buck." Brigadier-General McMaster also relates how he and two friends, whilst coursing, watched for a long time four jackals trying to force one of a small herd of young bucks to separate from the rest. "The gazelles stood in a circle, and maintained their ground well by keeping their heads very gallantly outwards to their foes, until at length, seeing us, both sides made off. We laid the greyhounds into and killed one of the jackals."

No. 457. GAZELLA FUSCIFRONS.

The Baluchistan Gazelle.

HABITAT.—The deserts of Jalk between Seistan and Baluchistan.

DESCRIPTION.—"Central facial band strongly marked, grizzled black; light facial streak grey, fairly definite, as is also the blackish dark facial streak; cheeks and anterior of neck grey; back of the neck, back, sides, haunches and legs sandy; lateral streaks wanting; belly and rump whitish; knee-brushes long, black; ears very long; horns (of female only known) strongly annulated, bending forwards and very slightly inwards at the tips" (*Sir V. Brooke*, 'P. Z. S.,' 1873, p. 545).

SIZE.—Total length, from tip of nose to end of tail, 4 feet; height at shoulder, 1 foot 11 inches.

This curious species was first brought to notice by Mr. Blanford. It is distinguished, he says, from the Indian *G. Bennetti*—first by colour, and secondly by the greater length and more strongly marked annulation of the horns of the female. "The face in the Indian gazelle," he says, "is nearly uniform rufescent fawn colour; the parts that are black and blackish in *G. fuscifrons* being only a little darker than the rest in *G. Bennetti*; the back also in the latter is more rufescent and less yellow, and the hairs are less dense."

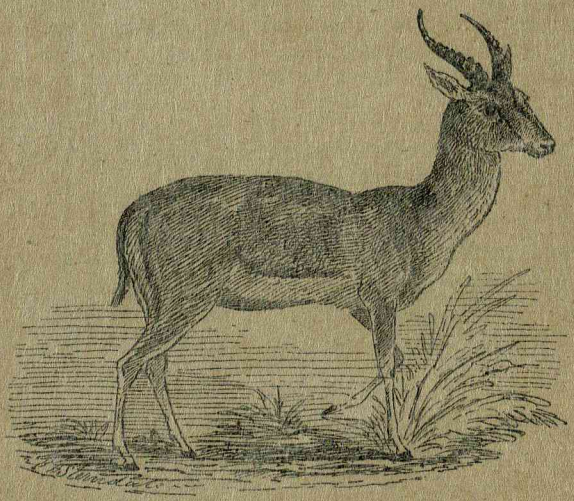
The following two species belong to section *B*, of which the females are hornless.

No. 458. GAZELLA SUBGUTTEROSA.

The Persian Gazelle.

NATIVE NAMES.—*Kik*, *Sai-kik*, and *Jairan*, Turki of Yarkand and Kashgar (*Blanford*).

HABITAT.—The high lands of Persia; to the north-west it is found



Gazella subgutterosa.

as far as Tabriz; it is probably, according to Blanford, the gazelle of Meshed and Herat; on the east it extends to the frontier of India, and is found in Afghanistan and northern Baluchistan; a variety also exists in Yarkand.

DESCRIPTION.—"Hair in winter rough and coarse, in summer much softer and smoother. During both seasons the dirty white of the face and cheeks is only relieved by the dark facial streak, which is short and narrow, but defined by a sprinkling of rufous hairs; the lateral and pygal bands are very faintly indicated, the dark bands being more rufous, the light band rather paler than the grey fawn colour of the upper parts of the body; breast and belly white; tail and ears moderate in length, the former blackish-rufous. Horns absent in the female; in the male long, annulated and lyrate, the points projecting inwards" (*Sir V. Brooke*). According to Blanford, who seemed doubtful whether it should not be raised to the rank of a species, the Yarkand variety differs from the typical *G. subgutterosa* in the very much darker markings on the face, and in the much smaller degree to which the horns diverge; he adds, however, that as there is some variation in face-markings amongst Persian specimens, it is perhaps better to consider the Yarkand race as only a variety. He gives a very good coloured plate of the animal. ('Sc. Results, Second Yarkand Mission—Mammalia.')

No. 459. GAZELLA PICTICAUDATA.

Thibetan Gazelle.

NATIVE NAME.—*Goa*, Thibetan.

HABITAT.—Ladakh. Abundant, according to Kinloch, on the plateau to the south-east of the Tsomoriri lake, on the hills east of Hanlé, and in the Indus valley from Demchok, the frontier village of Ladakh, as far down as Nyima. He had also seen it on the Nakpogoding pass to the north of the Tsomoriri, and picked up a horn on the banks of the Sutlej beyond the Niti pass.

DESCRIPTION.—Hair in winter long and softish; facial and lateral markings wanting; breast, belly and anal disk which surrounds the tail dirty white; the rest of the body grizzled fawn-colour, becoming more rusty towards the anal disk, a rusty line sometimes running through the disk to the short tail, the tip of which is rusty brown; the hairs about the corners of the mouth elongated. In the summer the coat is short and of a slaty-grey colour. Ears very short; horns long, annulated — diverge as they rise, bending forwards and backwards, again forwards, and a little inwards at the tips. Skull: ante-orbital fossa *very* shallow, nasals converging to a point, and rather elongated (*Sir Victor Brooke*, 'P. Z. S.,' 1873, p. 547).

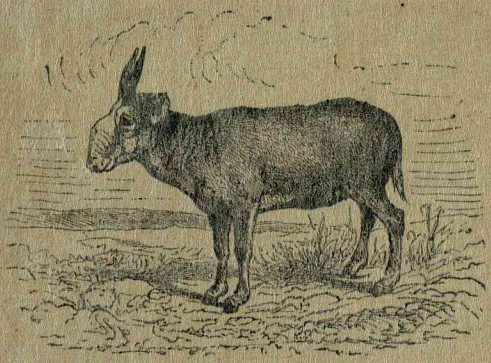
SIZE.—Height, about 18 inches.

There is a lovely little photograph of this gazelle in Kinloch's 'Large Game of Thibet,' wonderfully life-like; the head seems to stand out from the page. He describes it under Hodgson's generic name, *Procapra*, but

there is no reason for separating it from *Gazella*. He says: "The goa avoid rocky and steep ground, preferring the undulating plains and gently sloping valleys. Early in the season they are to be found in small herds, frequently close to the snow; as this melts they appear to disperse themselves over the higher ground, being often found singly or in twos and threes."

GENUS PANTHOLOPS

Between the gazelles and antelopes proper comes the *chiru* (*Pantholops Hodgsonii*), though strictly speaking it is, with the saiga antelope (*Saiga Tartarica*), though in a somewhat less degree, connected by cranial affinities with the sheep. The saiga is notable for its highly-arched nose and inflated nostrils, which are so much lengthened as to necessitate the animal's walking backwards when it feeds. The *chiru* is not quite so developed in this respect. The skull of the saiga is unique among ruminants, and those who wish to become acquainted with its most minute osteological details should refer to an article on this animal by Dr. James Murie in the 'P. Z. S.,' 1870, p. 457. I can only here give a very brief summary of the chief characteristics. Looked at in profile, the nasal bones we find to be remarkably short, the face being hollowed out, as it were, between the upper nasal cartilage and the very long and narrow maxillary and pre-maxillary bones; great vertical depth from the top of the nasal to the bottom of the maxillary bones; a very prominent bovine orbit, above and a little behind which the short tapering horns of a gazelle type are placed. The lower nasal cartilage is prolonged on to the fibrous cord of the nares, and the profile view of the animal in life is that of a grotesquely Roman-nosed antelope with swollen nostrils. Its nearest relative in India is the *chiru*, which has certain points of resemblance. The nose is but slightly arched, but the nostrils are more swollen than in antelopes as a rule. This is not sufficiently rendered in an otherwise admirable coloured plate in Blanford's 'Scientific Results of the Second Yarkand Mission,' but it is more apparent in the photograph of the head



Saiga Antelope.

Kinloch's 'Large Game of Thibet.' Another approach to the saiga is in the position of the horns, which, though of the same class, are much longer and more attenuated, but the position over the eye and the osseous development of the orbit are the same. The nasal bones are also shorter in proportion to other antelopes. The super-orbital foramina just under the horns, which are marked in most antelope and deer, are very minute in *Pantholops*. Dr. Murie notices the inflation of the post-maxilla in the saiga, and states that a similar extension is to be found in the *chiru*.

No. 460. PANTHOLOPS HODGSONII.

The Chiru.

NATIVE NAMES.—*Chiru* in Nepal; *Isos* in Thibet (*Strachey*); also *Isors* or *Choos* (*Kinloch*).

HABITAT.—The open plains of Thibet from Lhassa to Ladakh.

DESCRIPTION.—The following description was written in 1830, apparently by Mr. Brian Hodgson himself, and was published in 'Gleanings in Science' (vol. ii., p. 348), probably the first scientific magazine in India. As I have seen no better account of this curious antelope I give it as it stands. Mr. Hodgson had the advantage of drawing from life, he having had a living specimen as a pet:—

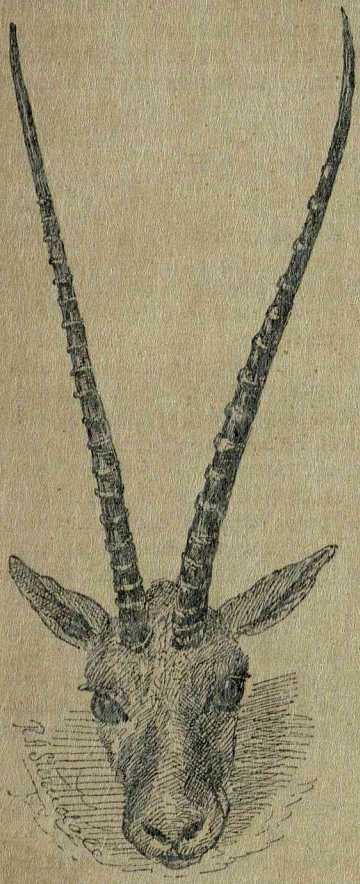
"Antelope with very long, compressed, tapering, sub-erect (? sub-lyrated) horns, having a slight concave arctuation forwards, and blunt annulations (prominently ridged on the frontal surface), except near the tips; a double coat throughout, greyish blue internally, but superficially fawn-coloured above, and white below, a black forehead, and stripes down the legs; and a tumour or tuft above either nostril.

"The ears and tail are moderate and devoid of any peculiarity; so likewise are the sub-orbital sinuses.* The horns are exceedingly long, measuring in some individuals nearly 2½ feet. They are placed very forward on the head, and may popularly be said to be erect and straight, though a reference to the specific character will show that they are not strictly one or the other.

"The general surface of the horns is smooth and polished, but its uniformity is broken by a series of from fifteen to twenty rings extending from the base to within six inches of the tip of each horn. Upon the lateral and dorsal surfaces of the horns these rings are little elevated, and present a wavy rather than a ridgy appearance; but on the frontal surface the rings exhibit a succession of heavy, large ridges, with furrows between; the annulation is nowhere acutely edged. The horns have a very considerable lateral compression towards the base, where their extent fore and aft is nearly double of that from side to side; upwards

* These are wanting.—R. A. S.

from the base the lateral compression becomes gradually less, and towards their tips the horns are nearly rounded. Compared with their length the thickness of the horns is as nothing—in other words they are slender, but not therefore by any means weak. The tips are acute rather than otherwise; the divergence at the points is from one-third to one-half of the length. At the base a finger can hardly be passed between the horns. Throughout five-sixths of their length from the base the horns describe an uniform slightly inward curve, and on the top angle of the curve they turn inwards again more suddenly, but still slightly, the points of the horns being thus directed inwards; the lateral view of the horns shows a considerable concave arctuation forwards, but chiefly derived from the upper part of the horns."



Panthalops Hodgsonii.

There is an excellent coloured plate of this animal in Blanford's 'Mammalia of the Second Yarkand Mission.' The only fault I see lies in the muzzle, especially of the male, which the artist has made as fine as that of a gazelle. The photograph in Kinloch's 'Large Game of Thibet' shows the puffiness of the nostrils much better; the latter author says of it:—

"The Thibetan antelope is a thoroughly game-looking animal; in size it considerably exceeds the common black buck or antelope of India, and is not so elegantly made. Its colour is a reddish fawn, verging on white in very old individuals. A dark stripe runs down the shoulders and flanks, and the legs are also dark brown. The face alone is nearly black, especially in old bucks. The hair is long and brittle, and extraordinarily thick-set, forming a beautiful velvety cushion, which must most effectually protect the animal from the intense cold of the elevated regions which it inhabits. A peculiarity about this antelope is the

existence of two orifices in the groin, which communicate with long tubes running up into the body. The Tartars say that the antelope inflates these with air, and is thereby enabled to run with greater swiftness! The muzzle of the Thibetan antelope is quite different from that of most of the deer and antelope tribe, being thick and puffed looking, with a small rudimentary beard; the eyes are set high up in the head; the sub-orbital sinus is wanting; the horns are singularly handsome, jet black, and of the closest grain, averaging about twenty-three or twenty-four inches in length. They are beautifully adapted for knife handles. The females have short black horns, and are much smaller than the males."

The last is a doubtful point; as far as I have been able to gather evidence on the subject the female appears to be hornless, which allies *Pantholops* more to the antelopes and the gazelles. Major Kinloch may have taken some young males for females, the general colouring being much the same. In the 'Proceedings of the Zoological Society' for 1834, p. 80, there is an extract from a letter from Mr. Hodgson, which, with reference to previous correspondence, says: "The communications referred to left only the inguinal pores, the number of teats in the female, and the fact of her being cornute or otherwise, doubtful. These points are now cleared up. The female is hornless, and has two teats only; she has no marks on the face or limbs, and is rather smaller than the male. The male has a large pouch at each groin, as in *Ant. dorcas*; that of the female is considerably smaller." Mr. Hodgson further remarks that "the *chiru* antelope can only belong either to the gazelline or the antelopine group. Hornless females would place it among the latter; but lyrate horns, ovine nose, and want of sinus, would give it rather to Gazella, and its singular inguinal purses further ally it to *Ant. dorcas* of this group. But from Gazella it is distinguished by the accessory nostrils, of inter-maxillary pouch, the hornless females, the absence of tufts on the knees, and of bands on the flanks. The *chiru*, with his bluff bristly nose, his inter-maxillary pouches, and hollow-cored horns, stands in some respects alone."

Hodgson was apparently not well acquainted at the time with saiga, or he would have certainly alluded to the affinity. Kinloch has the following regarding its habits:—

"In Chang Chenmo, where I have met with it, the elevation can be nowhere less than 14,000 feet, and some of the feeding grounds cannot be less than 18,000. In the early part of summer the antelope appear to keep on the higher and more exposed plains and slopes when the snow does not lie; as the season becomes warmer, the snow, which has accumulated on the grassy banks of the streams in the sheltered valleys, begins to dissolve, and the antelope then come down to feed on the grass which grows abundantly in such places, and then is the time when

they may easily be stalked and shot. They usually feed only in the mornings and evenings, and in the day-time seek more open and elevated situations, frequently excavating deep holes in the stony plains, in which they lie, with only their heads and horns visible above the surface of the ground. It is a curious fact that females are rarely found in Chang Chenmo; I have met with herds of sixty or seventy bucks, but have only seen one doe to my knowledge during the three times that I visited the valley."

GENUS ANTELOPE (restrictea).

Horns in the male only; abnormal cases of horned females are on record, but they only prove the rule. No muffle; sub-orbital sinus moderate, somewhat linear; no canines; groin-pits large; feet-pits present. In the skull the sub-orbital fossa is large.

No. 461. ANTELOPE BEZOARTICA.

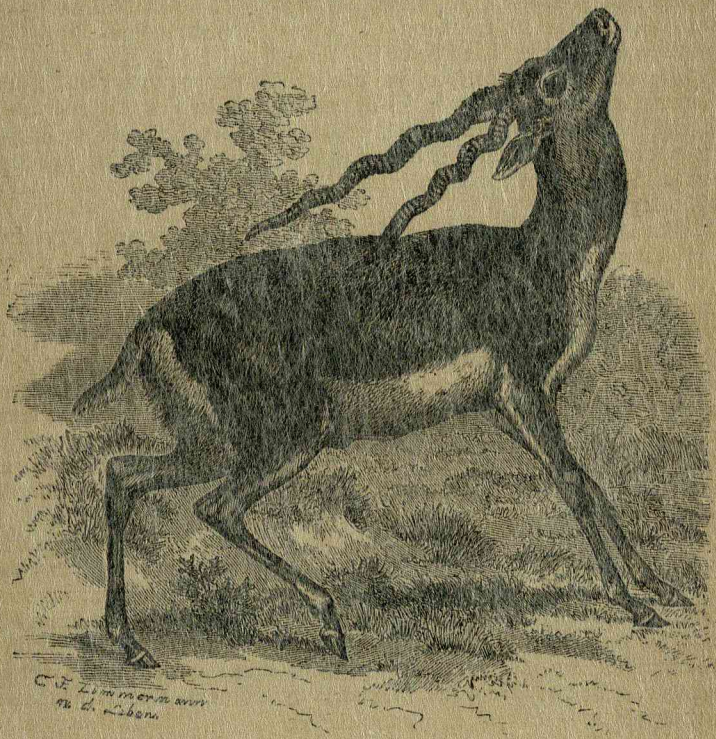
The Indian Antelope (Jerdon's No. 228).

NATIVE NAMES.—*Mrig* or *Mirga*, Sanscrit; *Harna, Hirun, Harin* (male) and *Hirni* (female), Hindi; also *Kalwit*, Hindi, according to Jerdon; *Goria* (female) and *Kala* (male), in Tirhoot; *Kalsar* (male) and *Baoti* (female), in Behar; *Bureta*, in Bhagulpore; *Barout* and *Sasin*, in Nepal; *Phandayet*, Mahrathi (*Jerdon*). *Hiru* and *Bamuni-hiru*, Mahrathi; *Chigri*, Canarese; *Irri* (male), *Sedi* (female), and *Jinka*, Telegu; *Alali* (male) and *Gandoli* (female), of Baoris.

HABITAT.—In open plain country throughout India except in Lower Bengal and Malabar. In the Punjab it does not cross the Indus. Dr. Jerdon says: "I have seen larger herds in the neighbourhood of Jalna in the Deccan than anywhere else—occasionally some thousands together, with black bucks in proportion. Now and then, Dr. Scott informs me, they have been observed in the Government cattle-farm at Hissar in herds calculated at 8000 to 10,000." I must say I have never seen anything like this, although in the North-west, between Aligarh and Delhi, I have noticed very large herds; in the Central provinces thirty to forty make a fair average herd, though smaller ones are more common. These small parties generally consist of does, and perhaps two or three young sandy bucks lorded over by one old black buck, who will not allow any other of his colour to approach without the ordeal of battle. I have lately heard of them in Assam, but forget the precise locality.

DESCRIPTION.—Form supple and elegant, with graceful curves; the neck held up proudly; the head adorned with long, spiral, and closely

annulated horns, close at the base, but diverging at the tips in a V form. In very large specimens there are five flexures in the horn, but generally four. They are perfectly round, and taper gradually to the tips, which are smooth; the bony cores are also spiral, so that in the dry skull the horn screws on and off. The colour of the old males is is deep blackish-brown, the back and sides with an abrupt line of separation from the



Antelope bezoartica.

white of the belly; the dark colour also extends down the outer surface of the limbs; the back of the head, nape and neck are hoary yellowish; under parts and inside of limbs pure white; the face is black, with a white circle round the eyes and nose; the tail is short; the young males are fawn-coloured. The females are hornless, somewhat smaller, and pale yellowish-fawn above, white below, with a pale streak from the shoulder to the haunch.

SIZE.—Length, about 4 feet to root of tail; tail, 7 inches; height at shoulder, 32 inches. Horns, average length about 20 inches—fine ones 22, unusual 24, very rare 26. Sir Barrow Ellis has or had a pair 26½, with only three flexures; 28 has been recorded by "Triangle" in *The Asian*, and 30 spoken of elsewhere, but I have as yet seen no proof of the latter. The measurement should be taken straight from base to tip, and not following the curves of the spiral. I have shot some a little over 22, but never more. I believe, however, that the longest horns come from the North-west.

This antelope is so well known that it is hardly necessary to dilate at length on it; every shikari in India has had his own experiences, but I will take from Sir Walter Elliot's account and Dr. Jerdon's some paragraphs concerning the habits of the animal which cannot be improved upon, and add a short extract from my own journals regarding its love of locality:—

"When a herd is met with and alarmed, the does bound away for a short distance, and then turn round to take a look; the buck follows more leisurely, and generally brings up the rear. Before they are much frightened they always bound or spring, and a large herd going off in this way is one of the finest sights imaginable. But when at speed the gallop is like that of any other animal. Some of the herds are so large that one buck has from fifty to sixty does, and the young bucks driven from these large flocks are found wandering in separate herds, sometimes containing as many as thirty individuals of different ages.

"They show some ingenuity in avoiding danger. In pursuing a buck once into a field of *toor*, I suddenly lost sight of him, and found, after a long search, that he had dropped down among the grain, and lay concealed with his head close to the ground. Coming on another occasion upon a buck and doe with a young fawn, the whole party took to flight, but the fawn being very young, the old ones endeavoured to make it lie down. Finding, however, that it persisted in running after them, the buck turned round and repeatedly knocked it over in a cotton field until it lay still, when they ran off, endeavouring to attract my attention. Young fawns are frequently found concealed and left quite by themselves."—*Elliot.*

Jerdon adds: "When a herd goes away on the approach of danger, if any of the does are lingering behind, the buck comes up and drives them off after the others, acting as whipper-in, and never allowing one to drop behind. Bucks may often be seen fighting, and are then so intently engaged, their heads often locked together by the horns, that they may be approached very close before the common danger causes them to separate. Bucks with broken horns are often met with, caused by fights; and I have heard of bucks being sometimes caught in this way, some nooses being attached to the horns of a tame one. I have

have seen a wounded antelope pursued by greyhounds drop suddenly into a small ravine, and lie close to the ground, allowing the dogs to pass over it without noticing, and hurry forward." ('Mamm. of India,' p. 278.)

I have myself experienced some curious instances of the hiding propensities spoken of by Sir Walter Elliot and Dr. Jerdon. In my book on Seonee I have given a case of a wounded buck which I rode down to the brink of a river, when he suddenly disappeared. The country was open, and I was so close behind him that it seemed impossible for him to have got out of sight in so short a space of time; but I looked right and left without seeing a trace of him, and, hailing some fishermen on the opposite bank, found that they had not seen him cross. Finally my eye lighted on what seemed to be a couple of sticks projecting from a bed of rushes some four or five feet from the bank. Here was my friend submerged to the tip of his nose, with nothing but the tell-tale horns sticking out.

This antelope attaches itself to localities, and after being driven away for miles will return to its old place. The first buck I ever shot I recovered, after having driven him away for some distance and wounded him, in the very spot I first found him; and the following extract from my journals will show how tenaciously they cling sometimes to favourite places:—

"I was out on the boundary between Khapa and Belgaon, and came across a particularly fine old buck, with very wide-spreading horns; so peculiar were they that I could have sworn to the head amongst a thousand. He was too far for a safe shot when I first saw him, but I could not resist the chance of a snap at him, and tried it, but missed; and I left the place. My work led me again soon after to Belgaon itself, and whilst I was in camp there I found my friend again; but he was very wary; for three days I hunted him about, but could not get a shot. At last I got my chance; it was on the morning of the day I left Belgaon. I rode round by the boundary, when up jumped my friend from a bed of rushes, and took off across country. I followed him cautiously, and found him again with some does about two miles off. A man was ploughing in the field close by; so, hailing him, I got his bullocks and drove them carefully up past the does. We splashed through a nullah, and waded through a lot of rushes, and at last I found myself behind a clump of coarse grass, with a nullah between me and the antelope. They jumped up on my approach, and Blacky, seeing his enemy, made a speedy bolt of it; but I was within easy range of him, and a bullet brought him down on his head with a complete somersault. Now this buck, in spite of the previous shot at him, and being hunted about from day to day, never left his ground, and used to sleep every night in a field near my tent."

This antelope has been raised by the Hindoos amongst the constellations harnessed to the chariot of the moon. Brahmins can feed on its flesh under certain circumstances prescribed by the 'Institutes of Menu,' and it is sometimes tamed by Fakirs. It is easily domesticated, but the bucks are always dangerous when their horns are full grown, especially to children. The breeding season begins in the spring, but fawns of all ages may be seen at any time of the year. The flesh of this species is among the best of the wild ruminants.

The next group of antelopes are those with smooth horns, without knots; spiral in some African species, but short and straight, or but slightly curved in the Indian ones. Females hornless. There are but two genera in India, *Portax* and *Tetraceros*.

GENUS PORTAX—THE NYLGAO.

Horns on back edge of frontal bone behind the orbit, short, recurved, conical and smooth, angular at the base; bovine nose with large moist muffle; small eye-pits; hind legs shorter than the front; tail long and tufted; back short, sloping down from high withers; the neck deep and compressed like a horse, with a short upright mane; on the throat of the male under a white patch is a long tuft of black hair. In the skull the nasal opening is small, and the molars have, according to Dr. Gray, supplementary lobes. Dr. Jerdon says: "There is a small pit in front of the orbit, and anterior to this a small longitudinal fold, in the middle of which there is a pore through which exudes a yellow secretion from the gland beneath."

The female has sometimes in an abnormal condition been found with horns. Mr. J. Cockburn, in a letter to *The Asian* (11th of November, 1879, p. 40), describes such a one.

No. 462. PORTAX PICTUS *vel* TRAGOCAMELUS.

The Nylgao or Blue Bull (Jerdon's No. 226).

NATIVE NAMES.—*Nilgao*, *Nilgai*, or *Lilgao*, *Lilgai*, *Rojra* or *Rojh*, *Rooi* (female), Hindi; *Guraya*, Gondi; *Maravi*, Canarese; *Manupotu*, Telegu.

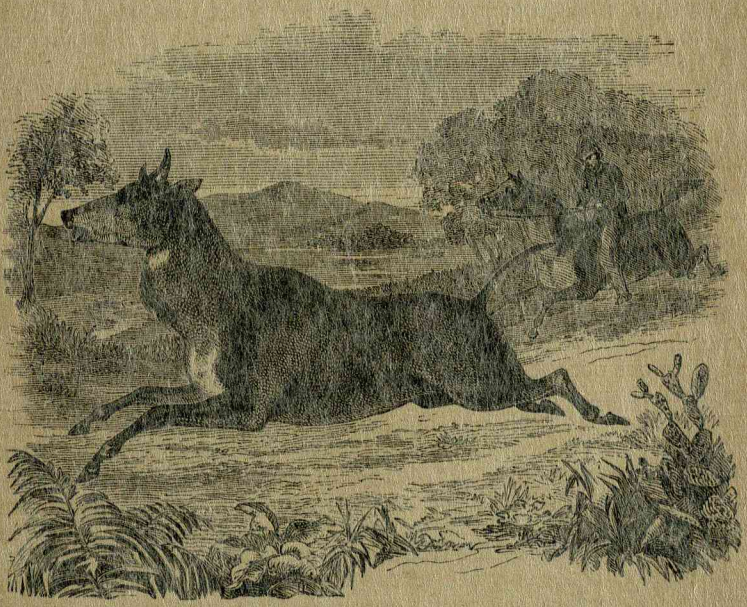
HABITAT.—India generally, from the Himalayas to the south. It is not common south of the Ganges, nor, according to Jerdon, is it found in the extreme south of India.

DESCRIPTION.—A horse-like animal at the first glance, owing to its lean head, long, flat, and deep neck, and high withers, but with cervine

hind-quarters, lower than in front. The male is of an iron grey colour, intensified by age; the inside of the ears, lips, and chin are white; a large white patch on the throat, below which is the pendant tuft of black hair; the chest, stomach, and rings on the fetlocks, white; mane, throat-tuft and tip of tail, black. The female is a sandy or tawny colour, and is somewhat smaller than the male.

SIZE.—Length of male, 6½ to 7 feet; tail 18 to 22 inches; height at shoulder, from 13 to 14½ hands; horns, from 8 to 10 inches.

The nilgao inhabits open country with scrub or scanty tree jungle,



Portax pictus.

also, in the Central provinces, low hilly tracts with open glades and valleys. He feeds on beyr (*Zizyphus jujuba*) and other trees, and at times even devours such quantities of the intensely acrid berries of the *aonla* (*Phyllanthus emblica*) that his flesh becomes saturated with the bitter elements of the fruit. This is most noticeable in soup, less so in a steak, which is at times not bad. The tongue and marrow-bones, however, are generally as much as the sportsman claims, and, in the Central provinces at least, the natives are grateful for all the rest.

He rests during the day in shade, but is less of a nocturnal feeder than the sambar stag. I have found nilgao feeding at all times of the day. The droppings are usually found in one place. The nilgao drinks daily, the sambar only every third day, and many are shot over water. Although he is such an imposing animal, the blue bull is but poor shooting, unless when fairly run down in the open. With a sharp spurt he is easily blown, but if not pressed will gallop for ever. In some parts of India nilgai are speared in this way. I myself preferred shooting them either from a light double-barrelled carbine or large bore pistol when alongside; the jobbing at such a large cow-like animal with a spear was always repugnant to my feelings. They are very tenacious of life. I once knocked one over as I thought dead, and, putting my rifle against a tree, went to help my shikaree to *hallal* him, when he jumped up, kicked us over, and disappeared in the jungle; I never saw him again. A similar thing happened to a friend who was with me, only he sat upon his supposed dead bull, quietly smoking a cigar and waiting for his shikarees, when up sprang the animal, sending him flying, and vanished. On another occasion, whilst walking through the jungle, I came suddenly on a fine dark male standing chest on to me. I hardly noticed him at first; but, just as he was about to plunge away into the thicket, I rapidly fired, and with a bound he was out of sight. I hunted all over the place and could find no trace of him. At last, by circling round, I suddenly came upon him at about thirty yards off, standing broadside on. I gave him a shot and heard the bullet strike, but there was not the slightest motion. I could hardly believe that he was dead in such a posture. I went up close, and finally stopped in front of him; his neck was stretched out, his mouth open and eyes rolling, but he seemed paralysed. I stepped up close and put a ball through his ear, when he fell dead with a groan. I have never seen anything like it before or since, and can only suppose that the shot in the chest had in some way choked him. I have alluded to this incident in my book on Seonee; it was in that district that it occurred.

The nilgao is the only one of the deer and antelope of India that could be turned to any useful purpose. The sambar stag, though almost equal in size, will not bear the slightest burden, but the nilgao will carry a man. I had one in my collection of animals which I trained, not to saddle, for such a thing would not stay on his back, but to saddle-cloth. He was a little difficult to ride, rather jumpy at times, otherwise his pace was a shuffling trot. I used to take him out into camp with me, and made him earn his grain by carrying the servants' bundles. He was not very safe, for he was, when excited, apt to charge; and a charge from a blue bull with his short sharp horns is not to be despised. In some parts the Hindoos will not touch the flesh of this animal, which they believe to be allied to the cow. It has much more

of a horsey look about it. McMaster says that in some parts of the Coimbatore district the natives described this creature to Colonel Douglas Hamilton as a wild horse, and called it by a name signifying such. He also notices the resemblance of the Gondi name *Guraya*, to the Hindi *Ghora*.

GENUS TETRACEROS.

Horns four, conical, smooth, slightly bent forward at tip, the anterior ones very short, sometimes rudimentary, which has led to the distinction of a separate species by some naturalists; slightly ringed at the base. The posterior ones situated far back on the frontal bone, the anterior ones above the orbits; eye-pits small, linear; muffle large; feet-pits in the hind feet; no groin-pits; four mammæ; canine teeth in the males; females hornless. The skull is characterized by the large sub-orbital fossæ which occupy nearly the whole cheek. The various species—*sub-quadricornutus* of Elliot, *iodes* and *paccerois* of Hodgson—are but varieties of the following only Indian species.

No. 463. TETRACEROS QUADRICORNIS.

The Four-horned Antelope (Jerdon's No. 227).

NATIVE NAMES.—*Chowsingha, Chowka.* Jerdon also gives *Bherki, Bekra,* and *Jangli-bakra,* but I have also heard these names given by natives to the rib-faced deer (*Cervulus aureus*); *Bhir-kura* (the male) and *Bhir* (female) Gondi; *Bhirul* of Bheels; *Kotri,* Bustar; *Kond-guri,* Canarese; *Konda-gori,* Telegu (*Jerdon*). Kinloch also gives *Doda,* Hindi.

Tetraceros quadricornis.

HABITAT.—Throughout India, but not in Ceylon or Burmah.

DESCRIPTION.—A small brownish-bay animal, slightly higher at the croup than at the shoulder, which gives it a poky look, lighter beneath and whitish inside the limbs and in the middle of the belly; fore-legs, muzzle, and edge of ears dark; fetlocks dark, sometimes ringed with lighter colour. The colouring varies a good deal. The horns are situated as I have before described; the anterior ones are subject to

such variation; sometimes they are absent or represented merely by a black callous skin; others are merely little knobs; the largest seldom exceed an inch and a-half, and the posterior horns five inches.

SIZE.—Head and body, 40 to 42 inches; height at shoulder, 24 to 26 inches; at croup a little higher.

This little antelope, the smallest of Indian hollow-horned ruminants, is very shy and difficult to get, even in jungles where it abounds. It was plentiful in the Seonee district, yet I seldom came across it, and was long before I secured a pair of live ones for my collection. It frequents, according to my experience, bamboo jungle; but, according to Kinloch, Jerdon and other writers, it is found in jungly hills and open glades, in the forests, and in bushy ground near dense forests.

It is an awkward-looking creature in action, as it runs with its neck stuck out in a poky sort of way, making short leaps; in walking it trips along on the tips of its toes like the little mouse-deer (*Meminna*). The young are stated to be born in the cold season. General Hardwicke created great confusion for a time by applying the name *chikara*, which is that of the *Gazella Bennettii*, to this species. It is not good eating, but can be improved by being well larded with mutton fat when roasted. McMaster believes in the individuality of Elliot's antelope (*T. sub-quadricornutus*), but more evidence is required before it can be separated from *quadricornis*. The mere variation in size, or the presence or absence of the anterior horns and the lighter shade of colour, are not sufficient reasons for its separation as a species, for the *quadricornis* is subject to variation in like manner.*

BOVINÆ—CATTLE.

These comprise the oxen, and wind up the hollow-horned ruminants as far as India is concerned. There are in the New World some other very interesting animals of this group, such as the musk-ox (*Ovibos*), and the prong-horned antelope (*Antilocapra*), which last so far resembles the Cervidæ that the horns, which are bifurcate, are also annually shed. They come off the bony core, on which the new horn is already beginning to form.

The Bovines are animals of large size, horned in both sexes, a very large and broad moist muffle, massive bodies and stout legs. The horns, which are laterally wide spread, are supported on cores of cellular bone, and are cylindrical or depressed at the base. The nose broad, with the nostrils at the side. The skull has no sub-orbital pit or fissure, and the bony orbit is prominent; grinders with a well-developed supplementary lobe; cannon bone short. In India, the groups into which

* See notes in Appendix C, p. 529.

sub-family may be divided, are oxen, the buffaloes, and the yaks. There are no true bison in our limits, the commonly so-called bison being properly a wild ox. The taurine or Ox group is divided into the *Zebus*, or humped domestic cattle; *Taurus*, humpless cattle with cylindrical horns; and *Gavæus*, humpless cattle with flattened horns.

According to Dr. Jerdon, in some parts of India small herds of zebus have run wild. He says:—

"Localities are recorded in Mysore, Oude, Rohilkund, Shahabad, &c., and I have lately seen and shot one in the Doab near Mozuffernugger. These, however, have only been wild for a few years. Near Nellore, in the Carnatic, on the sea-coast there is a herd of cattle that have been wild for many years. The country they frequent is much covered with jungle and intersected with salt-water creeks and back-waters, and the cattle are as wild and wary as the most feral species. Their horns were very long and upright, and they were of large size. I shot one there in 1843, but had great difficulty in stalking it, and had to follow it across one or two creeks."

GENUS GAVÆUS.

Massive head with large concave frontals, surmounted in *G. gaurus* by a ridge or crest of bone; horns flattened on the outer surface, corrugated at the base, and smooth for the rest of the two-thirds, or a little more; wide-spreading and recurved at the tips, forming a crescent; greenish grey for the basal half, darker towards the tips, which are black; muffle small; dewlap small or absent; the spinous processes of the dorsal vertebræ are greatly developed down to about half the length of the back; legs small under the knee, and white in colour; hoofs small and pointed, leaving a deer-like print in the soil, very different to the splay foot of the buffalo.

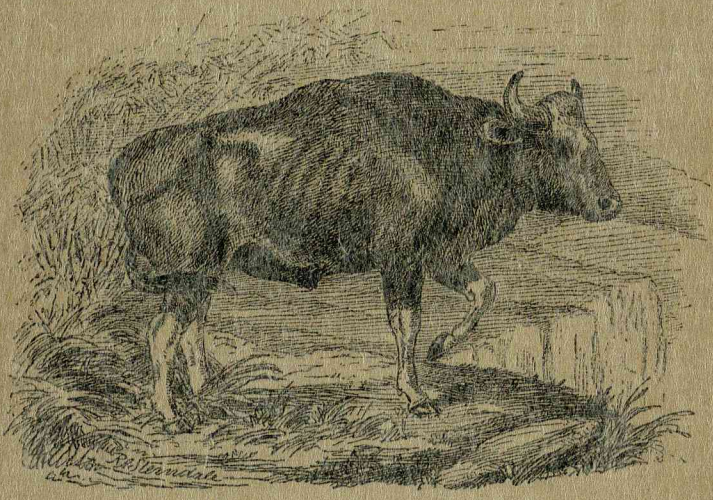
No. 464. GAVÆUS GAURUS.

The Gaur, popularly called Bison (Jerdon's No. 238).

NATIVES NAMES.—*Gaor* or *Gaori-gai*, *Bun-boda*, Hindi; *Boda* and *Bunparra* in the Seonee and Mandla districts; *Pera-maoo* of Southern Gonds; *Gaoiya*, Mahrathi; *Karkona*, Canarese; *Katuyeni*, Tamil; *Jangli-kulgha* in Southern India; *Pyoung* in Burmah; *Salandang* in the Malay countries. Horsfield gives the following names under his *Bibos asseel: As'l Gayal*, Hindi; *Seloi*, Kuki; *P'hanj* of the Mughs and Burmese, and some others which he considers doubtful.

HABITAT.—Regarding this, I quote at length from Jerdon, whose inquiries were carefully made. He says: "The gaur is an inhabitant of all the large forests of India, from near Cape Comorin to the foot of the Himalayas. On the west coast of India it is abundant all along the Syhadi

range on Western Ghâts, both in the forests at the foot of the hills, but more especially in the upland forests and the wooded country beyond the crest of the Ghâts. The Animally hills, the Neilgherries, Wynaad, Coorg, the Bababooden hills, the Mahableshwar hills, are all favourite haunts of this fine animal. North of this, it occurs to my own knowledge in the jungles on the Taptee river and the neighbourhood, and north of the Nerbudda; a few on the deeper recesses of the Vindhian mountains. On the eastern side of the peninsula it is found in the Pulney and Dindigul hills, the Shandamungalum range, the Shervaroys, and some of the hill ranges near Vellore and the borders of Mysore. North of this, the



Gavæus gaurus.

forest being too scanty, it does not occur till the Kistna and Godavery rivers; and hence it is to be found in suitable spots all along the range of Eastern Ghâts to near Cuttack and Midnapore, extending west far into Central India, and northwards towards the edge of the great plateau which terminates south of the Gangetic valley. According to Hogdson it also occurs in the Himalayan Terai, probably however only towards the eastern portion, and here it is rare, for I have spoken to many sportsmen who have hunted in various parts of the Terai, from Sikhim to Rohilkund, and none have ever come across the gaur at the foot of the Himalayas."—'Mam. of Ind.,' p. 303. (See also Appendix C, p. 530.)

In the Central provinces the gaur is found in several parts of the

bamboo-clad spurs of the Satpura range. My experience of the animal is limited to the Seonee district, where it is restricted to the now closely preserved forests of Sonawani in the south-east bend of the range, and a few are to be seen across occasionally, near the old fort of Amodagarh, on the Hiiri river.

It is also more abundant on the Pachmari and Mahadeo hills. On the east of the Bay of Bengal it is found from Chittagong through Burmah to the Malayan peninsula. It was considered that the gaur of the eastern countries was a distinct species, and is so noted in Horsfield's Catalogue, and described at some length under the name of *Bibos asseel;* but it appears that all this distinction was founded on the single skull of a female gaur, and is an instance of the proneness of naturalists to create new species on insufficient data. He himself remarks that when the skin was removed it was evident that the animal was nearly related to *Gavæus gaurus*, or, as he calls it, *Bibos cavifrons*. Mr. G. P. Sanderson shot a fine old male of what he supposed to be the wild *gayal*, and he says: "I can state that there was not one single point of difference in appearance or size between it and the bison of Southern India, except that the horns were somewhat smaller than what would have been looked for in a bull of its age in Southern India;" and this point was doubtless an individual peculiarity, for Blyth, in his 'Catalogue of the Mammals of Burmah,' says: "Nowhere does this grand species attain a finer development than in Burmah, and the horns are mostly short and thick, and very massive as compared with those of the Indian gaurs, though the distinction is not constant on either side of the Bay of Bengal."

Jerdon supposes it to have existed in Ceylon till within the present century, but I do not know on what data he founds his assertion.

DESCRIPTION.—I cannot improve on Jerdon's description, taken as it is from the writings of Hodgson, Elliot, and Fisher, so I give it as it stands, adding a few observations of my own on points not alluded to by them:—

"The skull is massive; the frontals large, deeply concave, surmounted by a large semi-cylindric crest rising above the base of the horns. There are thirteen pairs of ribs.* The head is square, proportionately smaller than in the ox; the bony frontal ridge is five inches above the frontal plane; the muzzle is large and full, the eyes small, with a full pupil (? iris) of a pale blue colour. The whole of the head in front of the eyes is covered with a coat of close short hair, of a light greyish-brown colour, which below the eyes is darker, approaching almost to black; the muzzle is greyish and the hair is thick and short; the ears are broad and fan-shaped; the neck is sunk between the head and back, is short, thick,

* The true bison has fourteen pairs of ribs.—R. A. S.

and heavy. Behind the neck and immediately above the shoulder rises a gibbosity or hump of the same height as the dorsal ridge. This ridge rises gradually as it goes back, and terminates suddenly about the middle of the back; the chest is broad; the shoulder deep and muscular; the fore-legs short, with the joints very short and strong, and the arm exceedingly large and muscular; the hair on the neck and breast and beneath is longer than on the body, and the skin of the throat is somewhat loose, giving the appearance of a slight dewlap; the fore-legs have a rufous tint behind and laterally above the white. The hind-quarters are lighter and lower than the fore, falling suddenly from the termination of the dorsal ridge; the skin of the neck, shoulders, and thigh is very thick, being about two inches and more.

"The cow differs from the bull in having a slighter and more graceful head, a slender neck, no hump; and the points of the horns do not turn towards each other at the tip, but bend slightly backwards, and they are much smaller; the legs too are of a purer white. The very young bull has the forehead narrower than the cow, and the bony frontal ridge scarcely perceptible. The horns too turn more upwards. In old individuals the hair on the upper parts is often worn off. The skin of the under parts when uncovered is deep ochrey-yellow."—'Mammals of India,' p. 302.

The fineness of the leg below the knee is another noticeable feature, and also the well-formed pointed hoof, which leaves an imprint like that of a large deer. Mr. Sanderson states in his book that the bison, after a sharp hunt, gives out an oily sweat, and in this peculiarity he says it differs from domestic cattle, which never sweat under any exertion. This I have not noticed.

The period of gestation seems to be about the same as that of the domestic cow, and the greatest number of calves are born in the summer.

SIZE.—I cannot speak personally, for I regret now that I took no measurements in the days when I was acquainted with these magnificent animals, but the experiences of others I give as follows:—

Sir Walter Elliot gives—

	Ft.	In.
Nose to root of tail	9	6½
Height at shoulder (over 18 hands!)	6	1½
,, at rump	5	3
Tail	2	10½
Length of dorsal ridge	3	4
Height of ,,	0	4½
Head from muzzle to top of frontal ridge	2	1¾
Breadth of forehead	1	3½
Ear	0	10½
Circumference of horn at base	1	7½
Distance between the points of the horns	2	1

I give the measurements of two fine heads :—

	Ft.	In.	Ft.	In.
From tip to tip round the outer edge and across the forehead	6	2	6	11
Across the sweep	2	9	3	2½
Circumference at base	1	7	1	5
Between tips	1	7	1	10½

The following careful measurements are recorded by Mr. Blyth ('J. A. S. B.,' vol. xi., 1842, p. 588), and were furnished to him by Lieut. Tickell from the recently-killed animal, in order to assist in the setting up of the specimen in the Asiatic Museum :—

	Ft.	In.
A string passed along the back to root of tail	8	8½
From frontal ridge to tip of muzzle	2	0
Horns apart anteriorly at base	1	0½
Tip to tip of horns	2	3¼
From nose to centre of eye	1	0¾
Eye to root of horn	0	4¼
Eye to base of ears	0	6
Humerus, &c.	1	11¼
Radius	2	8
Metacarpus	0	9¾
Pastern, &c., and hoof	0	7¼
Pelvis	1	4½
Femur	1	7¼
Tibia and fibula	1	10
Metatarsus	1	4
Pastern to end of hoof	0	7½
Height perpendicularly, about	5	9
Length of dorsal ridge	2	5½
Tail, root to tip of hairs	3	1¾
Circumference of head behind horns	3	11
,, ,, neck behind ears	4	0½
,, ,, chest	8	8
,, ,, muzzle	1	9¼
,, ,, forearm close to axilla	1	11½
,, ,, thigh close to body	3	0¾
,, ,, thigh close above hock	1	6

I feel tempted to let my pen run away with me into descriptions of the exciting scenes of the past in the chase of this splendid creature—the noblest quarry that the sportsman can have, and the one that calls forth all his cunning and endurance. As I lately remarked in another publication, I know of no other animal of which the quest calls forth the combined characteristics of the ibex, the stag and the tiger-hunter. Some of my own experiences I have described in 'Seonee;' but let those who wish to learn the poetry of the thing read the glowing, yet not less true pages of Colonel Walter Campbell's 'Old Forest Ranger;' and for clear practical information, combined also with graphic description,

the works of Captain J. Forsyth and Mr. G. P. Sanderson ('The Highlands of Central India' and 'Thirteen years among the Wild Beasts').

The gaur prefers hilly ground, though it is sometimes found on low levels. It is extremely shy and retiring in its habits, and so quick of hearing that extreme care has to be taken in stalking to avoid treading on a dry leaf or stick. I know to my cost that the labour of hours may be thrown away by a moment of impatience. In spite of all the wondrous tales of its ferocity, it is as a rule a timid, inoffensive animal. Solitary bulls are sometimes dangerous if suddenly come upon. I once did so, and the bull turned and dashed up-hill before I could get a shot, whereas a friend of mine, to whom a similar thing occurred a few weeks before, was suddenly charged, and his gun-bearer was knocked over. The gaur seldom leaves its jungles, but I have known it do so on the borders of the Sonawani forest, in order to visit a small tank at Untra near Ashta, and the cultivation in the vicinity suffered accordingly.

Hitherto most attempts to rear this animal when young have failed. It is said not to live over the third year. Though I offered rewards for calves for my collection, I never succeeded in getting one. I have successfully reared most of the wild animals of the Central provinces, but had not a chance of trying the bison.

No. 465. GAVÆUS FRONTALIS.

The Mithun or Gayal.

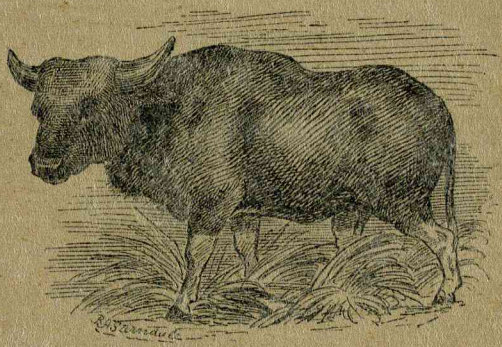
NATIVE NAMES.—*Gayal*, *Gavi* or *Gabi*, *Gabi-bichal* (male), *Gabi-gai* (female); *Bunerea-goru* in Chittagong and Assam; *Mithun*.

HABITAT.—The hilly tracts east of the Brahmaputra, at the head of the Assam valley, the Mishmi hills, in hill Tipperah, Chittagong, and then southwards through Burmah to the hills bordering on the Koladyne river.

DESCRIPTION.—Very like the gaur at first sight, but more clumsy looking; similarly coloured, but with a small dewlap; the legs are white as in the last species. In the skull the forehead is not concave as in the gaur, but flat, and if anything rather convex. The back has a dorsal ridge similar to that of the gaur.

The *gayal* is of a much milder disposition than the *gaur*, and is extensively domesticated, and on the frontiers of Assam is considered a valuable property by the people. The milk is rich and the flesh good. There are purely domesticated *mithuns* bred in captivity, but according to many writers the herds are recruited from the wild animals, which are tempted either to interbreed, or are captured and tamed. In Dr. F. Buchanan Hamilton's MS. (*see* Horsfield's 'Cat. Mammalia,

I. C. Mus.') the following account is given: "These people (i.e. the inhabitants of the frontiers) have tame gayals, which occasionally breed, but the greater part of their stock is bred in the woods and caught; after which, being a mild animal, it is easily domesticated. The usual manner employed to catch the full-grown gayal is to surround a field of corn with a strong fence. One narrow entrance is left, in which is placed a rope with a running noose, which secures the gayal by the neck as he enters to eat the corn; of ten so caught perhaps three are hanged by the noose running too tight, and by the violence of their struggling. Young gayals are caught by leaving in the fence holes of a size sufficient to admit a calf, but which excludes the full-grown gayal; the calves enter by these holes, which are then shut by natives who are watching, and who secure the calves. The gayal usually goes in herds of from twenty to forty, and frequents dry valleys and the sides of hills covered with



Gavæus frontalis.

forest." Professor Garrod, in his *Ungulata* in Cassell's Natural History, quotes the following account from Mr. Macrae concerning the way in which the Kookies of the Chittagong hill regions catch the wild gayal: "On discovering a herd of wild gayals in the jungle they prepare a number of balls, the size of a man's head, composed of a particular kind of earth, salt and cotton. They then drive their tame gayals towards the wild ones, when the two herds soon meet and assimilate into one, the males of the one attaching themselves to the females of the other, and *vice versâ*. The Kookies now scatter their balls over such parts of the jungles as they think the herd most likely to pass, and watch its motions. The gayals, on meeting these balls as they pass along, are attracted by their appearance and smell, and begin to lick them with their tongues, and, relishing the taste of the salt and the particular earth

composing them, they never quit the place till all the balls are consumed. The Kookies, having observed the gayals to have once tasted their balls, prepare a sufficient supply of them to answer the intended purpose, and as the gayals lick them up they throw down more; and it is to prevent their being so readily destroyed that the cotton is mixed with the earth and the salt. This process generally goes on for three changes of the moon or for a month and a-half, during which time the tame and the wild gayals are always together, licking the decoy balls, and the Kookie, after the first day or two of their being so, makes his appearance at such a distance as not to alarm the wild ones. By degrees he approaches nearer and nearer, until at length the sight of him has become so familiar that he can advance to stroke his tame gayals on the back and neck without frightening the wild ones. He next extends his hand to them and caresses them also, at the same time giving them plenty of his decoy balls to lick. Thus, in the short space of time mentioned, he is able to drive them, along with the tame ones, to his *parrah* or village, without the least exertion of force; and so attached do the gayals become to the *parrah*, that when the Kookies migrate from one place to another, they always find it necessary to set fire to the huts they are about to abandon, lest the gayals should return to them from the new grounds."

No. 466. GAVÆUS SONDAICUS.

The Burmese Wild Ox.

NATIVE NAME.—*Tsoing*, Burmese; *Banteng* of the Javanese.

HABITAT.—"Pegu, the Tenasserim provinces, and the Malayan peninsula, Sumatra, Borneo and Java; being domesticated in the island of Bali" (*Blyth*).

DESCRIPTION.—This animal resembles the gaur in many respects, and it is destitute of a dewlap, but the young and the females are bright chestnut. The bulls become black with age, excepting always the white stockings and a white patch on each buttock.

SIZE.—About the same as the last two species.

This animal has bred in captivity, and has also interbred with domestic cattle. Blyth says he saw in the Zoological Gardens of Amsterdam a bull, cow, and calf in fine condition. "The bull more especially has an indication of a hump, which, however, must be specially looked for to be noticed, and he has a broad and massive neck like the gaur, but no raised spinal ridge, nor has either of these species a deep dewlap like the gayal" ('Cat. Mamm. Burmah'). The banteng cow is much slighter in build, and has small horns that incline backwards, and she retains her bright chestnut colour permanently.

GENUS POEPHAGUS—THE YAK.

Somewhat smaller than the common ox, with large head; nose hairy, with a moderate sized bald muffle between nostrils; broad neck without dewlap; cylindrical horns; no hump or dorsal ridge, and long hair on certain parts of the body. Requires an intensely cold climate.

No. 467. POEPHAGUS GRUNNIENS.

The Yak or Grunting Ox.

NATIVE NAMES.—*Yak*, *Bubul*, *Soora-goy*, *Dong*, in Thibet; *Bun-chowr*, Hindi; *Brong-dong*, Thibetan.

HABITAT.—The high regions of Thibet and Ladakh, the valley of the Chang Chenmo, and the slopes of the Kara Koram mountains (*Kinloch*).

DESCRIPTION.—"In size it is somewhat less than the common or domestic ox. The head is large, and the neck proportionally broad, without any mane or dewlap, having a downward tendency; the horns are far apart, placed in front of the occipital ridge, cylindrical at the base, from which they rise obliquely outward and forward two-thirds of their length, when they bend inward with a semi-circular curve, the points being directed to each other from the opposite sides; the muffle is small; the border of the nostrils callous; the ears short and hairy. At the withers there is a slight elevation, but no protuberance or hump, as in the Indian ox. The dorsal ridge not prominent; body of full dimensions; rump and hinder parts proportionally large; limbs rather small and slender; hoofs smooth, square, and well defined, not expanded as in the musk-ox; anterior false hoofs small, posterior large; tail short, not reaching beyond the houghs, naked for some inches at the root, very bushy, lax, and expanded in the middle; colour black throughout, but varying in tint according to the character of the hairy covering; this, on the anterior parts, the neck, shoulders, back, and sides, is short, soft, and of a jet-black colour, but long, shaggy, pendulous, and shining on the sides of the anterior extremities, and from the medial part of the abdomen over the thighs to the hinder parts" (*Horsfield*, 'Cat. Mam. Ind. Mus.').

GENUS BUBALUS—THE BUFFALOS.

Horns very large, depressed and sub-trigonal at the base, attached to the highest line of the frontals, inclining upwards and backwards, conical towards the tip and bending upwards; muffle large, square. No hump or dorsal ridge; thirteen pairs of ribs; hoofs large.

No. 468. BUBALUS ARNI.

The Wild Buffalo (Jerdon's No. 239).

NATIVE NAMES.—*Arna* (male), *Arni* (female), *Arna-bhàinsa*, *Jangli-bhains*, Hindi; *Mung*, Bhagulpore; *Gera-erumi*, Gondi; *Karbo* of the Malays; *Moonding* of the Sundanese.

HABITAT.—In the swampy terai at the foot of the hills from Oude to Bhotan, in the plains of Lower Bengal as far west as Tirhoot, in Assam and in Burmah, in Central India from Midnapore to Rajpore, and thence nearly to the Godavery; also in Ceylon.

DESCRIPTION.—This animal so closely resembles the common

Bubalus arni.

domesticated buffalo that it seems hardly necessary to attempt a description. The wild one may be a trifle larger, but every one in India is familiar with the huge, ungainly, stupid-looking creature, with its bulky frame, black and almost hairless body, back-sweeping horns, and long narrow head.

SIZE.—A large male will stand 19 hands at the shoulder and measure 10¼ feet from nose to root of tail, which is short, reaching only to the hocks. Horns vary greatly, but the following are measurements of large pairs: In the British Museum are a pair without the skull. These horns measure 6 feet 6 inches each, which would give, when on the head, an outer curve measurement of nearly 14 feet. Another pair in the British Museum measure on the skull 12 feet 2 inches from tip to tip and across the forehead, but these horns do not exactly correspond in length and shape.

The buffalo never ascends mountains like the bison, but keeps to low and swampy ground and open grass plains, living in large herds, which occasionally split up into smaller ones during the breeding season in autumn. The female produces one, or sometimes two in the summer, after a period of gestation of ten months.

Forsyth doubts their interbreeding with the domestic race, but I see no reason for this. The two are identically the same, and numerous instances have been known of the latter joining herds of their wild brethren; and I have known cases of the domestic animal absconding from a herd and running wild. Such a one was shot by a friend of mine in a jungle many miles from the haunts of men, but yet quite out of the range of the wild animal. Probably it had been driven from a herd. Domestic buffalo bulls are much used in the Central provinces for carrying purposes. I had them yearly whilst in camp, and noticed that one old bull lorded it over the others, who stood in great awe of him; at last one day there was a great uproar; three younger animals combined, and gave him such a thrashing that he never held up his head again. In a feral state he would doubtless have left the herd and become a solitary wanderer. Dr. Jerdon, in his 'Mammals of India,' says: "Mr. Blyth states it as his opinion that, except in the valley of the Ganges and Burrampooter, it has been introduced and become feral. With this view I cannot agree, and had Mr. Blyth seen the huge buffalos I saw on the Indrawutty river (in 1857), he would, I think, have changed his opinion. They have hitherto not been recorded south of Raepore, but where I saw them is nearly 200 miles south. I doubt if they cross the Godavery river.

"I have seen them repeatedly, and killed several in the Purneah district. Here they frequent the immense tracts of long grass abounding in dense, swampy thickets, bristling with canes and wild roses; and in these spots, or in the long elephant-grass on the bank of jheels, the buffalos lie during the heat of the day. They feed chiefly at night or early in the morning, often making sad havoc in the fields, and retire in general before the sun is high. They are by no means shy (unless they have been much hunted), and even on an elephant, without which they could not be successfully hunted, may often be approached within good shooting distance. A wounded one will occasionally charge the elephant, and, as I have heard from many sportsmen, will sometimes overthrow the elephant. I have been charged by a small herd, but a shot or two as they are advancing will usually scatter them."

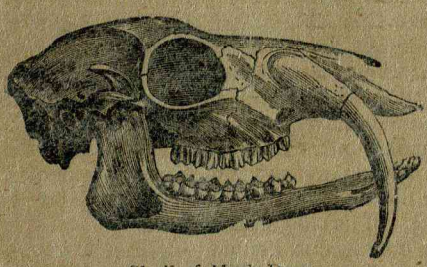
The buffalo is, I should say, a courageous animal—at least it shows itself so in the domesticated state. A number of them together will not hesitate to charge a tiger, for which purpose they are often used to drive a wounded tiger out of cover. A herdsman was once seized by a man-eater one afternoon a few hundred yards from my tent. His

saws fled, but his buffalos, hearing his cries, rushed up and saved him.

The attachment evinced by these uncouth creatures to their keepers was once strongly brought to my notice in the Mutiny. In beating up the broken forces of a rebel Thakoor, whom we had defeated the previous day, I, with a few troopers, ran some of them to bay in a rocky ravine. Amongst them was a Brahmin who had a buffalo cow. This creature followed her master, who was with us as a prisoner, for the whole day, keeping at a distance from the troops, but within call of her owner's voice. When we made a short halt in the afternoon, the man offered to give us some milk; she came to his call at once, and we had a grateful draught, the more welcome as we had had nothing to eat since the previous night. That buffalo saved her master's life, for when in the evening the prisoners were brought up to court martial and sentenced to be hanged, extenuating circumstances were urged for our friend with the buffalo, and he was allowed to go, as I could testify he had not been found with arms in his hands; and I had the greatest pleasure in telling him to be off, and have nothing more to do with rebel Thakoors. Jerdon says the milk of the buffalo is richer than that of the cow. I doubt this. I know that in rearing wild animals buffalos' milk is better than cows' milk, which is far too rich, and requires plentiful dilution with water.

There is a very curious little animal allied to the buffalo, of which we have, or have had, a specimen in the Zoological Gardens at Alipore—the *Anoa depressicornis*; it comes from the Island of Celebes, and seems to link the buffalo with the deer. It is black, with short wavy hair.

Before passing on to the true Cervidæ I must here place an animal commonly called a deer, and generally classed as such—the musk-deer according to some naturalists. There is no reason, save an insufficient one, that this creature should be so called and classed, there being much evidence in favour of its alliance to the antelopes. In the first place it has a gall bladder, which the Cervidæ have not, with the exception, according to Dr. Crisp, of the axis ('P. Z. S.'). On the other hand it has large canine tusks like the muntjacs, deerlets, and water-deer, and, as these are all aberrant forms of the true Cervidæ, there is no reason why

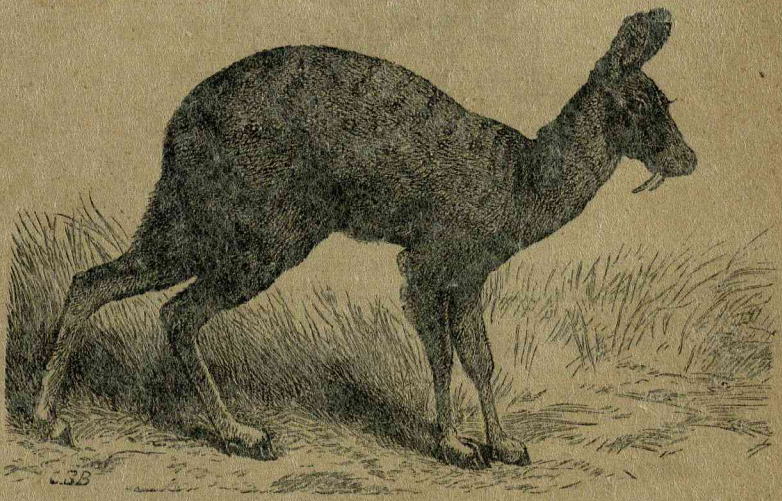


Skull of Musk Deer.

the same character should not be developed in the antelopes. Its hair is more of the goat than the deer, and the total absence of horns removes a decided proof in favour of one or the other. The feet are more like some of the Bovidæ than the generality of deer, with the exception, perhaps, of *Rangifer* (the reindeer), the toes being very much cloven and capable of grasping the rocky ground on which it is found. A very eminent authority, however, Professor Flower, is in favour of placing the musk-deer with the Cervidæ, and he instances the absence of horns as in favour of this opinion, for in none of the Bovidæ are the males hornless. There are many other points also, such as the fawns being spotted, some intestinal peculiarities, and the molar and pre-molar teeth being strictly cervine, which strengthen him in his opinion. (*See* article on the structure and affinities of the musk-deer, 'P. Z. S.' 1879, p. 159.)

GENUS MOSCHUS—THE MUSK DEER.

Canines in both sexes, very long and slender in the male; no horns; feet much cloven, with large false hoofs that touch the ground; the



Moschus moschiferus.

medium metacarpels fused into a solid cannon bone; in the skull the intermaxillaries join the nasals; hinder part of tarsus hairy; fur thick,

elastic, and brittle; muffle large; no eye, feet, or groin-pits; a large gland or præputial bag under the stomach in the males, which contains the secretion known in commerce as "musk."

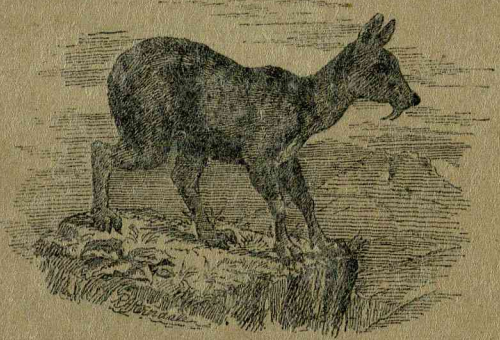
No. 469. MOSCHUS MOSCHIFERUS.

The Musk Deer.

NATIVE NAMES.—*Kastura*, Hindi; *Rous*, *Roos*, and *Kasturé*, in Kashmir; *La-lawa*, Thibetan; *Rib-jo*, Ladakhi; *Bena* in Kunawur (*Jerdon*); *Mussuck-nabá*, Pahari (*Kinloch*).

HABITAT.—Throughout the Himalayas at elevations above 8000 feet, extending also through Central and Northern Asia as far as Siberia.

DESCRIPTION.—It is difficult to describe the colour of this animal, for it so constantly changes; and, as I do not know the creature personally,



Moschus moschiferus.

I think it better to give the recorded opinions of three writers who have had personal experience. Markham describes it as a dark speckled brownish-grey, nearly black on the hind-quarters, edged down the inside with reddish-yellow; the throat, belly, and legs lighter grey. Leith Adams ('P. Z. S.' 1858, p. 528) says: "Some are very dark on the upper parts, with black splashes on the back and hips; under-parts white or a dirty white. Others are of a yellowish-white all over the upper parts, with the belly and inner sides of the thighs white. A brownish-black variety is common, with a few white spots arranged longitudinally on the back—the latter I found were young." Kinloch writes: "The prevailing colour is brownish-grey, varying in shade on the back, where it is darkest, so as to give the animal a mottled or brindled appearance."

SIZE.—Length, about 3 feet; height, 22 inches.

The musk-deer is a forest-loving animal, keeping much to one locality. It bounds with amazing agility over the steepest ground, and is wonderfully sure-footed over the most rocky hills. It ruts in winter, produces one or two young, which are driven off in about six weeks' time by the mother to shift for themselves. They begin to produce at an early age—within a year. The musk bag is an abdominal or præputial gland which secretes about an ounce of musk, worth from ten to fifteen rupees. It is most full in the rutting season; in the summer, according to Leith Adams, it hardly contains any. The musk does not seem to affect the flavour of the meat, which is considered excellent.

CERVIDÆ—THE DEER.

Of the horned ruminants these are the most interesting. In all parts of the world, Old and New, save the great continental island of Australia, one or other kind of stag is familiar to the people, and is the object of the chase. The oldest writings contain allusions to it, and it is frequently mentioned in the Scriptures.

"Like as the hart desireth the water brooks,"

sang David. It is bound up in history and romance, and the chase of it in England is to this day a royal pastime.

However, to come back from the poetry of the thing to dry scientific details, I must premise that the two main distinctions of the Cervidæ, as separating them from the Bovidæ, are horns which are not persistent, but annually shed, and the absence of a gall bladder, which is present in nearly all the Bovidæ. The deer also, with one exception (the reindeer, *Rangifer tarandus*) have horns only in the males.

Regarding the shedding of these horns, it is supposed that the operation is connected with the sexual functions. It is a curious fact that castration has a powerful effect on this operation; if done early no horns appear; if later in life, the horns become persistent and are not shed.

Captain James Forsyth (in his 'Highlands of Central India'), was of opinion that the Sambar does not shed its horns annually, and states that this also is the opinion of native shikaris in Central India. This, however, requires further investigation. I certainly never heard of such a theory amongst them, nor noticed the departure from the normal state.

There have been several classifications of the Cervidæ, but I think the most complete and desirable one is that of Sir Victor Brooke (*see* 'P. Z. S.' 1878, p. 883), which I shall endeavour to give in a condensed

fossa. Dr. Gray's classification was based on three forms of antlers and the shape of the tail. But Sir Victor Brooke's is founded on more reliable osteological details. As I before stated in my introductory remarks on the Ruminantia, the first and fourth digits, there being no thumb, are but rudimentary, the metacarpal bones being reduced to mere splints; the digital phalanges are always in the same place, and bear the little false hoofs, which are situated behind and a little above the large centre ones, but the metacarpal splint is not always in the same place; it may either be annexed to the phalanges, or widely separated from them and placed directly under the carpus. The position of these splints is an important factor in the classification of the Cervidæ into two divisions, distinguished by Sir Victor Brooke as the *Plesiometacarpals*, in which the splint is near the carpus, and the *Telemetacarpals*, in which the splint is far from the carpus, and articulated with the digital phalanges. All the known species of deer can be classified under these two heads; and it is a significant fact that this pedal division is borne out by certain cranial peculiarities discovered by Professor Garrod, and also, to a certain extent, by an arrangement of hair-tufts on the tarsus and metatarsus. In the Old World deer, which are with few exceptions *Plesiometacarpi*, those which have these tufts have them above the middle of the metatarsus, and those of the New World, which are, with one exception, *Telemetacarpi*, have them, when present, below the middle of the metatarsus.

There is also another character in addition to the cranial one before alluded to, which was also noticed by Professor Garrod. The first cranial peculiarity is that in *Telemetacarpi*, as a rule, the vertical plate developed from the lower surface of the vomer is prolonged sufficiently downwards and backwards to become anchylosed to the horizontal plate of the palatals, forming a septum completely dividing the nasal cavity into two chambers. In the *Plesiometacarpi* this vertical plate is not sufficiently developed to reach the horizontal plate of the palatals. The second cranial peculiarity is that in the Old World deer (*Plesiometacarpi*), the ascending rami of the premaxillæ articulate with the nasals with one or two exceptions, whereas in the New World deer (*Telemetacarpi*), with one or two exceptions, the rami of the premaxillæ do not reach the nasals. It will thus be seen that the osteological characters of the head and feet agree in a singularly fortunate manner, and, when taken in connection with the external signs afforded by the metatarsal tufts, prove conclusively the value of the system. In India we have to deal exclusively with the *Plesiometacarpi*, our nearest members of the other division being the Chinese water-deer (*Hydropotes inermis*), and probably *Capreolus pygargus* from Yarkand, the horns of a roebuck in velvet attached to a strip of skin having been brought down by the Mission to that country in 1873–74.

Now comes the more difficult task of subdividing these sections into genera—a subject which has taxed the powers of many naturalists, and which is still in a far from perfect state. To all proposed arrangements some exception can be taken, and the following system is not free from objection, but it is on the whole the most reliable; and this system is founded on the form of the antler, which runs from a single spike, as in the South American *Coassus*, to the many branches of the red deer (*Cervus elaphas*); and all the various changes on which we found genera are in successive stages produced in the red deer, which we may accept as the highest development; for instance, the stag in its first year develops but a single straight "beam" antler, when it is called a "brocket," and it is the same as the South American brocket (*Coassus*). On this being shed the next spring produces a small branch from the base of this beam, called the brow antler, which is identical almost with the single bifurcated horn of the *Furcifer* from Chili. The stag is then technically known as a "spayad." In the third year an extra front branch is formed, known as the tres-tine. The antler then resembles the rusine type, of which our sambar stag is an example. In the fourth year the top of the main beam throws out several small tines called "sur-royals," and the brow antler receives an addition higher up called the "bez-tine." The animal is then a "staggard." In the fifth year the "sur-royals" become more numerous, and the whole antler heavier in the "stag," whose next promotion is to that of "great hart" of ten or more points. The finest heads are found in the German forests. Sir Victor Brooke alludes to some in the hunting Schloss of Moritzburg of the 15th to 17th century, of enormous size, bearing from 25 to 50 points—50 inches round the outside curve, 10 inches in circumference round the *smallest* part of the beam, and of one of which the spread between the coronal tines is 74 inches. Professor Garrod mentions one as having sixty-six points, and states that Lord Powerscourt has in his possession a pair with forty-five tines. The deer with which we have to deal range from the elaphine, or red deer type, to the simple bifurcated antler of the muntjac, which consists of a beam and brow antler only. We then come to the rusine type of three points only—brow, tres, and royal tines, and of this number are also the spotted and hog deer of India, but the arrangement of the tines is different; and following the rusine type comes the rucervine, in which the tres and royal tines break out into points—the tres-tine usually bifurcate, and the royal with two, three or more points. The arrangements of the main limbs of the horns is strictly rusine—that is to say, the external and anterior tine is equal to or shorter than the royal tine, whereas it is the reverse in the axis (spotted deer), and therefore this genus should come between the two. Even in the sambar and axis there is a tendency to throw out abnormal tines. There are many

examples in the Indian Museum, and I possess a magnificent head which bears a large abnormal tine on one horn, and a faint inclination in the corresponding spot on the other horn to do likewise. I have no doubt, had the animal lived another year, the second extra tine would

Stag with Horns matured.

have been developed. Professor Garrod has three phases of the rucervine type, which he calls the normal, the intermediate, and the extreme. The first has both branches of the beam, tres and royal of equal size (*ex.* Schomburgk's deer); the second has the tres-tine larger than the royal (*ex.* our swamp deer); and the extreme type is that in

with the royal is represented merely by a snag, the whole horn being bent forward (*ex.* the Burmese *Panolia Eldii*). The true cervine type of horn I have already described in its progress from youth to age. The Kashmir and Sikim stags are the representatives of this form in India. In Japan there is an intermediate form in *Cervus sika* which has no bez-tine.

Deer have large eye-pits, but no groin-pits; feet-pits in all four, or sometimes only in the hind feet. The female has four mammæ.

Stag with Horns in velvet.

At the time of reproduction of the antlers a strong determination of blood to the head takes place, enlarging the vessels, and a fibro-cartilaginous substance is formed, which grows rapidly, and takes the form of the antler of the species. The horns in their early stage are soft and full of blood-vessels on the surface, covered with a delicate skin, with fine close-set hairs commonly called the velvet.

"As the horns ossify the periosteal veins become enlarged, grooving the external surface; the arteries are enclosed by hard osseus tubercles

at the base of the horns, which coalesce and render them impervious, and, the supply of nutriment being thus cut off, the envelopes shrivel up and fall off, and the animals perfect the desquamation by rubbing their horns against trees, technically called 'burnishing.'"—*Jerdon.*

We now begin with the simplest form of tine we have, viz. with one basal snag only.

GENUS CERVULUS—THE MUNTJACS OR RIB-FACED DEER.

Of small size, slightly higher at the croup than at the shoulders; short tail; large pits in hind feet; no groin-pits; no tuft on the metatarsus. This genus is specially characterised, according to Sir Victor Brooke, by the absence of the lateral digital phalanges on all four feet; the proximal ends of the metacarpals are however present; horns situated on high pedicles of bone, covered with hair, continued down the face in two longitudinal ridges, between which the skin is ridged or puckered; horns small, composed of a single beam with a basal snag; skull with a very large, deep sub-orbital pit; forehead concave; large canine tusks in the upper jaw; moderate, moist muffle.

No. 470. CERVULUS MUNTJAC *vel* AUREUS.

The Muntjac or Rib-faced Deer (*Jerdon's No.* 223).

NATIVE NAMES.—*Kakur*, *Bherki*, *Jangli-bakra*, Hindi; *Maya* Bengali; *Ratwa*, in Nepal; *Karsiar*, Bhotia; *Siku* or *Suku*, Lepcha; *Gutra*, *Gutri*, Gondi; *Bekra* or *Baikur*, Mahrathi; *Kankuri*, Canarese; *Kuka-gori*, Telegu; *Gee*, Burmese; *Kidang*, Javanese; *Muntjac*, Sundanese; *Kijang*, Malayan of Sumatra; *Welly* or *Hoola-mooha*, Singhalese.

HABITAT.—India, Burmah, Ceylon, the Malay peninsula, Sumatra, Java, Hainan, Banka and Borneo.

DESCRIPTION.—Between the facial ridges the creases are dark brown, with a dark line running up the inside of each frontal pedestal; all the rest of the head and upper parts a bright rufous bay; chin, throat, inside of hind-legs, and beneath tail, white; some white spots in front of the fetlocks of all four legs; fore-legs from the shoulder downwards, the legs under the tarsal joints, and a line in front of hind-legs, dark blackish-brown. The doe is a little smaller, and has little black bristly knobs where the horns of the buck are.

SIZE.—Head and body, about 3½ feet; tail, 7 inches; height, 26 to 28 inches. Jerdon gives the size of the horn 8 to 10 inches, but in this he doubtless included the pedicle, which is about 5 inches, and the

horns, from 2 to 5 inches. Of the only specimen I have at present in my collection the posterior measurement from cranium to tip of horn is 6½ inches, of which the bony pedicle is 3 inches.

It is a question whether we should separate the Indian from the Malayan animal. The leading authority of the day on the Cervidæ, Sir Victor Brooke, was of opinion some time back (*see* 'P. Z. S.,' 1874,

Cervulus aureus.

p. 38), that the species were identical. He says: "In a large collection of the skins, skulls, and horns of this species, which I have received from all parts of India and Burmah, and in a considerable number of living specimens which I have examined, I have observed amongst adult animals so much difference in size and intensity of coloration that I have found it impossible to retain the muntjac of Java and Sumatra as a distinct species. The muntjacs from the south of India

are as a rule, smaller than those from the north, as is also the case with the axis and Indian antelope. But even this rule is subject to many exceptions. I have received from Northern India perfectly adult, and even slightly aged, specimens of both muntjac and axis inferior in size to the average as presented by these species in Southern India. These small races are always connected with particular areas, and are doubtless the result of conditions sufficiently unfavourable to prevent the species reaching the full luxuriance of growth and beauty of which it is capable, though not sufficiently rigorous to prevent its existence." In a later article on the Cervidæ, written four years afterwards, he seems, however, to qualify his opinion in the following words: "This species appears to attain a larger size in Java, Sumatra, and Borneo than it does on the mainland; and I think it not improbable that persistent race characters may eventually be found distinguishing the muntjac of these islands from that of British India."

The rib-face is a retiring little animal, and is generally found alone, or at times in pairs. Captain Baldwin mentions four having been seen together at one time, and General McMaster mentions three; but these are rare cases.

It is very subtle in its movements, carrying its head low, and creeping, as Hodgson remarks, like a weasel under tangled thickets and fallen timber. In captivity I have found it to be a coarse feeder, and would eat meat of all kinds greedily.

Its canine teeth are very long and sharp, and have a certain amount of play in the socket, but I am unable to state whether they are ever used for any purpose, whether of utility or defence. Its call is a hoarse, sharp bark, whence it takes its name of barking deer. What Jerdon says about the length of its tongue is true; it can certainly lick a good portion of its face with it.

For excellent detailed accounts of this little deer I must refer my readers to Kinloch's 'Large Game Shooting,' and a letter by "Hawkeye," quoted by McMaster's 'Notes on Jerdon.' My space here will not allow of my quoting largely or giving personal experience, but both the above articles, as well as Captain Baldwin's notice, nearly exhaust the literature on this subject in a popular way.

The next development of antler is the rusine type, in which the main beam divides at the top into two branches, making with the basal tine a horn of three points only.

GENUS RUSA—THE RUSINE DEER.

Antlers with a brow tine, the beam bifurcating into a tres and royal tine; muffle large; lachrymal fossa large and deep; ante-orbital vacuity very large; rudimentary canines in both sexes, except in the hog deer; tail of moderate length; no feet-pits. The males heavily maned.

No. 471. RUSA ARISTOTELIS.

The Sambar (*Jerdon's No.* 220).

NATIVE NAMES.—*Sambar* or *Samhar*, Hindi; *Jerai* and *Jerao* in the Himalayas; *Maha* in the Terai; *Meru*, Mahrathi; *Ma-oo*, Gondi;

Rusa Aristotelis.

Kadavi or *Kadaba*, Canarese; *Kannadi*, Telegu; *Ghous* or *Gaoj*, Eastern Bengal, the female *Bholongi* (*Jerdon*); *Schap*, Burmese (*Blyth*); *Gona-rusa*, Singhalese (*Kellaart*).

HABITAT.—Throughout India from the Himalayas to Cape Comorin; through Assam round to the east of the Bay of Bengal, down through Burmah to the Malay peninsula; it is also found in Ceylon.

DESCRIPTION.—The sambar stag is a grand animal, with fine erect carriage, heavily maned neck, and with massive horns of the rusine

type. In size it is considerably larger than the red deer, and, though its horns are not so elegant, it is in its *tout ensemble* quite as striking an animal. In colour it is dark brown, somewhat slaty in summer; the chin, inside of limbs and tail, and a patch on the buttocks yellowish or orange yellow. The head of the sambar is very fine; the eye large and full, with immense eye-pits, which can be almost reversed or greatly dilated during excitement. The ears are large and bell-shaped, and the throat surrounded by a shaggy mane—truly a noble creature. The female and young are lighter.

SIZE.—A large stag will stand 14 hands at the withers, the length of the body being from 6 to 7 feet; tail about a foot; ears 7 to 8 inches. The average size of horns is about 3 feet, but some are occasionally found over 40 inches. Jerdon says: "some are recorded 4 feet along the curvature; the basal antler 10 to 12 inches or more." A very fine pair, with skull, in my own collection, which I value much, show the following measurements: right horn, 45 inches; left horn, 43 inches; brow antler from burr to tip, 18¼ inches circumference; just above the burr, 9 inches; circumference half-way up the beam, 7¼ inches. On the right horn underneath the tres-tine is an abnormal snag 9 inches long. The left horn has an indication of a similar branch, there being a small point, which I have no doubt would have been more fully developed had the animal lived another year.

I have had no experience of deer-shooting in the regions inhabited by the Kashmir and Sikim stags, which are approximate to our English red deer; but no sportsman need wish for a nobler quarry than a fine male sambar.

As I write visions of the past rise before me—of dewy mornings ere the sun was up; the fresh breeze at daybreak, and the waking cry of the koel and peacock, or the call of the painted partridge; then, as we move cautiously through the jungle that skirts the foot of the rocky range of hills, how the heart bounds when, stepping behind a sheltering bush, we watch the noble stag coming leisurely up the slope! How grand he looks!—with his proud carriage and shaggy, massive neck, sauntering slowly up the rise, stopping now and then to cull a berry, or to scratch his sides with his wide, sweeping antlers, looming large and almost black through the morning mists, which have deepened his dark brown hide, reminding one of Landseer's picture of 'The Challenge.' Stalking sambar is by far the most enjoyable and sportsmanlike way of killing them, but more are shot in *battues*, or over water when they come down to drink. According to native shikaris the sambar drinks only every third day, whereas the nylgao drinks daily; and this tallies with my own experience—in places where sambar were scarce I have found a better chance of getting one over water when the footprints were about a couple of days old. An exciting way of hunting this animal is

practised by the Bunjaras, or gipsies of Central India. They fairly run it to bay with dogs, and then spear it. I have given in 'Seonee' a description of the *modus operandi*.

When wounded or brought to bay the sambar is no ignoble foe; even a female has an awkward way of rearing up and striking out with her fore-feet. A large hind in my collection at Seonee once seriously hurt the keeper in this manner.

Those who have read 'The Old Forest Ranger,' by Colonel Campbell, have read in it one of the finest descriptions of the stalking of this noble animal. I almost feel tempted to give it a place here; but it must give way to an extract from a less widely known, though as graphic a writer, "Hawkeye," whose letters to the *South of India Observer* deserve a wider circulation. I cannot find space for more than a few paragraphs, but from them the reader may judge how interesting the whole article is:—

"The hill-side we now are on rapidly falls towards the river below, where it rushes over a precipice, forming a grand waterfall, beautiful to behold. The hill-side is covered with a short, scrubby rough-leafed plant, about a foot and a-half high. Bending low, we circle round the shoulder of the slope, beyond the wood. The quick eye of the stalker catches sight of a hind's ears, at the very spot he hoped for. The stag must be nigh.

"Down on all-fours we move carefully along, the stalker keenly watching the ears. A short distance gained, and the hind detects the movement of our heads. At the same moment the upper tines of the stag's antlers are in sight; he lies to the right of the hind, about 120 yards distant, hidden by an inequality of the ground. Be still, oh beating heart! Be quiet, oh throbbing pulse! Steady, oh shaky hand, or all your toil is vain! Onward, yet only a few paces! Be not alarmed, oh cautious hind! We care not for you. Crouching still lower, we gain ground; the head and neck of our noble quarry are in sight; the hind still gazes intensely. Presently she elongates her neck in a most marvellous manner. We still gain. On once more we move, when up starts the hind. We know that in another moment she will give the warning bell, and all will vanish. The time for action has arrived. We alter our position in a second, bring the deadly weapon to bear on the stag; quickly draw a steady bead, hugging the rifle with all our might, and fire! The hinds flash across our vision like the figures in a magic lantern, and the stag lies weltering in his couch."

GENUS AXIS.

Horns of the rusine type, but with the tres-tine longer than the royal or posterior tine; beam much bent; horns paler and smoother than in the sambar; large muffle and eye-pits; canines moderate; feet-pits in the hind-feet only; also groin-pits; tail of moderate length; skin spotted with white; said to possess a gall-bladder.

No. 472. AXIS MACULATUS.

The Spotted Deer (Jerdon's No. 221).

NATIVE NAMES.—*Chital, Chitra, Chritri-jhank.* (the male), Hindi; *Chatidah* in Bhagulpore; *Boro-khotiya*, Bengali at Rungpore; *Buriya*, in Gorukpore; *Saraga*, Canarese; *Dupi*, Telegu; *Lupi*, Gondi (*Jerdon*); *Tic-mooha*, Singhalese (*Kellaart*); *Sarga, Jati, Mikka*, Canarese (*Sanderson*).

HABITAT.—Throughout India, with the exception of the Punjab; nor is it found, I believe, in the countries east of the Bay of Bengal. It is however obtained in Ceylon, where it has been classed by Kellaart as a distinct species, *A. oryzeus.*

DESCRIPTION.—General colour like that of the English fallow deer, yellowish or rufous fawn, spotted with white; the spots on the sides low down assuming an elongated shape, forming lines; a dark dorsal stripe from nape to tail; head brownish, unspotted; muzzle dark; ears dark externally, white within; chin, throat, and under-parts whitish, as also the inside of limbs and tail; the horns frequently throw out snags on the brow antler.

SIZE.—Length, 4½ to 5 feet. Height at shoulder, 36 to 38 inches. I regret I cannot give accurate measurements just now of horns, as I am writing on board ship, with all my specimens and most of my books boxed up, but I should say 30 inches an average good horn. Jerdon does not give any details.

This deer is generally found in forests bordering streams. I have never found it at any great distance from water; it is gregarious, and is found in herds of thirty and forty in favourable localities. Generally spotted deer and lovely scenery are found together, at all events in Central India. The very name *chital* recalls to me the loveliest bits of the rivers of the Central provinces, the Nerbudda, the Pench, the Bangunga, and the bright little Hirrie. Where the bamboo bends over the water, and the *kouha* and *saj* make sunless glades, there will be found the bonny dappled hides of the fairest of India's deer. There

is no more beautiful sight in creation than a *chital* stag in a sun-flecked dell when—

"Ere his fleet career he took
The dewdrops from his flanks he shook;
Like crested leader, proud and high,
Toss'd his beam'd frontlet to the sky;
A moment gazed adown the dale,
A moment snuff'd the tainted gale,
A moment listen'd to the cry
That thicken'd as the chase drew nigh;
Then, as the headmost foes appeared,
With one brave bound the copse he clear'd."

Axis maculatus.

Here I may fitly quote again from "Hawkeye," whose descriptions are charming: "Imagine a forest glade, the graceful bamboo arching

overhead, forming a lovely vista, with here and there bright spots and deep shadows—the effect of the sun's rays struggling to penetrate the leafy roof of nature's aisle. Deep in the solitude of the woods see now the dappled herd, and watch the handsome buck as he roams here and there in the midst of his harem, or, browsing amongst the bushes, exhibits his graceful antlers to the lurking foe, who by patient woodcraft has succeeded in approaching his unsuspecting victim; observe how proudly he holds himself, as some other buck of less pretensions dares to approach the ladies of the group; see how he advances, as on tiptoe, all the hair of his body standing on end, and with a thundering rush drives headlong away this bold intruder, and then comes swaggering back! But, hark—a twig has broken! Suddenly the buck wheels round, facing the quarter whence the sound proceeded. Look at him now, and say, is he not a quarry well worth the hunter's notice?

"With head erect, antlers thrown back, his white throat exposed, his tail raised, his whole body gathered together, prepared to bound away into the deep forest in the twinkling of an eye, he stands a splendid specimen of the cervine tribe. We will not kill him; we look and admire! A doe suddenly gives that imperceptible signal to which I have formerly alluded, and the next moment the whole herd has dashed through the bamboo alleys, vanishing from sight—a dappled hide now and again gleaming in the sunlight as its owner scampers away to more distant haunts."

Jerdon is a follower of Hodgson, who was of opinion that there are two species of spotted deer—a larger and smaller, the latter inhabiting Southern India; but there is no reason for adopting this theory; both Blyth, Gray, and others have ignored this, and the most that can be conceded is that the southern animal is a variety owing to climatic conditions. Multiplication of species is a thing to be avoided of all naturalists—I have, therefore, not separated them. McMaster too writes: "I cannot agree with Jerdon that there are two species of spotted deer." And he had experience in Southern India as well as in other parts. He states that the finest *chital* he ever came across were found in the forests in Goomsoor, where, he adds, "as in every other part of Orissa, both spotted deer and sambar are, I think, more than usually large."

No. 473. AXIS PORCINUS.

The Hog Deer (*Jerdon's No.* 222).

NATIVE NAMES.—*Para*, Hindi; Jerdon also gives *Khar-laguna*, Nepal Terai; *Sugoria* also in some parts. *Nuthurini-haran* in some parts of Bengal; *Weel-mooha*, Singhalese (*Kellaart.*)

HABITAT.—Throughout India, though scarce in the central parts; it

is abundant in Assam and Burmah, and is also found in Ceylon, but is stated not to occur in Malabar.

DESCRIPTION.—"Light chestnut or olive-brown, with an eye-spot; the margin of the lips, the tail beneath, limbs within, and abdomen, white—in summer many assume a paler and more yellow tint, and get a few white spots, and the old buck assumes a dark slaty colour; the horns resemble those of a young spotted deer, with both the basal and upper tines very small, the former pointing directly upwards at a very acute angle, and the latter directed backwards and inwards, nearly at a

Axis porcinus.

right angle, occasionally pointing downwards" (*Jerdon*). McMaster says: "I can corroborate Jerdon's statement that the young of this deer are beautifully spotted; but, although I have seen many specimens, dead and alive, and still more of the skins while I was in Burmah, I do not remember having remarked the few white spots which he says many of them assume in summer." The fawns lose their spots at about six months.

SIZE.—Length, 42 to 44 inches; tail, 8 inches; height, 27 to 28. Average length of horns, 15 to 16 inches.

This animal is seldom found in forest land; it seems to prefer open grass jungle, lying sheltered during the day in thick patches, and lies close till almost run upon by beaters or elephants. Its gait is awkward, with some resemblance to that of a hog carrying its head low; it is not speedy, and can easily be run down by dogs in the open. McMaster writes: "Great numbers of these deer are each season killed by Burmans, being mobbed with dogs." The meat is fair. Hog deer are not gregarious like *chital*; they are usually solitary, though found occasionally in pairs.

The horns are shed about April, and the rutting season is September and October. This species and the spotted deer have interbred, and the hybrid progeny survived.

The next stage from the rusine to the cervine or elaphine type is the rucervine. In this the tres-tine, as well as the royal tine, throw out branches, and in the normal rucervine type the tres and royal are equal as in Schomburgk's deer, but in the extreme type, *Panolia* or *Rucervus Eldii* of Burmah, the tres-tine is greatly developed, whilst the royal is reduced to a mere snag. The Indian swamp-deer (*Rucervus Duvaucelli*) is intermediate, both tres and royal tines are developed, but the former is much larger than the royal. In none of the rucervine forms is the bez-tine produced.

GENUS RUCERVUS.

Horns as above; muzzle pointed. Canines in males only.

No. 474. RUCERVUS DUVAUCELLI.

The Swamp-Deer (*Jerdon's No.* 219).

NATIVE NAMES.—*Bara-singha*, Hindi; *Baraya* and *Maha* in the Nepal Terai; *Jhinkar* in Kyarda Doon; *Potiyaharan* at Monghyr (*Jerdon*); *Goen* or *Goenjak* (male), *Gaoni* (female), in Central India.

HABITAT.—"In the forest lands at the foot of the Himalayas, from the Kyarda Doon to Bhotan. It is very abundant in Assam, inhabiting the islands and churs of the Berhampooter, extending down the river in suitable spots to the eastern Sunderbunds. It is also stated to occur near Monghyr, and thence extends sparingly through the great forest tract of Central India" (Jerdon's 'Mamm. Ind.'). I have found it in abundance in the Raigarh Bichia tracts of Mundla, at one time attached to the Seonee district, but now I think incorporated in the new district of Balaghat. In the open valleys, studded with sal forest, of the Thanwur, Halone, and Bunjar tributaries of the Nerbudda, may be found bits reminding one of English parks, with noble herds of this

handsome deer. It seems to love water and open country. McMaster states that it is found in the Golcondah Zemindary near Daraconda.

DESCRIPTION.—Smaller and lighter than the sambar. Colour rich light yellow or chestnut in summer, yellowish-brown in winter, sometimes very light, paler below and inside the limbs, white under the tail. The females are lighter; the young spotted.

SIZE.—Height, about 44 to 46 inches; horns, about 36 inches. They have commonly from twelve to fourteen points, but Jerdon states he has seen them with seventeen.

Like the spotted deer this species is gregarious; one writer, speaking of them in Central India, says: "The plain stretched away in gentle undulations towards the river, distant about a mile, and on it were three large herds of bara singhas feeding at one time; the nearest was not more than five hundred yards away from where I stood. There must have been at least fifty of them—stags, hinds, and fawns, feeding together in a lump, and outside the herd grazed three most enormous stags" ('Indian Sporting Review,' quoted by Jerdon).

No. 475. RUCERVUS *vel* PANOLIA ELDII.

The Brow Antlered or Eld's Deer.

NATIVE NAMES.—*Thamin*, in Burmah; *Sungrai* or *Sunguaie*, in Munipur, Eastern Himalayas, Terai, Munipur, Burmah, Siam, and the Malay peninsula.

DESCRIPTION.—In body similar to the last, but with much difference in the horns, the tres-tine being greatly developed at the expense of the royal, which gives the antlers a forward cast; the brow-tine is also very long. In summer it is a light rufous brown, with a few faint indications of white spots; the under-parts and insides of ears nearly white; the tail short and black above. It is said to become darker in winter instead of lighter as in the last species.

SIZE.—Height from 12 to 13 hands.

This deer, which is identical with *Cervus frontalis* and Hodgson's *Cervus dimorpha*, and which was discovered in 1838 by Captain Eld, has been well described by Lieutenant R. C. Beavan. The following extracts have been quoted by Professor Garrod; the full account will be found in the 'Journal of the Asiatic Society of Bengal.' The food of this species seems to consist of grass and wild paddy. "In habits they are very wary and difficult of approach, especially the males. They are also very timid and easily startled. The males, however, when wounded and brought to bay with dogs, get very savage, and charge vigorously. On being disturbed they invariably make for the open instead of resorting to the heavy jungle, like hog deer and sambar. In fact the thamyn is essentially a plain-loving species; and although it

frequent tolerably open tree-jungle for the sake of its shade, it will never venture into dense and matted underwood. When first started the pace of the thamyn is great. It commences by giving three or four large bounds, like the axis or spotted deer, and afterwards settles down into a long trot, which it will keep up for six or seven miles on end when frequently disturbed."

The next phase of development of which we have examples in India is the true cervine or elaphine type of horn in which the brow-tine is doubled by the addition of the bez; the royal is greatly enlarged at the expense of the tres-tine, and breaks out into the branches known as the sur-royals.

GENUS CERVUS.

Horns as above, muzzle pointed, muffle large and broad, with a hairy band above the lip; hair coarse, and usually deep brown, with a light and sometimes almost white disc or patch round the tail, which is very short; eye-pits moderate.

No. 476. CERVUS CASHMIRIANUS.

The Kashmir Stag.

Cervus Wallichii of Jerdon (*No.* 217).

NATIVE NAMES.—*Hangul* or *Honglu* in Kashmir; *Barasingha*, Hindi.

HABITAT.—Kashmir. Jerdon also gives out that it is found throughout great part of Western and Central Asia, as far as the eastern shores of the Euxine Sea, and that it is common in Persia, where it is called *maral*; but according to careful observations made by Sir Victor Brooke the *maral* is a distinct species, to which I will allude further on. In Kashmir it frequents the Sind valley and its offshoots; the country above also.

DESCRIPTION.—Brownish-ash, darker along the dorsal line; caudal disk white, with a dark border; sides and limbs paler; ears light coloured; lips and chin and a circle round eyes white. The male has very long and shaggy hair on the lower part of the neck. The colour of the coat varies but little; at times it is liver-coloured or liver-brown, sometimes "bright pale rufous chestnut," with reddish patches on the inner sides of the hips. Jerdon says: "The belly of the male is dark brown, contrasting with the pale ashy hue of the lower part of the flanks; the legs have a pale dusky median line. In females the whole lower parts are albescent."

SIZE.—Length, 7 to 7½ feet; height, 12 to 13 hands; tail, 5 inches. The horns are very large and massive, with from ten to fifteen, or even

many points. Jerdon states that even eighteen points have been counted, but such cases are rare. Dr. Leith Adams says the largest he ever measured were four feet round the curves. "A. E. W." in his

Cervus Cashmirianus.

interesting papers on Kashmir game, published in *The Asian*, gives the following measurements of two heads :—

Length of horns.	Girth above brow antler.	Divergency at tips.		Where obtained.
		Greatest.	Least.	
inches.	inches.			
47	$7\frac{5}{8}$	56 in.	29 in.	Sindh Valley
46	8	50 in.	32 in.	Ditto

I once saw a beautiful head at a railway-station, the property of an officer who had just come down from Kashmir, the horns of which appeared to me enormous. The owner afterwards travelled with me in the train, and gave me his card, which I regret I lost, and, having forgotten his name, I was never enabled to write to him, either on the subject of the horns or to send him some papers he wanted on Asiatic sheep.

Dr. Leith Adams writes: "They (the horns) are shed in March, and the new horn is not completely formed till the end of October, when the rutting season commences, and the loud bellowings of the stags are heard all over the mountains." Of this bellowing Sir Victor Brooke says it is just like the voice of the Wapiti stag, which this animal closely resembles, and is quite different from that of the red deer. "In the former it is a loud squeal, ending in a more gutteral tone; in the latter it is a distinct roar, resembling that of a panther." Sir Victor Brooke also points out another peculiarity in this deer: namely, that "the second brow antler (bez) in *Cervus Cashmirianus*, with very rare exceptions, exceeds the brow antler in length; a peculiarity by which the antlers of this species may be distinguished from those of its allies."

The female gives birth in April, and the young are spotted.

The points on which this stag differs from the *maral* are the longer and more pointed head of the latter.

No. 477. CERVUS AFFINIS *vel* WALLICHII.

The Sikhim Stag (*Jerdon's No.* 218).

NATIVE NAME.—*Shou*, Thibetan.

HABITAT.—Eastern Himalayas; Thibet in the Choombi valley, on the Sikhim side of Thibet.

DESCRIPTION.—Jerdon describes this stag as "of very large size; horns bifurcated at the tip in all specimens yet seen; horns pale, smooth, rounded, colour a fine clear grey in winter, with a moderately large disk; pale rufous in summer." Hodgson writes of the horns: "Pedicles elevate; burrs rather small; two basal antlers, nearly straight, so forward in direction as to overshadow the face to the end of the nasal; larger than the royal antlers; median or royal antlers directed forward and upwards; beam with a terminal fork, the prongs radiating laterally and equally, the inner one longest and thinnest." Jerdon adds: "Compared with the Kashmir stag this one has the beam still more bent at the origin of the median tine, and thus more removed from *C. elaphus*, and like *C. Wallichii* (*C. Cashmirianus*). The second basal tine or bez antler is generally present, even in the second pair of horns assumed. Moreover the simple bifurcation of the crown mentioned above is a still more characteristic point of difference both from the Kashmir *barasingha* and the stag of Europe.

Regarding the nomenclature of this species there seems to be some uncertainty. Jerdon himself was doubtful whether the *shou* was not *C. Wallichii*, and the Kashmir stag *C. Cashmirianus*. He says: "It is a point reserved for future travellers and sportsmen to ascertain the limits of *C. Wallichii* east and *C. affinis* west, for, as Dr. Sclater remarks, it would be contrary to all analogy to find two species of the same type inhabiting one district."

Sir Victor Brooke writes: "Should *Cervus Wallichii* (*Cuvier*) prove to be specifically identical with *Cervus affinis* (*Hodgson*), the former name, having priority, must stand.

SIZE.—Length, about 8 feet; height at shoulders, 4½ to 5 feet. Horns quoted by Jerdon 54 inches round curve, 47 inches in divergence between the two outer snags. Longest basal tine, 12 inches; the medians, 8 inches.

An allied stag, *Cervus maral*, is found in Circassia and Persia. Sir Victor Brooke mentions a pair kept for some years in one of his parks, which never interbred with the red deer, and kept apart from them. "The old stag *maral*, though considerably larger in size, lived in great fear of the red deer stag." Another very fine species, *Cervus Eustephanus*, was discovered by Mr. W. Blanford inhabiting the Thian Shan mountains. As yet it is only known from its antlers, which are of great size, and in their flattened crowns closely resemble Wapiti horns.

TRAGULIDÆ—THE CHEVROTIANS OR DEERLETS.

Animals of small size and delicate graceful form, which are separated from the deer and oxen by certain peculiarities which approximate them to the swine in their feet. They are, however, ruminants, having the complex stomach, composed of paunch, honeycomb-bag and reed, the manyplies being almost rudimentary; but in the true ruminants the two centre metacarpals are fused into a single bone, whilst the outer ones are rudimentary. In the pig all the metacarpal bones are distinct, and the African Tragulus closely resembles it. The Asiatic ones have the two centre bones fused, but the inner and outer ones are entire and distinct as in the swine. The legs are, however, remarkably delicate, and so slight as to be not much thicker than an ordinary lead pencil. The males have pendant tusks, like those of the musk and rib-faced deer.

GENUS TRAGULUS.

Has the hinder part of metatarsus bald and callous.

No. 478. Tragulus napu.

The Javan Deerlet.

Native Name.—*Napu.*

Habitat.—Tenasserim and the Malay countries.

Description.—Above rusty brown, with three whitish stripes; underparts white, tail tipped with white, muzzle black.

Tragulus napu.

Tragulus kanchil is another Malayan species yet smaller than the preceding; it may be found in Tenasserim. It is darker in colour than the last, especially along the back, with a broad black band across the chest.

GENUS MEMINNA.

Hinder edge of metatarsus covered with hair.

No. 479. Meminna Indica.

Indian Mouse Deer.

Native Names.—*Pisuri*, *Pisora*, *Pisai*, Hindi and Mahratti; *Mugi* in Central India; *Turi-maoo*, Gondi; *Jitri-haran*, Bengali; *Gandwa*, Ooria; *Yar* of the Koles; *Wal-mooha*, Singhalese.

HABITAT.—In all the large forests of India; but is not known, according to Jerdon, in the countries eastward of the Bay of Bengal. It is common in the bamboo forests of the Central provinces, where I obtained it on several occasions.

DESCRIPTION.—"Above olivaceous, mixed with yellow grey; white below; sides of the body with yellowish-white lines formed of interrupted spots, the upper rows of which are joined to those of the opposite side by some transverse spots; ears reddish-brown" (*Jerdon*). The colour however varies; some are darker than others.

Mouse Deer.*

SIZE.—Length, 22 to 23 inches; tail, 1½ inches; height, 10 to 12 inches. Weight, 5 to 6 lbs.

The above measurements and weight are taken from Jerdon. Professor Garrod (Cassell's Nat. His.) gives eighteen inches for length and eight inches for height, which is nearer the size of those I have kept in confinement; but mine were young animals. They are timid and delicate, but become very tame, and I have had them running loose about the house. They trip about most daintily on the tips of their toes, and look as if a puff of wind would blow them away.

They are said to rut in June and July, and bring forth two young about the end of the rainy season.

* (From Sir Emerson Tennant's 'Ceylon,' by permission of Messrs. Longmans.)

TRIBE TYLOPODA—THE CAMELS.

This name, which is derived from the Greek τύλος, a swelling, pad, or knot, and ποῦς, a foot, is applied to the camels and llamas, whose feet are composed of toes protected by cushion-like soles, and not by a horny covering like those of the Artiodactyli generally. The foot of the camel consists of two toes tipped by small nails, and protected by soft pads which spread out laterally when pressed on the ground. The two centre metacarpal bones are fused into one cannon bone, and the phalanges of the outer and inner digits which are more or less traceable in all the other families of the Artiodactyli are entirely absent.

The dentition of the camel too is somewhat different from the rest of the Ruminantia, for in the front of the upper jaw there are two teeth placed laterally, one on each side, whereas in all other ruminating animals there are no cutting teeth in the upper jaw—only a hard pad, on which the lower teeth are pressed in the act of tearing off herbage.

The stomach of the camel is the third peculiarity which distinguishes it. The psalterium or manyplies is wanting. The abomasum or "reed" is of great length, and the rumen or paunch is lined with cells, deep and narrow, like those of a honeycomb, closed by a membrane, the orifice of which is at the control of the animal. These cells are for the purpose of storing water, of which the stomach when fully distended will hold about six quarts. The second stomach or reticulum is also deeply grooved.

The hump of the camel may also be said to contain a store of food. It consists of fatty cells connected by bands of fibrous tissue, which are absorbed, like the fat of hibernating bears, into the system in times of deprivation. Hard work and bad feeding will soon bring down a camel's hump; and the Arab of the desert is said to pay particular attention to this part of his animal's body.

There are two species of true camel, *Camelus dromedarius*, with one hump only, most commonly seen in India, and *C. bactrianus*, the two-humped camel, a shorter, coarser-looking, and less speedy animal.

There never was a creature about whom more poetical nonsense has been written. He has been extolled to the skies as patient, long-suffering, the friend of man, and what not. In reality he is a grumbling, discontented, morose brute, working only under compulsion and continual protest, and all writers who know anything of him agree in the above estimate of his disposition. The camel is nowhere found in a wild state.

ORDER EDENTATA.

THESE are animals without teeth, according to the name of their order. They are however without teeth only in the front of the jaw in all, but with a few molars in some, the Indian forms however are truly edentate, having no teeth at all. In those genera where teeth are present there are molars without enamel or distinct roots, but with a hollow base growing from below and composed of three structures, vaso-dentine, hard dentine and cement, which, wearing away irregularly according to hardness, form the necessary inequality for grinding purposes.

The order is subdivided into two groups: *Tardigrada*, or sloths, and *Effodientia* or burrowers. With the former we have nothing to do, as they are peculiar to the American continent. The burrowers are divided into the following genera: *Manis*, the scaly ant-eaters; *Dasypus*, the armadillos; *Chlamydophorus*, the pichiciagos; *Orycteropus*, the ant-bears, and *Myrmecophaga*, the American ant-eaters.

Of these we have only one genus in India; *Manis*, the pangolin or scaly ant-eater, species of which are found in Africa as well as Asia.

GENUS MANIS.

Small animals from two to nearly five feet in length; elongated cylindrical bodies with long tails, covered from snout to tip of tail with large angular fish-like scales, from which in some parts of India they are called *bun-rohu*, or the jungle carp; also in Rungpore *Keyot-mach*, which Jerdon translates the fish of the *Keyots*, but which probably means *khet-mach* or field-fish—but in this I am open to correction. The scales overlap like tiles, the free part pointing backwards. These form its defensive armour, for, although the *manis* possesses powerful claws, it never uses them for offence, but when attacked rolls itself into a ball.

In walking it progresses slowly, arching its back and doubling its fore-feet so as to put the upper surface to the ground and not the palm. The hind-foot is planted normally—that is, with the sole on the earth.

The tongue is very long and worm-like, and covered with glutinous saliva; and, much of this moisture being required, the sub-maxillary glands are very large, reaching down under the skin of the neck on to the chest.

The external ear is very small, and internally it is somewhat complicated, there being a large space in the temporal bone which communicates with the internal ear, so that, according to Professor Martin-Duncan, one tympanum is in communication with the other.

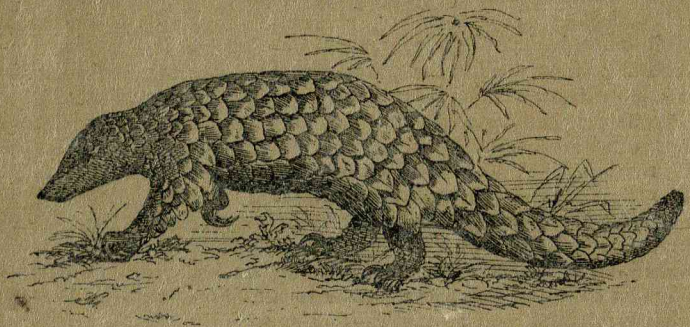
These animals are essentially diggers. The construction of their

fore-arms is such as to economise strength and the effectiveness of their excavating instruments. The very doubling up of their toes saves the points of their claws. The joints of the fore-fingers bend downwards, and are endowed with powerful ligaments; and in the wrist the scaphoid and semi-lunar bones are united by bone, which increases its strength. As Professor Martin-Duncan remarks: "Every structure in the creature's fore-limbs tends to the promotion of easy and powerful digging, and, as the motion of scratching the ground is directly downwards and backwards, the power of moving the wrist half-round and presenting the palm more or less upwards, as in the sloths and in man, does not exist. In order to prevent this pronation and supination the part of the fore-arm bone, the radius, next to the elbow, is not rounded, but forms part of a hinge joint." He also notices another interesting peculiarity in the chest of this animal, the breast-bone being very long; the cartilage at end large, with two long projections resembling those of the lizards. There is no collar-bone.

No. 480. MANIS PENTADACTYLA *or* BRACHYURA.

The Five-fingered or Short-tailed Pangolin (*Jerdon's No.* 241).

NATIVE NAMES.—*Bajar-kit*, *Bajra-kapta*, *Sillu*, *Sukun-khor*, *Sal-salu* Hindi; *Shalma* of the Bauris; *Armoi* of the Kols; *Kauli-mah*, *Kauli-*



Manis pentadactyla.

manjra, *Kassoli-manjur*, Mahratti; *Alawa*, Telegu; *Alangu*, Malabarese; *Bun-rohu* in the Deccan, Central provinces, &c.; *Keyot-mach*, in Rungpore; *Katpohu*, in parts of Bengal; *Caballaya*, Singhalese.

HABITAT.—Throughout India. Jerdon says most common in hilly districts, but nowhere abundant. I have found it myself in the Satpura range, where it is called *Bun-rohu*.

DESCRIPTION.—Tail shorter than the body, broad at the base, tapering gradually to a point. Eleven to thirteen longitudinal rows of sixteen scales on the trunk, and a mesial line of fourteen on the tail; middle nail of fore-foot much larger than the others. Scales thick, striated at base; yellowish-brown or light olive. Lower side of head, body, and feet, nude; nose fleshy; soles of hind-feet dark.

SIZE.—Head and body, 24 to 27 inches; tail, about 18. Jerdon gives the weight of a female measuring 40 inches as 21 pounds.

This species burrows in the ground to a depth of a dozen feet, more or less, where it makes a large chamber, sometimes six feet in circumference. It lives in pairs, and has from one to two young ones at a time in the spring months. Sir W. Elliot, who gives an interesting detailed account of it, says that it closes up the entrance to its burrow with earth when in it, so that it would be difficult to find it but for the peculiar track it leaves (*see* 'Madras Journal,' x. p. 218). There is also a good account of it by Tickell in the 'Journal As. Soc. of Bengal,' xi. p. 221, and some interesting details regarding one in captivity by the late Brigadier-General A. C. McMaster in his 'Notes on Jerdon.' I have had specimens brought to me by the Gonds, but found them very somnolent during the day, being, as most of the above authors state, nocturnal in its habits. The first one I got had been kept for some time without water, and drank most eagerly when it arrived, in the manner described by Sir Walter Elliot, "by rapidly darting out its long extensile tongue, which it repeated so quickly as to fill the water with froth."

The only noise it makes is a faint hiss. It sleeps rolled up, with the head between the fore-legs and the tail folded firmly over all.

The natives believe in the aphrodisine virtues of its flesh.

No. 481. MANIS AURITA.

The Eared Pangolin (Jerdon's No. 242).

HABITAT.—Sikhim, and along the hill ranges of the Indo-Chinese frontier. Dr. Anderson says it is common in all the hilly country east of Bhamo.

DESCRIPTION.—Tail shorter and not so thick at the base as that of the last; the body less heavy; smaller and darker scales; muzzle acute; ears conspicuous; scales of head and neck not so small in proportion as in *M. pentadactyla*.

SIZE.—Head and body of one mentioned by Jerdon, 19 inches; tail, 15¼ inches.

No. 482. MANIS JAVANICA.

The Javan Ant-eater.

HABITAT.—Burmah and the Malayan peninsula; also Tipperah.

DESCRIPTION.—To be distinguished from the two preceding species by the greater number of longitudinal rows of scales, *M. pentadactyla* having from eleven to thirteen, *M. aurita* from fifteen to eighteen, and *M. Javanica* nineteen. Taking the number of scales in the longitudinal mesial line from the nose to the tip of the tail in *M. pentadactyla*. it is forty-two; in *aurita* forty-eight to fifty-six; in *javanica* as high as sixty-four; on the tail the scales are: *M. pentadactyla*, fourteen; *M. aurita* sixteen to twenty; *M. Javanica* thirty.

I am indebted to Dr. Anderson's 'Zoological and Anatomical Researches' for the following summary of characteristics:—

"*M. pentadactyla* by its less heavy body; by its tail, which is broad at the base, tapering gradually to a point, and equalling the length of the head and trunk; by its large light olive-brown scales, of which there are only from eleven to thirteen longitudinal rows on the trunk, and a mesial line of fourteen on the tail; and by its powerful fore-claws, the centre one of which is somewhat more than twice as long as the corresponding claw of the hinder extremity. *M. aurita* is distinguished from *M. pentadactyla* by its less heavy body; by its rather shorter tail, which has less basal breath than *M. pentadactyla*; by its smaller and darker brown, almost black scales in the adult, which are more numerous, there being from fifteen to eighteen longitudinal rows on the trunk, seventeen rows being the normal number, and sixteen to twenty caudal plates in the mesial line; and by its strong fore-claws, the middle one of which is not quite twice as long as the corresponding claw on the hind foot.

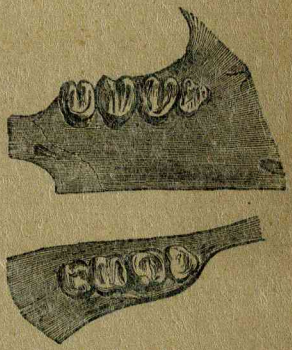
M. Javanica is recognised by its body being longer and more attenuated than in the two foregoing species; by its narrower and more tapered tail; by its longer and more foliaceous or darker olive-brown scales, of which there are nineteen longitudinal rows on the trunk, and as many as thirty along the mesial line of the tail; and by the claws of the fore-feet being not nearly so long as in *M. Jaurita*, and being but little in excess of the claws of the hind-feet.

APPENDIX A.

FAMILY MYOXIDÆ—THE DORMICE.

THESE small rodents approximate more to the squirrels than the true mice; but they differ from all others intestinally by the absence of a cæcum. They have four rooted molars in each upper and lower jaw, the first of each set being smaller than the other three, the crowns being composed of transverse ridges of enamel. In form they are somewhat squirrel-like, with short fore-limbs, and hairy, though not bushy, tails. The thumb is rudimentary, with a small, flat nail; hind-feet with five toes.

The common English dormouse is a most charming little animal, and a great pet with children. I have had several, and possess a pair now which are very tame. They are elegant little creatures, about three inches long, with tails two and a-half inches; soft deep fur of a pale reddish-tawny above, pale yellowish-fawn below, and white on the chest. The eyes are large, lustrous, and jet-black. The tails of some are slightly tufted at the end. They are quite free from the objectionable smell of mice. In their habits they are nocturnal, sleeping all day and becoming very lively at night. I feed mine on nuts, and give them a slice of apple every evening; no water to drink, unless succulent fruits are not to be had, and then sparingly. The dormouse in its wild state lives on fruits, seeds, nuts and buds. In cold countries it hibernates, previous to which it becomes very fat. It makes for itself a little globular nest of twigs, grass, and moss, pine-needles, and leaves, in which it passes the winter in a torpid state. "The dormouse lives in small societies in thickets and hedgerows, where it is as active in its way amongst the bushes and undergrowth as its cousin the squirrel upon the larger trees. Among the small twigs and branches of the shrubs and small trees the dormice climb with wonderful adroitness, often, indeed, hanging by their hind feet from a twig, in order to reach and operate on a fruit or a nut which is otherwise inaccessible, and running along the lower surface of a branch with the activity and certainty of a monkey" (*Dallas*).



Dentition of Dormouse (magnified).

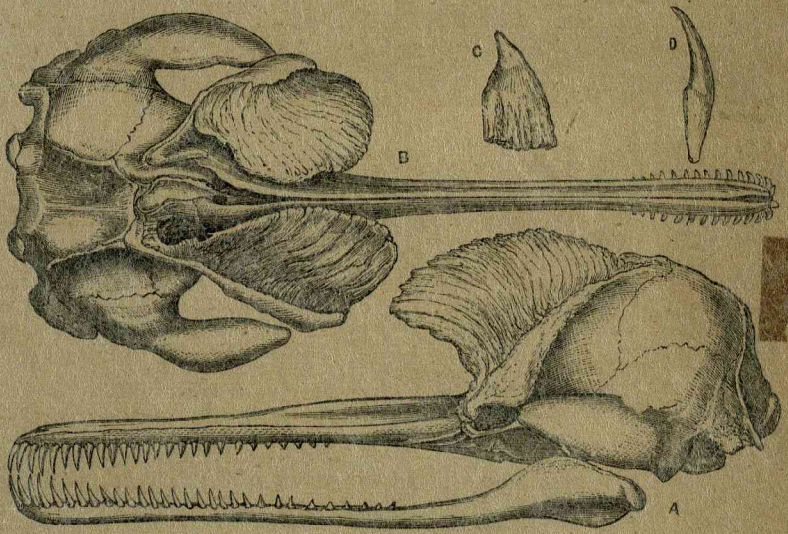
This little animal is supposed to breed twice in the year—in spring and autumn. It is doubtful whether we have any true *Myoxidæ* in India, unless *Mus glircoides* should turn out to be a *Myoxus*. The following is mentioned in Blanford's 'Eastern Persia': *Myoxus pictus*—new species,

Myoxus.

I think; I regret I have not the book by me at present—also *Myoxus dryas*, of which I find a pencil note in my papers. Mouse-red on the back, white belly with a rufous band between; white forehead; a black stripe from the nose to the ears, passing through the eye.

APPENDIX B.

Osteology of the Skull of Platanista Gangetica, page 251.



A. Side view. B. Upper view. C. Back tooth. D. Front tooth.

The above illustration was by accident omitted from the text.

APPENDIX C.

NOTES ON SOME OF THE FOREGOING SPECIES.

The Slow Loris, p. 31.—This creature sometimes assumes the erect posture, though in general it creeps. The following illustration shows an attitude observed and sketched by Captain Tickell, as the animal was about to sieze a cockroach. When it had approached within ten or twelve inches, it drew its hind feet gradually forward until almost under its chest; it then cautiously and slowly raised itself up into a standing position, balancing itself awkwardly with its uplifted arms; and then, to his astonishment, flung itself, not upon the insect, which was off "like an arrow from a Tartar's bow," but on the spot which it had, half a second before, tenanted.

Trade Statistics of Fur-skins, p. 139.—The Philadelphia *Times*, in an article on furs, says that the best sealskins come from the antarctic waters, principally from the Shetland Islands. New York receives the bulk of American skins, which are shipped to various ports. London is the great centre of the fur trade of the world. In the United States the sea-bear of the north has the most valuable skin. Since 1862 over 500,000 have been killed on Behring Island alone. In 1867 there were 27,500 sea-bears killed; in 1871 there was a very large decrease, only 3,614 being killed. There were 26,960 killed in 1876; and in 1880 the number killed was 48,504, a large increase. Sea-otter fur is about as expensive as any, and some 48,000 skins are used yearly. Over 100,000 marten or Russian sable skins are annually used. Only about 2,000 silver foxes are caught every year; and about 6,500 blue foxes. Other fox skins are used more or less. About 600 tiger skins are used yearly, over 11,000 wild cat skins, and a very large trade is being carried on in house cat skins. Aout 350,000 skunk and 42,000 monkey skins are utilised annually. The trade in ermine skins is falling off, as is

as to the trade in chinchilla. About 3,000,000 South American nutrias are killed every year, and a very large business is carried on in musk-rat skins. About 15,000 each of American bear and buffalo skins were used last year. There are also used each year about 3,000,000 lamb, 5,000,000 rabbit, 6,000,000 squirrel, and 620,000 filch skins; also 195,000 European hamster, and nearly 5,000,000 European and Asiatic hares.

Tigers, p. 168.—Since writing on the subject of the size of tigers I have received the following extract from a letter addressed to the editor of *The Asian*. Both the animals were measured on the ground before being skinned, and in the presence of all whose names are given :—

"Tiger shot on the 6th of July, 1882. Party present: C. A. Shillingford, Esq.; J. L. Shillingford, Esq.; F. A. Shillingford, Esq.; A. J. Shillingford, Esq. Length of head, 1 ft. 8½ in.; body, 5 ft. 6½ in.; tail, 3 ft. 6½ in.; total length, 10 ft. 9½ in. Height at shoulder, 3 ft. 7 in.

"Tiger shot on the 17th of March, 1883. Party present: The Earl of Yarborough; A. E. Fellowes, Esq.; Col. R. C. Money, B.S.C.; Capt. C. H. Mayne, A.D.C.; Lieut. R. Money; J. D. Shillingford, Esq. Length of head, 1 ft. 8 in.; body, 5 ft. 7 in.; tail, 3 ft. 5½ in.; total length, 10 ft. 8½ in. Height at shoulder, 3 ft. 8½ in.; girth of head round jaw, 3 ft. 1½ in.; girth of body round chest, 4 ft. 7 in.

"The latter animal, though not so long as the former, was the larger animal of the two, being more massively built, and by far the finer specimen of a tiger. He was shot by Mr. Fellowes while out shooting in the Maharajah of Darbhanga's hunt in the Morung Terai."

The following is an extract from a letter lately received by me from General Sir Charles Reid, K.C.B., with reference to an enormous tiger killed by him :—

"I had a tiger in the Exhibition of 1862, and which is now in the museum at Leeds, which was the largest tiger I ever killed or ever saw. As he lay on the ground he measured 12 feet 2 inches—his height I did not measure—from the tip of one ear to the tip of the other 19½ inches. I never took skull measurements, nor did I ever weigh a tiger. I had another in the International Exhibition, which measured 11½ feet fair measurement as he lay on the ground. The one at Leeds 12 feet 2 inches, as before mentioned, is not now more than 11 feet 6 inches. Mr. Ward was not satisfied with the Indian curing, and had it done over again, and it shrunk nearly a foot. The three tigers* mentioned are the largest I ever killed—all Dhoon tigers."

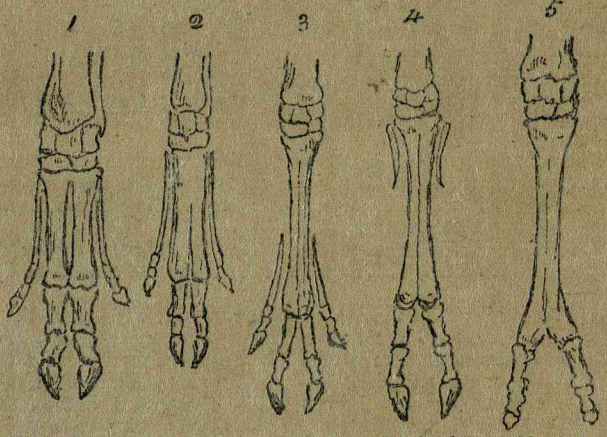
Elephants, p. 394.—The two Indian elephants now in the Zoological Society's Gardens, in Regent's Park, are interesting examples of the growth of these animals in captivity. I regret extremely that I have not been able to get accurate statistics regarding them before leaving England; I was obliged to put off several proposed visits to the Gardens in consequence of ill

* The third tiger is one which Sir Charles Reid has had set up, and is now in his house; it measured, as he lay on the ground, 10 ft. 6 in. He then goes on to say that his father-in-law had killed in the Dhoon four or five tigers over 11 feet, and that the late Sir Andrew Waugh told him he had killed one in the same place 13 feet. He says: "I believe the Dhoon tigers are the largest and finest beasts that are found in any part of India." Their coats are longer and thicker also.

health, and am now correcting the final proof-sheets of this work on board ship, preparatory to posting them at Suez, so I must trust to memory for what I heard concerning them.

The large male, *Jung Pershad*, must be close upon nine feet high, and the female, *Suffa Kulli*, at least seven feet; and I was astonished to find that they were the same that I had seen as little things in the Prince of Wales's collection in 1876. *Suffa Kulli's* age is not more than fifteen, yet she has been in a fair way of becoming a mother. There was no doubt as to the possibility, and she seemed to show some signs of it, but it ended in disappointment; however it is hoped that she will yet prove that these noble animals may be bred in captivity.

Osteology of the feet in Ruminantia, p. 414.—The following illustrations were inadvertently omitted from the text in the above page.



1. Pig, or African deerlet. 2. Javan deerlet. 3. Roebuck. 4. Sheep. 5. Camel.

Wild Boar, p. 417.—A few days before leaving England, I called to say good-bye to an old friend well known in Calcutta and Lower Bengal, Dr. Charles Palmer. He asked me whether I had ever heard of a boar killing a tiger, and, on my answering in the affirmative, he told me he had just heard from his son, who had witnessed a fight between these two animals, in which the boar came off victorious, leaving his antagonist dead on the field.

Ovis Polii, p. 427.—Mr. Carter in one of his letters to me says: "I see that you make the biggest horns of *Ovis Polii* 53 inches from tip to tip. In a photo of one brought down by the Yarkhand Expedition, which had a foot rule laid close, so as to scale it, the distance from tip to tip is nearly five feet."

I do not know which particular head is referred to, but two out of the three measurements given by me were of the finest heads brought down by the Expedition. There may have been a smaller pair with a wider spread, as

the 22-inch horns I also mention, and which Sir Victor Brooke, to whom I sent a photograph, tells me is the finest head he has heard of, has only a spread of 48 inches.

Ovis cycloceros, p. 435.—I gave from 25 to 30 inches as an average size for the horns of this species, but Captain W. Cotton, F.Z.S., writes to me that he sent home a pair of ovrial horns from Cabul, 35⅓ inches, and that there is a pair in the R.A. mess at Attock 38½ inches, but very thin. They were looted in the Jowaki campaign. This sheep has bred freely in the Zoological Society's Gardens, and two hybrids have been born there from a male of this species and the Corsican mouflon, *Ovis musimon*.

I mentioned that there is in the Gardens a specimen of *Ovis Blanfordi*. I see by the Society's list that this was presented by Captain Cotton; the habitat given is Afghanistan.

The Wild Goat of Asia Minor, p. 447.—Mr. Carter writes to me: "In one of your letters you mention the Scind ibex, which is a wild goat. I have a photo of a head 31 inches round curve, but Mr. Inverarity, barrister, Bombay, says he has seen one 52¼. The animal is not much bigger than the black buck." This last agrees with the estimate I formed from the specimens in the Indian Museum, Calcutta.

Tetraceros sub-quadricornutus, p. 480.—It is doubtful whether Elliot's antelope should stand as a separate species; Blyth was against it, and Jerdon followed him, and I incline to think that it is only a variety. Dr. Sclater, to whom I mentioned the subject, appeared to me to agree in this view, but I see he includes it in his list of the Society's mammals. Being adverse to the multiplication of species, I gave it the benefit of the doubt, and included it with *T. quadricornis*; but, as I have received one or two letters from writers whose opinions are entitled to consideration, I mention them here, merely stating that I still feel inclined to doubt the propriety of promoting *sub-quadricornutus* to the dignity of a species. Dr. Gray was certainly of opinion it was separate; but then, great naturalist as he was, his peculiar foible was minute sub-division.

The claims of Elliot's antelope to separate rank are: absence of the anterior horns, or with only a trace; smaller size; lighter colour; but even the larger, darker *quadricornis* is sometimes without the anterior horns; and, unless some other marked difference is found in the skull, it is hardly sufficient to warrant separation. However, I will give what others say on the subject.

"I can scarcely agree with you as to Elliot's antelope not being a good species, I have therefore taken the trouble of having a most accurate and full-size sketch of the skull of one made, and if you will compare it with those of the ordinary *quadricornis* I think you will see a well-marked difference. Dr. Gray wrote to me, and said that there was the recognised species of *sub-quadricornutus*."—Letter from Mr. H. R. P. Carter, "Smoothbore" of the *Field*.

The following is an extract from a letter signed "Bheel," addressed to the editor of *The Asian*, which appeared in that paper:—

"In the jungles of Rajputana, especially about the Arravelli Range, I have shot repeatedly very small, exceedingly shy deer, called by the Bheels and

karies in this part 'bhutar.' They are very much smaller than the four-horned antelope, having very sharp thin horns about two inches in length, which are perfectly smooth, as if polished, and black. The colour of the skin is light brown, somewhat like a chinkara, white inside the limbs and under the belly. The hair on the skin is short, smooth and glossy. The feet are exceedingly small, about one-third in size smaller than that of the four-horned antelope. They are very retiring little creatures, and very difficult to bag. They run, or, more appropriately, bound with amazing swiftness when disturbed, and disappear like some passing shadow. These little deer live on the lower spurs of the hills, and are generally found in pairs. They are very plump, and appear to be always in good condition. The last one I shot was last year. The females are hornless.

"The four-horned antelope is described accurately by Mr. Sterndale, only that, in my humble opinion, I do not consider it to be the smallest of the ruminant species. The 'Bheel' name for this creature is 'fonkra.' It is found in the thick jungles at the foot of the hills. It selects some secluded spot, which it does not desert when disturbed, returning invariably to its hiding-place when the coast is clear. I noticed this very particularly. The hair of the 'fonkra' is comparatively much longer than the bhutar's, and the colour is a great deal darker. Could Mr. Sterndale kindly let me know the Latin name for the 'bhutar'? I am sure it can't be *Cervulus aureus* (kakur, or barking deer), because the colour given of this deer is a beautiful bright glossy red or chesnut, while, as I have mentioned above, the colour of the bhutar is light brown."

"Bheel's" "bhutar" is evidently Elliot's *sub-quadricornutus*.

The Gaur.

The Gaur, p. 482.—Jerdon doubted the existence of this animal in the Himalayan Terai, according to Hodgson's assertion; but Hodgson was right, for I have a letter before me which I received some time back from Dr. W. Forsyth, stating that a few days previously a companion of his shot a large

solitary bull (6 feet 1 inch at the shoulder) in the Terai, and he himself knocked one and lost another the day before he wrote. The local name is *gauri-gai*.

I also received a letter through the columns the *The Asian* from "Snap-shot," vouching for the existence of the *gaur* in the Darjeeling Terai.

Another correspondent of *The Asian* writes regarding the naming of this species :—

"In referring to Mr. Sterndale's descriptions of the gaur and gayal, in your issues of the 28th March and 11th April, I trust that that gentleman will not be offended by my making a few remarks on the subject, and that he will set me right if I am in the wrong. I see that he has perpetuated what appears to my unscientific self a mistake on the part of the old writers—Colebrooke, Buchanan, Trail, and others, who I fancy got confused, and mixed up the animals. The local name for the Central Indian ox is over a large tract of country the gayal, or gyll; and this, being the animal with the peculiar frontal development, was most probably named bos, or *Gavæus frontalis*, whilst the mithun, or Eastern Bengal animal, was the gaur. It seems to me, therefore, that the names should be transposed. Will Mr. Sterndale consider this, if he has not already done so; and, if I am wrong, tell me why the animal with peculiar frontal development, and called the gayal locally, should not have been named *frontalis*, whilst the animal called mithun, with nothing peculiar in his frontal development, is so called?

"Orissa, *April 15th*, 1882. "CHAMPSE.

"P.S.—Do any of the Eastern Bengal races call this mithun gayal?"

I think Hodgson's name *Bibos cavifrons* is a sufficient proof that *Gavæus gaurus* is applicable to the animal with the high frontal crest, which is the species inhabiting the Himalayan Terai, and is locally known as the *gaur*, or *gauri-gai*. It is known as *gayal* in some parts of India, but, where the people are familiar with the *mithun*, the *gaur* is called *asl'gayal*, from whence Horsfield's name *Bibos asseel*. Probably the *mithun* was called *frontalis*, under ignorance of a species with a still greater frontal development.

Gavæus frontalis interbreeds freely with domesticated cattle of all kinds. In the Society's Gardens are several hybrids between this and *Bos Indicus*, one of which hybrids again interbred with American bison (*Bison Americanus*), the progeny being one-half bison, and one-quarter each *frontalis* and *Indicus*.

APPENDIX D.

As many specimens are spoilt by either insufficient curing, or curing by wrong methods, I have asked Mr. Geo. F. Butt, F.Z.S., who was for many years manager to Edwin Ward, whom he has now succeeded, to give me a page or two of useful hints on the preservation of skins. The following notes are what he has kindly placed at my disposal. I know of no one I can more strongly recommend for good work than Mr. Butt. Some of his groups are works of art, with most lifelike finish. I have just seen a bear set up by him which seems almost to breathe.

NOTES ON SKINNING THE MAMMALIA AND THE PRESERVATION OF SKINS. By GEO. F. BUTT, F.Z.S., Naturalist to the Royal Family, 49, Wigmore Street, London, W.

The quadruped killed, the first and important step is to plug up the nostrils and throat with cotton-wool or tow, as also any wound from which blood may escape. Place the animal on its back, make a longitudinal incision with the knife at the lower part of the belly (the vent), and thence in as straight a line as possible extending to the chin bone, taking particular care that during the operation the hair is carefully divided and not cut. Vertical incisions may then be made extending down the inside of each leg to the claws. The skin can then be turned back in every direction as far as the extent of the incisions will admit of—the legs may now be freed from the skin. Next make a straight incision down the under part of the tail to the tip, turn the skin back until it is free. Having executed this, there remains only to remove the skin from the back and head; to do this place the carcase on its side, and with the scalpel carefully separate the skin by drawing it towards the head, in skinning which care being taken to cut the ears as close to the skull as possible, leaving the cartilage in the skin; the eyelids, also nose and lips, should be carefully skinned without injury. The skin is now free from the carcase. Turn the ears inside out, the nostrils, lips, and feet, removing all cartilage and flesh.

Place the skin open on the ground with the fur side down, and remove all the flesh and pieces of fat adhering; scrape the skin well, so as to get away all the loose particles of under-skin or pelt. When this has been thoroughly done, take powdered alum plentifully, and, with a *very* small quantity of common salt, rub well into the skin, especially into the ears, nostrils, lips,

and feet, so that every portion of the skin is powerfully impregnated. Allow the skin to lie in this condition for an hour or so, then place it on a line or branch to dry. The operation should be carried on in the shade, if possible.

If the specimen is not for stuffing it may be pegged out to dry on the ground, but in no one instance should a skin be unduly strained out of shape, which is often done in order to make it appear larger than it really is, a mistake which is very common.

When this operation is completed, and the skin dry, it is ready for packing, and should be folded, with the fur or hair inside, and placed in a sound box or case well protected against the visits of ants, beetles, or moth.

Where it is intended that the animal should be ultimately stuffed whole, it is necessary to preserve the leg bones. These should be separated from the trunk at the os humeri or shoulder-joint, and at the os femoris or thigh bones; these bones cleanse from flesh.

The skull in every instance should be preserved: remove the flesh and brain; to do this place the skull in boiling water for five or ten minutes—in the case of small skulls for five minutes only, care being taken that the teeth are not lost. In packing skulls each one should be tied up in paper, marked with a corresponding number to the skin to which it belongs, and packed firmly, to prevent rolling about, the result of which is often broken teeth and disappointment.

Another excellent method for the preservation of skins of mammalia, where convenience will permit, and which can be followed with confidence, is as follows: After the skin has been treated according to the directions given—viz. thoroughly scraped and cleansed of all adherent particles of flesh, &c.—place it entirely in a tub or cask in which a solution or pickle has been previously prepared, as follows: to every gallon of cold water add 1 lb. powdered alum, ½-oz. saltpetre, 2 oz. common salt; well mix. Allow the skin to remain about a couple of days, after which hang it up to dry and for packing.

INDEX.

N.

O.

P.

* By oversight this species has been twice described.

R.

S.

T.

U.

V.

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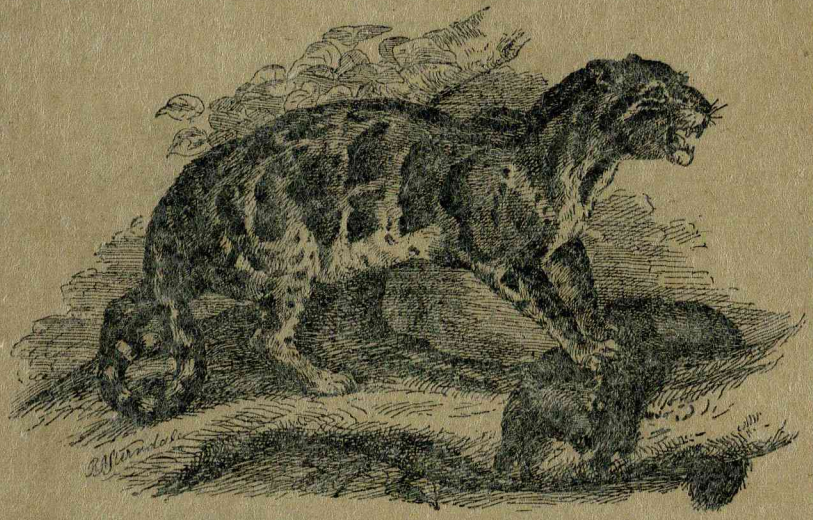

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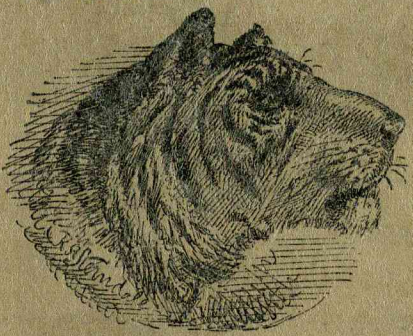

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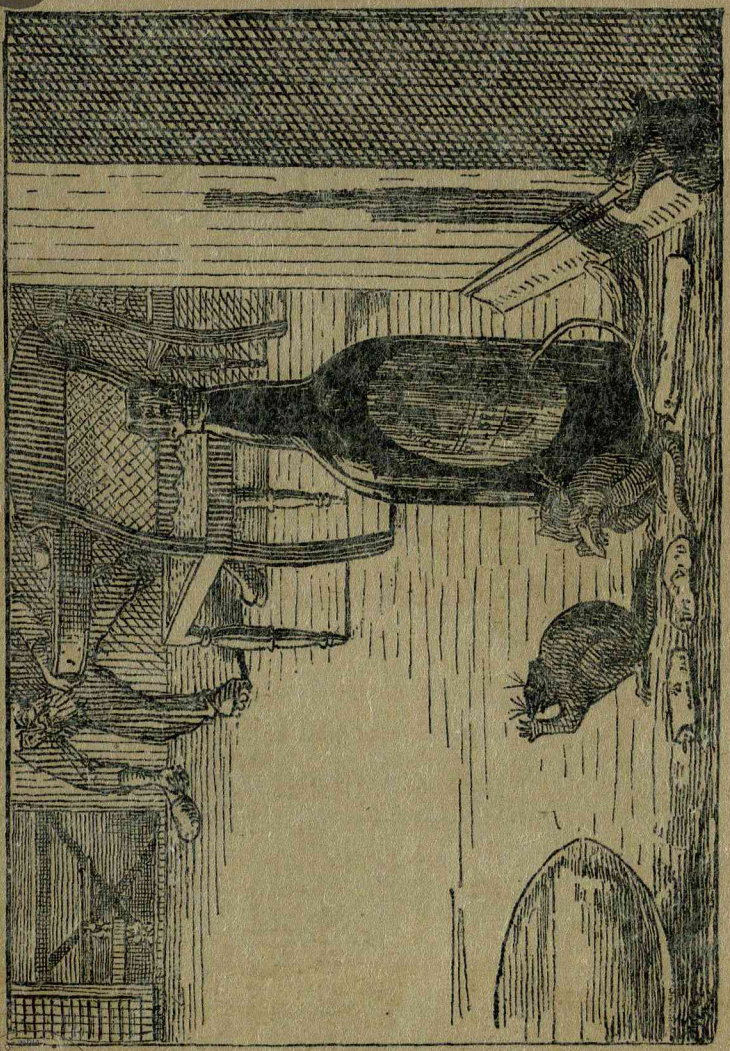

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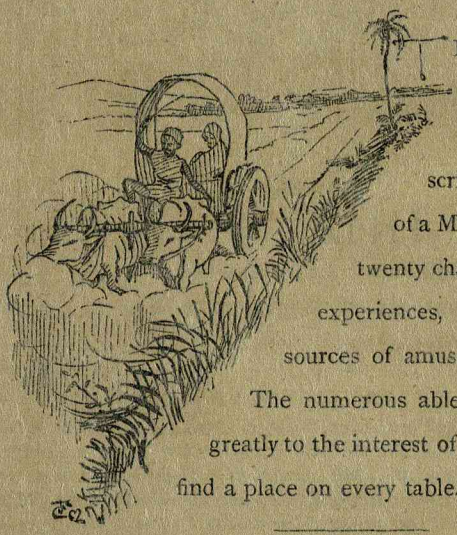

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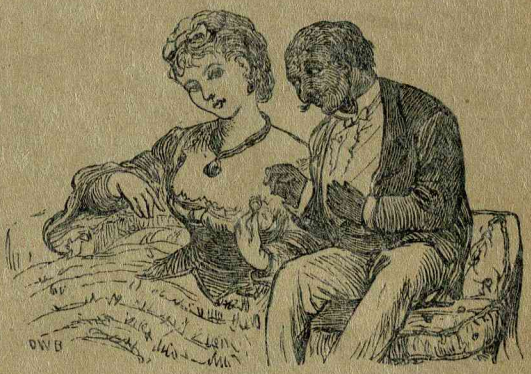

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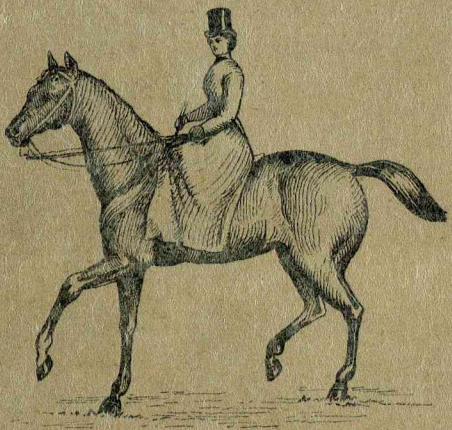

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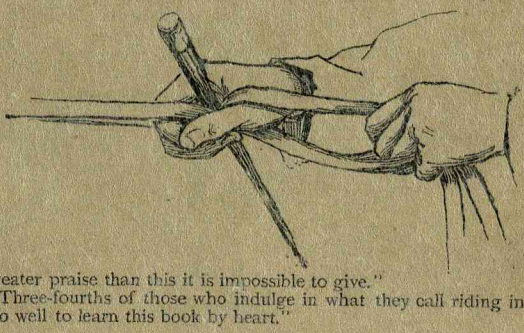

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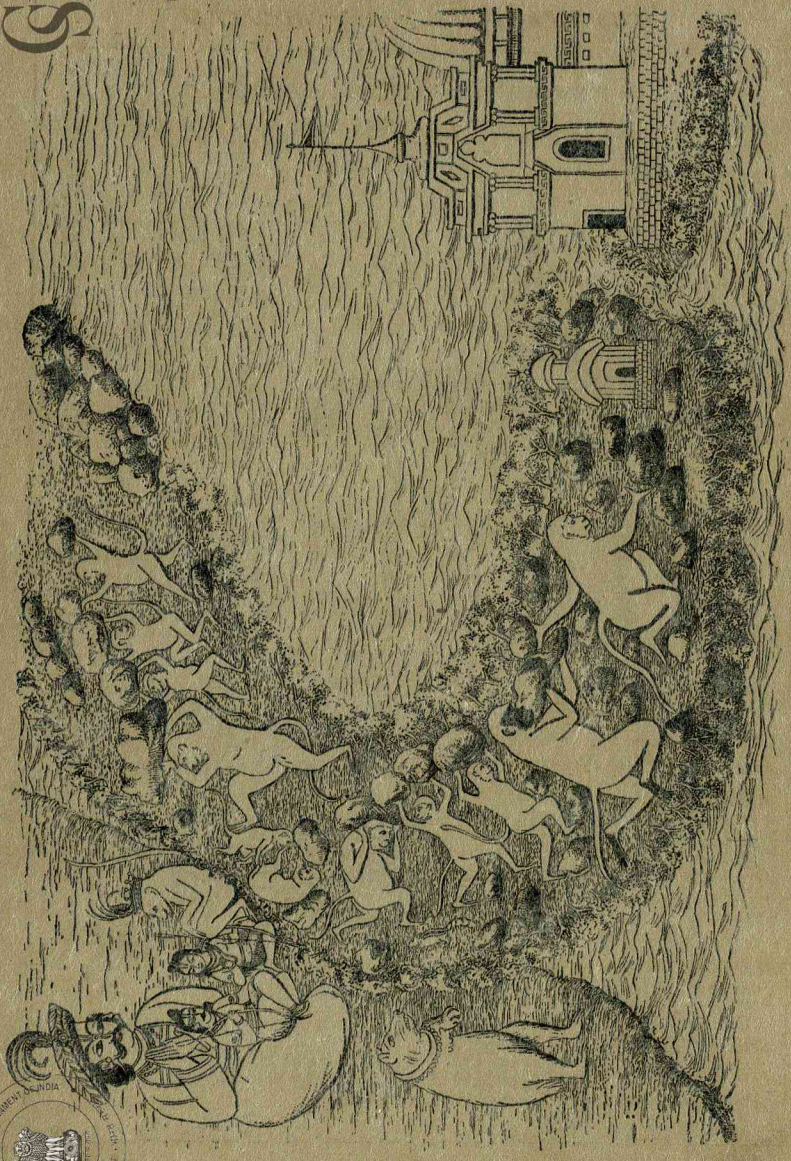

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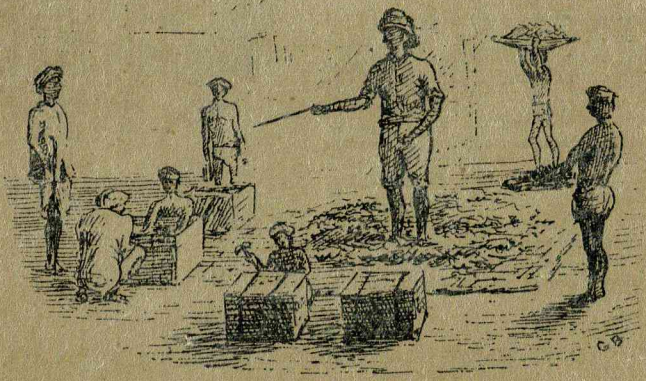

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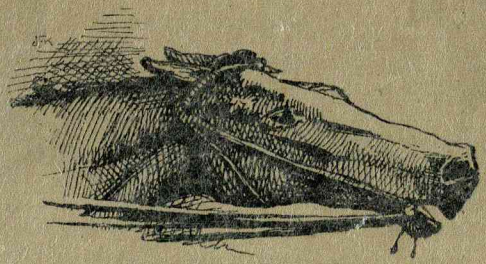

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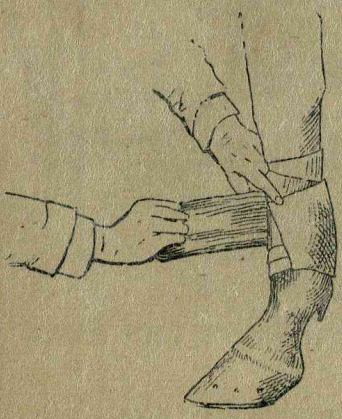

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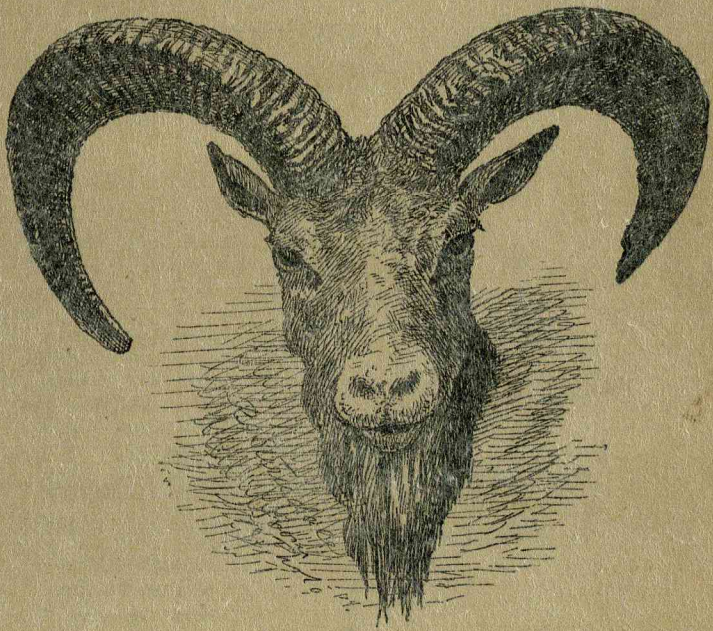

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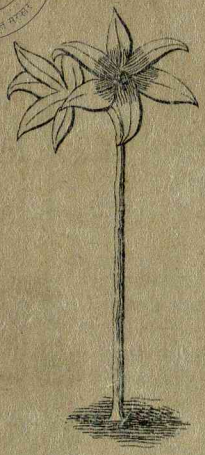

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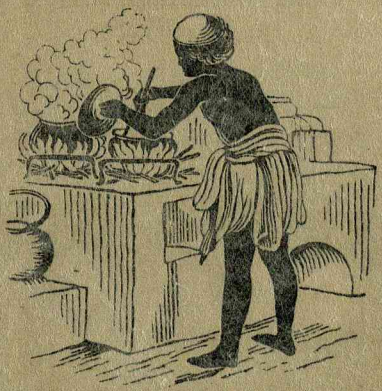

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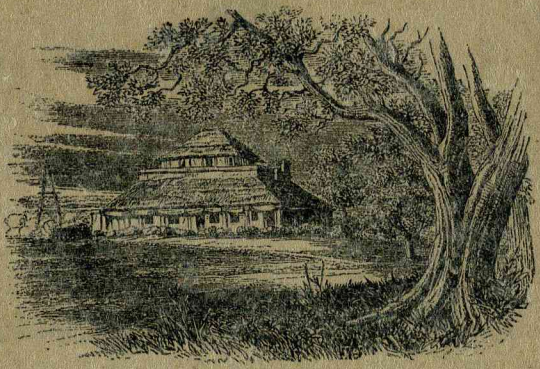

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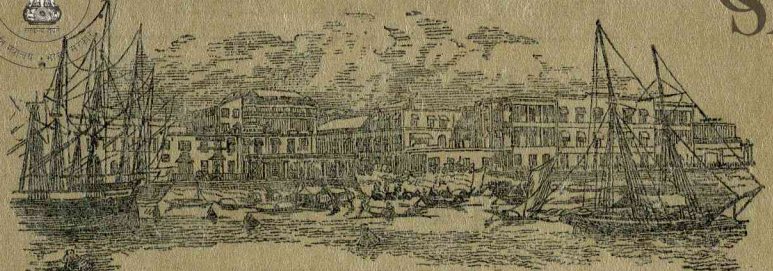

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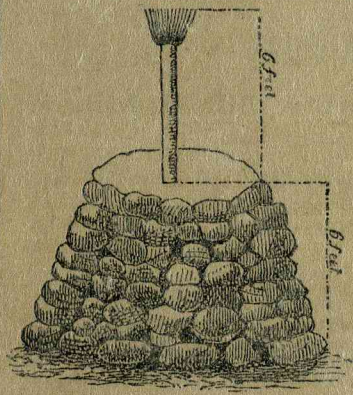

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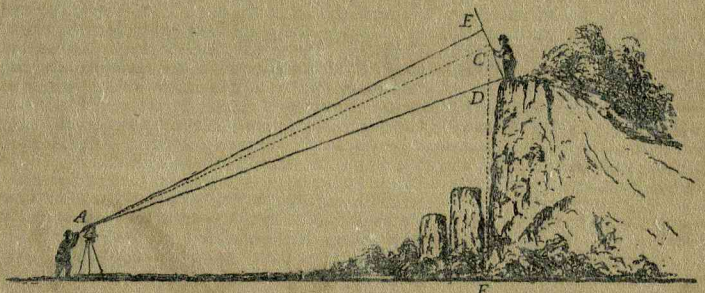

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