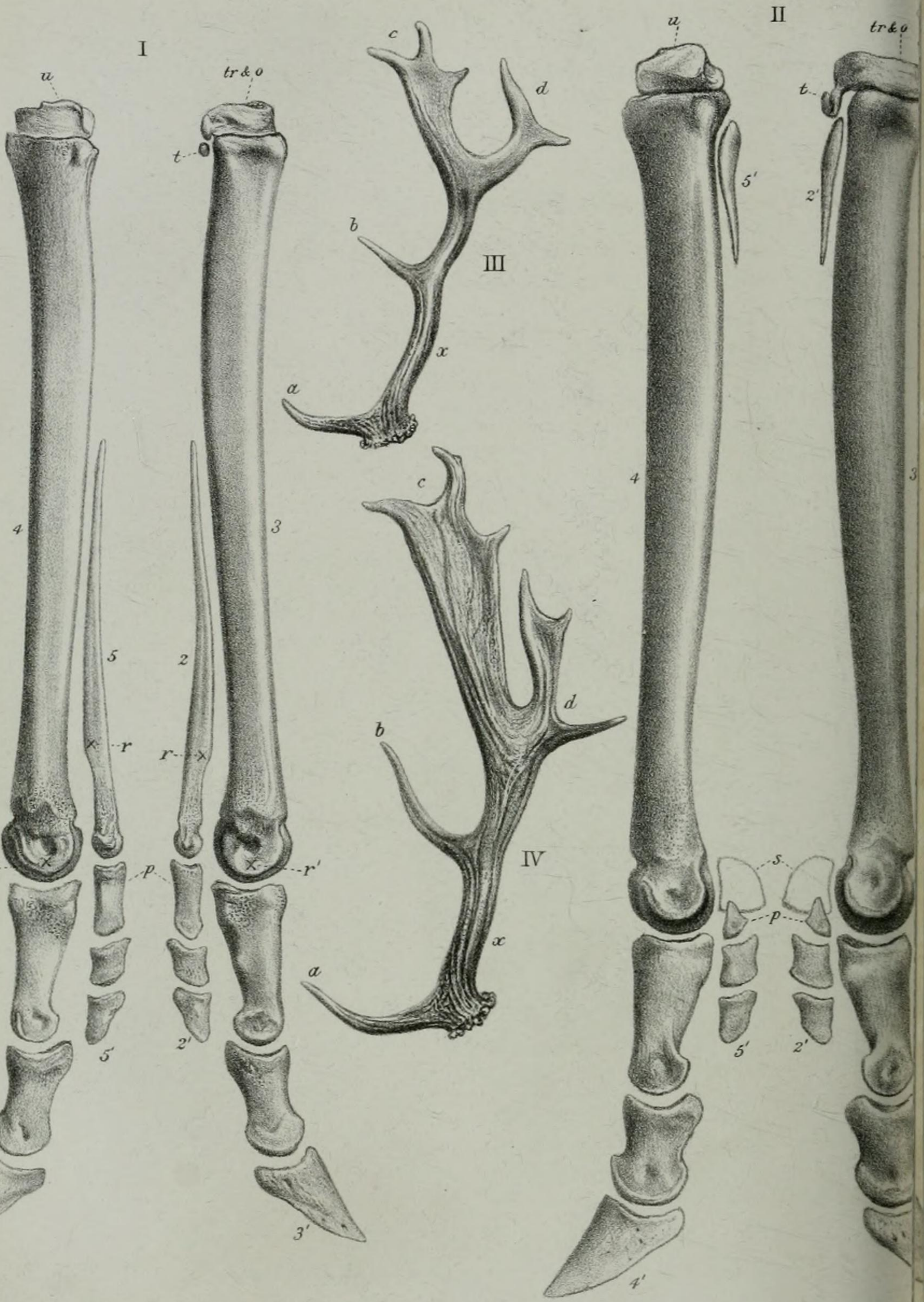


J.Smit lith.

Hanhart im

CLASSIFICATION OF THE CERVIDÆ.

kept them a long time; and not finding any one that would have them, I at last sent them to Stevens's sale-rooms where they were sold for a few shillings. I can assure you that these animals were not like the *Anoa*, but much larger, and had all the appearance of a common Indian Buffalo of small size. Yours faithfully,

"A. D. BARTLETT."

The following papers were read:—

1. On the Classification of the *Cervidæ*, with a Synopsis of the existing Species. By Sir VICTOR BROOKE, Bart., F.Z.S.

(Plate LV.)

I. *Introduction.*

Some years ago I brought before the notice of the Society certain pedal characters in the Cervidæ (vide P. Z. S. 1874, p. 33) which appeared to me to be of some importance; but at that time, not having had the opportunity of extending my observations to all the forms of existing Cervidæ, a generalization, which I believe to be of considerable taxonomic value, deducible from these characters, escaped my notice. A reconsideration of the characters themselves, and an attempt to work out the deductions which may be drawn from these and other established facts relating to the Cervidæ, is the object of the present paper.

Before entering into the subject immediately before us, it may be well to consider briefly the peculiarities common to all Deer, the possession of which distinguishes them from all other mammals, and which may therefore be called their family characters.

The Cervidæ, together with *Moschus*, the Giraffidæ, and the Bovidæ, constitute the Pecora, one of the four distinct sections into which the Artiodactyla, or even-toed Ungulates, is divisible. In having (1) the odontoid process crescentic, (2) the left axillary rising from the innominate artery, (3)the placenta cotyledonous, (4) the psalterium added to the stomach, and (5) the outer bones of the metapodium rudimentary, the inner confluent, all the members of the Pecora, as Professor Flower in his exhaustive paper on *Moschus* (P. Z. S. 1875, p. 159) has taught us, agree together, and differ from the three remaining sections of the Artiodactyla, viz. the Tragulina, Suina, and Tylopoda.

So far there is little difficulty in defining the zoological position of the Cervidæ. That they form part of the Pecora there can be no doubt; but when the subdivision of the Pecora is attempted difficuties arise which bid fair to set at defiance all systems of classification. An estimate of the nature and relative value of the characters which distinguish the Cervidæ from the Bovidæ will be most clearly shown by placing them in tabular form. With *Moschus* and the Giraffidæ we

need not at present occupy ourselves; in Professor Flower's paper, above referred to, the characters in which they differ from the typical Cervidæ, of which Professor Flower regards them as early offshoots, are distinctly defined.

Cervidæ.	*Bovidæ.*
(1) Osseous deciduous outgrowths from cylindrical processes of the frontals in the males of all excepting *Hydropotes*, in which genus they are wanting in both sexes. These appendages, the antlers, are absent in the females excepting *Rangifer*.	(1) Epidermal persistent (exc. *Antilocapra*) sheaths envelop processes of the frontals in both sexes, with the exception of the females of the following genera, in which these appendages, the horns, are wanting:—*Portax, Tragelaphus, Procapra, Antilope, Æpyceros, Saiga, Kobus, Cervicapra, Pelea, Nanotragus, Neotragus, Tetraceros.*
(2) Two orifices to the lacrymal duct, situated on or inside the rim of the orbit.	(2) One orifice to the lacrymal duct, situated inside the rim of the orbit. Exceptions:—*Tragelaphus sylvaticus, Tragelaphus decula, Tragelaphus angasi, Tragelaphus spekii*; in these species there are two orifices, situated as in the Cervidæ.
(3) A depression in the facial plate of the lacrymal, called the lacrymal pit or fossa.	(3) Absence of this depression. Exceptions:—*Gazella, Antilope, Nanotragus, Neotragus, Cephalophus, Tetraceros, Alcelaphus.*
(4) An anteorbital vacuity of such dimensions as to exclude the lacrymal from articulation with the nasals.	(4) Lacrymal articulates with the nasals, except in *Gazella* and *Oryx*.
(5) In all species the first molar in both jaws is brachyodont, or short-crowned, so that when the tooth is in place the neck, which is much constricted, is on a level with or a little above the alveolar border, and in the dry skull the upper ends of the roots are visible.	(5) The first molar in both jaws is hypsodont, or long-crowned, so that a large part of the crown is buried in the socket when the tooth is first in place, and there is no constriction between the long crown and the very short roots. Exception, *Tragelaphus*.
(6) Upper canines present in both sexes. Exceptions:—*Capreolus, Axis, Dama, Cariacus, Blastocerus, Pudu, Alces*, and some of the smaller Rusine Deer.	(6) Canines absent in both sexes. Exception, *Nanotragus pygmæus* has sometimes the upper milk-canine.
(7) Distal ends of the lateral metacarpals present in some.	(7) Distal ends of the lateral metacarpals wanting in all genera.
(8) The first and second	(8) The first and second pha-

Cervidæ (continued).	*Bovidæ* (continued).
phalanges of the lateral digits present. Exception, *Cervulus*.	langes of the lateral digits wanting in all.
(9) Parieto-squamosal suture nearer the upper than the lower border of the temporal fossa[1].	(9) This suture is nearer the lower than the upper border of the temporal fossa. Exception, *Antilocapra*.
(10) Navicular, cuboid, and ectocuneiform united in some.	(10) These bones never all united.
(11) Placenta with few cotyledons (*Oligocotyledontophora*, Garrod [2]).	(11) Placenta with many cotyledons (*Polycotyledontophora*, Garrod).
(12) Gall-bladder absent.	12 Gall-bladder present. Exception, *Cephalophus*.

From this table it becomes apparent that, with the exception of the eleventh, none of these characters can be considered exclusively characteristic of the Cervidæ; and even with regard to it, more extensive observation is required before it can be laid down as a fixed and exclusive Cervine character. But although, with this exception, none of the above characters can be taken *singly* as distinctive of a Cervine from a Bovine animal, the coexistence of the second, third, fourth, and fifth in all the Cervidæ and their absence in combination in the *Bovidæ* will, I think, be found universal.

Deer may therefore for the present be characterized as *Pecora* having two orifices to the lacrymal duct, situated on or inside the orbit, lacrymal fossæ, an anteorbital vacuity, cutting off the lacrymal from articulation with the nasals, the first molar brachyodont, the parieto-squamosal suture nearer the upper than the lower border of the temporal fossa, and the placenta with few cotyledons.

II. *On the Division of the* Cervidæ *into Sections larger than Genera.*

I will now pass on to the consideration of the pedal characters above alluded to.

The fore limbs of all existing species of Cervidæ exhibit one of the two following conditions.

(1) Two slender, short, detached, splint-like bones, the rudiments of the second and fifth metacarpals (Plate LV. figs. 2, 2′ and 5′), situated posterior to and one on each side of the *proximal* extremity of the metacarpal cannon (or confluent third and fourth metacarpals); the phalanges of the second and fifth digits separated from their rudimentary metacarpals by a very wide interval; the proximal phalanx of these digits (Plate LV. fig. 2 *p*) inferior in size to the central and ungual phalanges. In *Cervulus* the phalanges of the second and fifth digits are undeveloped.

[1] *Vide* Prof. Garrod, P. Z. S. 1877, p. 15.
[2] Garrod, *loc. cit.* p. 12.

(2) Two slender pointed bones, the rudiments of the second and fifth metacarpals (Plate LV. figs. 1, 2′ and 5′), situated posterior to and one on each side of the *distal* extremity of the metacarpal cannon. These bones articulate with their respective phalanges, but are separated from the carpus by a wide interval. The proximal phalanx of these digits (Plate LV. fig. 1, *p*) is superior in size to the central and ungual phalanges.

For these forms Professor Flower has kindly assisted me in finding convenient names. For the former, that in which the proximal (or near) extremities of the lateral metacarpals remain, I would propose the term *Plesiometacarpal* (*πλησίον*, near, and *μετακάρπιον*, *metacarpus*); and the latter, that in which the distal (or more remote) extremity of these bones remains, I would designate *Telemetacarpal* (*τῆλε*, far, *μετακάρπιον*, *metacarpus*).

With the view of ascertaining whether the myology of the fore limbs of the Cervidæ confirms or confutes the importance which I would assign to their osteological characters, I have been lately engaged in the examination of the muscles of the fore limbs of the Artiodactyles in general. My materials have been, however, as yet far too meagre to justify me in attaching any great weight to the characters afforded by myology; but I am encouraged in expecting that my observations may not be altogether unimportant, in which case I shall hope to lay them before the Society upon some future occasion.

I will only here mention that in the telemetacarpal limb of the Common Roe, the phalanges of each lateral digit are supplied with two tendons from the extensor muscles of the forearm—a condition precisely similar to that which obtains in the tetradactyle *Tragulus*. On the other hand, in the plesiometacarpal limb of the Red Deer and Fallow Deer, the lateral phalanges are entirely without muscular attachment. In neither the Roe, Red Deer, or Fallow Deer are the lateral phalanges supplied with tendons from the flexors. A similar condition is seen in *Tragulus*, in which form the lateral phalanges are but slightly functional; but in the telemetacarpal limb of *Moschus* the lateral phalanges are (as in *Sus*) supplied with strong tendons from the flexor profundus digitorum. In *Moschus*, the lateral phalanges are highly functional. The special office performed by the lateral phalanges is the prevention of the animal slipping when rushing at speed down slopes or sinking in swampy ground; and this function is effected without danger of the displacement of these delicate structures, by means of strong ligamentous bands developed in the aponeurosis surrounding them, which bind them firmly in their normal position. In the telemetacarpal limbs which I have examined, in addition to these bands, distinct round ligaments pass from the sides of the distal articular surface of the metapodium to the centre of the metacarpal splint on each side (Plate LV. fig. 1, *r*–*r*′), and aid in preventing its displacement upwards, upon undue pressure being applied from without.

In the annexed list of all the known species of existing Deer, arranged according to their geographical distribution, the names of

those with telemetacarpal limbs are printed in italics, and those with plesiometacarpal limbs in ordinary type. From this a remarkable parallelism becomes at once apparent between the distribution of the Cervidæ in the two main divisions of the earth's surface, and the condition of the rudimentary external digits of their fore limbs. Of the 39 species confined to the Old World, 36 are *Plesiometacarpi*, the exceptions being *Hydropotes inermis* and the two species of *Capreolus*. Of the 22 species confined to the New World, 21 are *Telemetacarpi*, *Cervus canadensis* being the sole exception. Both species of circumpolar range are *Telemetacarpi*.

Old World.	*Northern regions of both Hemispheres.*	*New World.*
1. Cervulus muntjac.	1. *Alces machlis.*	1. *Cariacus* (*Cariacus*) *virginianus.*
2. —— lacrymans.	2. *Rangifer tarandus.*	2. —— (——) *leucurus?*
3. —— reevesii.		3. —— (——) *mexicanus.*
4. Elaphodus cephalophus.		4. —— (——) *similis?*
5. —— michianus?		5. —— (——) *savannarum.*
6. Cervus (Rusa) aristotelis.		6. —— (——) *peruvianus.*
7. —— (——) equinus.		7. —— (——) *gymnotis.*
8. —— (——) swinhoii.		8. —— (——) *toltecus.*
9. —— (——) philippinus.		9. —— (——) *macrotis.*
10. —— (——) mariannus?		10. —— (——) *columbianus.*
11. —— (——) nigricans.		11. —— (*Blastocerus*) *paludosus.*
12. —— (——) alfredi.		12. —— (——) *campestris.*
13. —— (——) kuhli.		13. —— (*Furcifer*) *chilensis.*
14. —— (——) porcinus.		14. —— (——) *antisiensis.*
15. —— (——) lepidus?		15. —— (*Coassus*) *rufus.*
16. —— (——) hippelaphus.		16. —— (——) *simplicicornis.*
17. —— (Rucervus) duvauceli.		17. —— (——) *rufinus.*
18. —— (——) schomburgki.		18. —— (——) *nemorivagus.*
19. —— (——) eldi.		19. —— (——) *superciliaris.*
20. —— (Elaphurus) davidianus.		20. —— (——) *whitelyi.*
21. —— (Axis) axis.		21. *Pudua humilis.*
22. —— (Pseudaxis) sika.		22. Cervus canadensis.
23. —— (——) euopis?		
24. —— (——) mantchuricus.		
25. —— (——) dybowskii?		
26. —— (——) kopschi?		
27. —— (——) taëvanus.		
28. —— (——?) caspicus.		
29. —— (Cervus) elaphus.		
30. —— (——) xanthopygus?		
31. —— (——) eustephanus.		
32. —— (——) maral.		
33. —— cashmeerianus.		
34. —— affinis.		
35. —— (Dama) dama.		
36. —— (——) mesopotamicus.		
37. *Hydropotes inermis.*		
38. *Capreolus capræa.*		
39. —— *pygargus.*		

The fact of the plesiometacarpal and telemetacarpal limb-characters so closely corresponding with the distribution of the Cervidæ in the Old and New Worlds, would in itself have convinced me of their fundamental importance; but a certain osteological cranial cha-

racter lately discovered by Professor Garrod (see P. Z. S. 1877, p. 13, fig. 24) has confirmed me in this opinion.

Professor Garrod has observed that in all the American Deer, with the exception of *Cervus canadensis*, the vertical plate developed from the lower surface of the vomer is prolonged sufficiently downwards and backwards to become ankylosed to the horizontal plate of the palatals, and to form a complete septum dividing the nasal cavity into two distinct chambers. The posterior edge of the vertical plate of the vomer is plainly visible upon looking into the posterior nares in the dry skull. In none of the Deer confined to the Old World is the vertical plate of the vomer sufficiently developed to reach the horizontal plate of the palatals; and therefore in none is there a septum dividing the nasal cavity into two chambers separated from the anterior to the posterior nares.

This cranial character agrees with the pedal characters in placing the Reindeer, one of the species of circumpolar distribution, with the Deer of the New World. *Alces*, along with *Hydropotes* and *Capreolus*, all of which are Telemetacarpi, Prof. Garrod's cranial character places with the *Plesiometacarpi* of the Old World.

So long ago as 1836, Dr. Gray[1] pointed out characters afforded by the tufts of hair observable on the tarsus and metatarsus of most Deer, and expressed his opinion that they constitute "a means of subdividing them in natural sections." In his Catalogue of the Ruminant Mammalia in the British Museum (1872), Dr. Gray divides the Cervidæ into two primary groups:—(1) that in which tuft of hair on the outside of the metatarsus is above the middle of that bone, and (2) that in which this tuft is below the middle of the metatarsus.

Now I cannot but think it is a highly significant fact, and one that should make us very cautious in condemning any character as trivial, to find that a classification based on these apparently superficial characters coincides exactly, as far as it goes, with that founded on Prof. Garrod's cranial characters, and, with the exceptions referred to, with that based on the osseous structure of the limb.

There are some species both in the Old and the New World which are devoid of either metatarsal or tarsal tufts. When present, the metatarsal tuft is always above the middle of the metatarsus; and there is never any tuft on the inner surface of the tarsal joint in the Deer confined to the Old World. In the Deer confined to the New World, the metatarsal tuft when present is always below the middle of the metatarsus, and there is frequently a distinct tarsal tuft. *Cervus canadensis* constitutes the solitary exception.

There is yet another character which lends some weight to the teaching of those already mentioned; and for the observation of it we are again indebted to Prof. Garrod[2]. Prof. Garrod has observed that the ascending rami of the præmaxillæ articulate with the nasals in all the Old-World Deer, with one or two exceptions, whilst in the Deer of the New World, again with one or two exceptions, the rami of the præmaxillæ do not reach the nasals.

I shall not now attempt to decide the relative value of these charac-

[1] Vide P. Z. S. 1836, p. 66. [2] P. Z. S. 1877, p. 13.

ters, a task which can only become possible when our knowledge of the extinct forms of Deer shall be very much more complete than it is at present. Accepting the facts as we find them, the existing Cervidæ may be divided into three primary sections.

A. Proximal ends of the lateral metacarpals remaining. (PLESIOMETACARPI.)

Posterior portion of the nasal cavity not divided by the vomer into two distinct chambers.

Tuft of hair on the external surface of the metatarsus, when present, above the centre of that bone. Tuft of hair on the inside of the tarsus always absent.

Ascending rami of the præmaxillæ articulating generally with the nasals.

Genera:—*Cervulus, Elaphodus, Cervus* (subgen. *Rusa, Rucervus, Elaphurus, Axis, Pseudaxis, Dama*).

B. Distal ends of the metacarpals remaining. (TELEMETACARPI.)

Posterior portion of the nasal cavity not divided by the vomer into two distinct chambers.

Tuft of hair on the external surface of the metatarsus, when present, above the centre of that bone.

Genera:—*Alces, Hydropotes, Capreolus.*

C. Distal ends of the metacarpals remaining. (TELEMETACARPI).

Posterior portion of the nasal cavity divided by the vomer into two distinct chambers.

Tuft of hair on the external surface of the metatarsus when present, below the centre of that bone. Tuft on the inside of the tarsus frequently present.

Ascending rami of the præmaxillæ generally not reaching the nasals.

Genera:—*Cariacus* (subgen. *Cariacus, Blastocerus, Furcifer, Coassus*), *Pudua, Rangifer.*

Of the inequivalency and heterogeneous nature of section *B* I am most fully aware. It can only be considered a temporary receptacle for species whose natural relationship to sections *A* and *C* cannot as yet be finally decided.

III. *On the Subdivision of the Sections into minor Groups.*

The definition of the minor groups into which the three primary sections are ultimately divisible in such a manner as to render their boundaries readily appreciable, is, I believe, almost impossible. And yet that a solid bond of affinity unites the members of each natural minor group, that they possess in common certain peculiarities which distinguish them from species contained in other minor groups, no one who has studied the Cervidæ can for a moment doubt. This being so, I think that the distinct recognition of the various clusters of species, into which the Cervidæ naturally group themselves, is a matter of the first importance in an attempt to understand their entire life-history.

The question as to whether these minor groups should be regarded as genera or subgenera, or merely marked as nameless sections, appears to me to be of wholly secondary importance.

Actuated by this belief, I have retained the names originally given to these subgroups whenever the grouping has appeared to me to be natural, and have spoken of them as subgenera. The characters upon which the subgenera are based are derived principally from the form of the antlers, the skull, the rhinarium[1], external coloration, position and degree of development of the cutaneous glands, and general external form.

As is the case with the family characters, it is seldom that any one subgeneric peculiarity can be taken singly as exclusively characteristic of a certain subgenus; but the existence in different fixed combinations of these characters in the several subgenera is an empirical certainty. For example, the form of rhinarium peculiar to *Rusa* (*vide infra*) is shared by other groups, but never in combination with the form of antler and immense lacrymal pit typical of that subgenus; and no species of *Rusa* is without this combination. Again, the form of the rhinarium in the subgenus *Cervus* differs from that of *Rusa*, but resembles that of *Dama* &c.; but in *Cervus* this rhinarium is always associated with the antlers typical of that subgenus, and an anal disk of paler colour than the adjacent parts surrounding the tail; whilst in *Dama* it is combined with the palmated form of antler and tuft of long hair surrounding the prepuce. It is needless here to give further examples of this law: it will be found fully illustrated in the diagnoses of the subgenera (imperfect as these doubtless are) given in the synopsis.

The objection that antlers are absent in the females of all existing species with the exception of *Rangifer*, whilst in *Hydropotes* they are wanting in both sexes, has been frequently urged against the value of characters based on these appendages. The stability of this objection strikes me as very questionable. There can be no doubt that it would be highly convenient if such prominent and easily observed features as those afforded by the antlers were universally attainable; and the lack of their invariable occurrence is doubtless a source of some slight confusion to the systematist.

But surely the value of a character as a test of genetic affinity cannot be judged upon utilitarian principles; and if, as I think, I can show reason for believing the form of the antlers is one of the clearest proofs of the blood-relationship of the species contained in the various subgenera, characters derived therefrom must be regarded as the most trustwothy for taxonomic purposes.

In order to account for the phenomena presented by the antlers in the males of the existing Deer, four factors are necessary:—(1) The gradual evolution of the antlers from very simple to complex forms; (2) Their constant tendency to vary; (3) Variation extending far enough to induce the partial atrophy of one part of the antler

[1] I follow Illiger and Sundevall in the adoption of this term for the naked moist skin between the nostrils. It is decidedly preferable to muffle, which is French, or muzzle, which signifies something quite different in every-day speech.

to compensate for the extra development of some other part; (4) The transmission and fixation of such variations by heredity.

(1) The gradual evolution of the antlers from very simple to more complex forms.

The earliest Cervine animal of which we have any knowledge is *Dremotherium* from the early Miocene of Europe. This species was, so far as is at present known, without antlers. In the middle Miocene of France and Germany, and in a somewhat similar horizon in North America, the earliest antlered Deer as yet discovered have been found. These species, belonging to the very closely allied genera *Dicrocerus* and *Cosoryx*, possessed very short antlers with a single tine projecting forwards; in fact they closely resembled the antlers of the existing species of *Furcifer* (fig. 17, p. 923).

From this period to recent times a gradual increase in the luxuriance of growth and diversity in the form of the antlers is evidenced even by the miserably imperfect materials as yet at the command of naturalists. Of this the following forms bear witness:—

Cervus matheroni, Gerv.

Cervus matheroni, Gaudr. An. foss. Mont Léb. p. 66, pl. 13.

Horizon. Upper Miocene.

Cervus cusanus, Croiz. & Job.

Cervus cusanus, Boyd Dawk. Quart. Journ. Geol. Soc. 1878, p. 405, fig. 2.

Horizon. Pliocene (Lower?)

Cervus perrieri, Croiz. & Job.

Cervus perrieri, Boyd Dawk. Quart. Journ. Geol. Soc. 1878, p. 488, figs. 3–5.

Horizon. Pliocene.

Cervus cylindricornis, Boyd Dawk. Vide *loc. cit.* p. 415, figs. 11, 12.

Horizon. Upper Pliocene.

Cervus tetracerus, Boyd Dawk. *loc. cit.* p. 417, figs. 13–17.

Horizon. Upper Pliocene.

Megaceros hibernicus.

Horizon. Post-tertiary Deposits.

Cervus elaphus.

Horizon. Post-tertiary deposits, and existing epoch.

I need hardly say that these species have no direct affinity to each other; they are simply chosen as illustrating the general fact that the antlers of the Cervidæ have gradually increased in complexity from the Upper Miocene period to recent times.

It might at first sight appear as though the occurrence of existing species with very simple antlers militated against the more compre-

hensive fact of the gradual augmentation of complexity in these organs through geological time; but as the converse, namely the existence of highly complicated antlers in the Miocene and Pliocene periods, finds no support in the Geological record, the simple antlers of some existing species may be, I think, safely regarded as the result of arrestation, dependent on a less severe struggle for existence, or possibly upon some hitherto undiscovered influence.

(2) A constant tendency to vary.

Of this, any one can satisfy himself by the inspection of large collections of antlers. No two antlers are ever exactly alike; and the variations to which the antlers are subject in some species (*e. g. Cervus elaphus*, vide infr. p. 910) is so great, that in the absence of a large series they would be held as indicative of several distinct species.

(3) Variation extending far enough to induce the partial atrophy of one part of the antler to compensate for the extra development of some other part.

To illustrate this subject exhaustively would occupy more space than can be well devoted to it in the present paper. An attentive examination of any large collection will yield abundant evidence that such is invariably the case. It will, perhaps, be sufficient for my present purpose to bring forward one special example. The normal form of the upper half of the antlers of the common Fallow Deer (fig. 9, p. 914) may be described as broadly palmated, with several rudimentary tines produced from the posterior margin of the palm, the tine situated lowest on the palm exceeding the others slightly in length (fig. 9, *d*). In my cousin Mr. J. Bloomfield's place, Castle Caldwell, on the shores of Lough Erne, there is a herd of Fallow Deer which have lived at large in the woods, and under perfectly natural conditions, for upwards of 50 years. The antlers of these Deer are so remarkable in form, and present the peculiarities in which they are remarkable so constantly, that they could be recognized amongst a large collection of Fallow-Deers' antlers without the slightest difficulty. The tine growing from the inferior and posterior border of the palm (Plate LV. fig. 3, *d*) is in the Castle-Caldwell Deer immensely developed, and the palm itself is much contracted and seldom bears more than 3 or 4 tines. Variation is still actively at work on the antlers of these Deer, and reversion towards the normal form occasionally asserts itself; but, notwithstanding, a fixed type of antler has stamped itself indelibly upon the males in this herd in the short space of 50 years, and the peculiarities characteristic of that type are unquestionably the result of the extra development of one of the posterior tines and the consequent partial atrophy of the palm.

(4) The transmission and fixation of such variations by heredity.

That this is the case has been in a large measure proved by what has been already said; but the following fact places the matter beyond all possibility of doubt. The Castle-Caldwell Deer are the descendants of about one or two males and twice as many females. A single antler of one of the fathers of the herd has been fortunately preserved in the Museum at Castle Caldwell. This antler (Plate

LV. fig. 4) I have the pleasure of exhibiting this evening. It will be seen that it presents the same peculiarities that are characteristic of the distant descendants of its original owner, and that we have here a direct proof of heredity transmitting, and to a very great extent fixing, a definite and prominent variation[1].

Did space permit I could give many more illustrations corroborating the evidence of the above-mentioned facts. Innumerable instances of the power of heredity to transmit and fix variations in the antlers until some stronger influence interferes, are enacted annually before my eyes, amongst about 600 Deer of several different species preserved in my parks. Enough has, however, I think, been adduced to leave the *onus probandi* upon those who deny to characters derived from the antlers the right to be considered one of the surest land-marks of affinity in the Cervidæ.

IV. *Geographical Distribution of the* Cervidæ, *and Remarks thereon.*

Genera and Subgenera.	Number of species.	W. Palæarctic Reg. W. of long. 70° E.	E. Palæarctic Reg. E. of long. 70° E.	Indian Region.	Nearctic Region.	Neotropical Region.
		No. of sp.	No. of sp.	No. of sp.	No. of sp.	No. of sp.
Cervulus ...	3	...	...	3		
Elaphodus ...	2	...	...	2		
Rusa	11	...	...	11		
Rucervus ...	3	...	...	3		
Elaphurus ...	1	...	1			
Axis	1	...	...	1		
Pseudaxis ...	7?	1?	4	2		
Cervus	7	2	4	...	1	
Dama	2	2				
Hydropotes .	1	...	1			
Capreolus ...	2	1	1			
Cariacus.....	10?	...	...	...	7	3
Blastocerus ..	2	...	...	...	...	2
Furcifer.....	2	...	...	...	...	2
Coassus	6	...	...	...	...	6
Pudu	1	...	...	...	...	1
Total	61	6	11	22	8	14

[1] The production of so marked a variation from the form of antler typical of *Dama vulgaris* in the short space of fifty years as that exhibited by the Castle-Caldwell Fallow Deer might be considered as tending to prove the instability of the original specific characters. It may, however, be observed that the general form of antler typical of the species has not been obliterated by the evolution of the characters now peculiar to the variety, but that, on the contrary, heredity has preserved a record of the earlier, or specific, alongside of the later, or varietal, modification. Essentially analogous phenomena are presented by the antlers typical of the species and subgenera of the Cervidæ, the distinctive specific characters being, in every instance, an evident modification of the form of antler characteristic of the subgenus.

In this Table, showing the geographical distribution of the Cervidæ exclusive of the Elk and Reindeer, which have a circumpolar range, the following are the most important facts observable. Out of a total of 61 species 39 are confined to the Old and 22 to the New World. Of the 39 Old-world species 33 are found in the Eastern Palæarctic and Indian regions, the latter containing 22 species, a much larger number than that contained in any one of the remaining four regions.

Of the 22 species confined to the New World, 8 are found to the north and 14 to the south of the Isthmus of Tehuantepec, the division adopted by Mr. Sclater between the Nearctic and Neotropical regions. These figures cannot, however, be taken as affording a just estimate of the relative degree of specialization of the Cervidæ in the Nearctic and Neotropical regions respectively. On the one hand, the three species of *Cariacus* in the latter are undoubtedly immigrants from the former region; and on the other hand, the species contained in the subgenera *Coassus* and *Furcifer* are, as far as the antlers are concerned, amongst the least-specialized of existing species.

Out of the eleven genera into which the Old-world Deer are divisible, there is only one (*Dama*) which has not a representative in either the Palæarctic or Indian region.

Owing to the exceeding paucity of Palæontological material, any attempt to account for the present differentiation and distribution of the Cervidæ must be considered as purely tentative; and I venture to put forward the following hypothesis, more to provoke investigation and criticism, which may possibly bring new and more correct ideas to light, than from any great confidence that I feel in its approximation to completeness.

In order to avoid unnecessary recapitulation, and to indicate as clearly as possible the interdependence of the facts and hypothesis, I shall place the facts and theory in two columns, numbering the former, and merely introducing the number attached to each fact before the deduction or deductions which are drawn from it.

Facts.	*Hypothesis.*
(1) So many characters are common to the Cervidæ and Bovidæ that it is very difficult to lay down definitions distinctive of the families.	(1) A very high degree of specialization had been attained by the common ancestor of the Cervidæ and Bovidæ, especially in the structure of the skull, dentition, and limbs; hence the possibility of divergence of character in its descendants was much restricted. (2) For a long period the early ancestors of the Cervidæ, which were tetradactyle,
(2) *Dremotherium*, the earliest known Cervine form, was without antlers and tetradactyle.	

Facts (continued).

(3) The antlers of the European *Procervulus* and of some species of the North-American *Cosoryx* appear to have been persistent.

(4) The antlers of *Dicroceros* and *Cosoryx* possessed one, or at most two tines.

(5) The increase in the complexity of the antlers of extinct species accompanies their chronological sequence in geological time.

(6) In a conversation which I have lately had with Prof. Marsh, he informed me that some of the specimens of *Cosoryx* collected by him in North America were tetradactyle. The lateral metacarpals in these specimens are excessively attenuated in the centre third of their length. In other specimens Prof. Marsh tells me a natural separation had taken place between the proximal and distal ends of the bones.

(7) The condition of the lateral metacarpals separates existing Deer into two great groups, the *Plesiometacarpi* and *Telemetacarpi*.

Hypothesis (continued).

remained unantlered; and spread from the centre of their geographical area (13), which was probably in the Eastern Palæarctic and Indian regions, they passed westward into Europe, and eastward into North America. (3) Processes then became developed from the frontals, which gradually elongated and in some instances branched. At first these outgrowths from the frontals remained persistently attached; but eventually the great advantage enjoyed by individuals who through necrosis lost, and through an inherited tendency to produce frontal processes renewed their antlers, over individuals who retained antlers broken and rendered useless by frequent combats, caused the natural selection of the former in the struggle for existence. (4, 5) These first deciduous antlers were exceedingly simple; but as time rolled on the advantage of large and complex antlers as a means of offence and defence established an ever-increasing tendency towards complexity in their form. (6) A diminution in the size of the lateral digits of the early forms of Deer accompanied the increase in the size of their antlers. The centre part of these bones, after attaining an extreme degree of atrophy, at last ceased to ossify. (7, 8) In some species the default in ossification took place nearer the distal than the proximal extremity of the bone. In others the converse obtained. The reduction of the rudiments steadily continued, resulting eventually in the disappearance of the shorter rudiment in both forms. Hence the origin of the plesiome-

Facts (continued).

(8) In some of the *Telemetacarpi* the distal extremities of the lateral metacarpals is two thirds the length of the metacarpal cannon. In some of the Bovidæ (e. g. *Gazella*), of which family all the species are plesiometacarpal, the proximal extremity of these bones is two thirds the length of the metacarpal cannon.

(9) With three exceptions all the Old-world Deer are plesiometacarpal; and with one exception all the New-world Deer are telemetacarpal.

(10) In none of the Old-world Deer is the vomer sufficiently prolonged backwards to divide the nasal cavity into two chambers. In all the New-world Deer the nasal cavity is so divided.

(11) The vomer of *Megaceros hibernicus* exhibits an intermediate condition. The limb in this form is plesiometacarpal, and as highly specialized as in the existing *Plesiometacarpi*.

(12) The *Telemetacarpi* of the Old World resemble the *Plesiometacarpi* in the form of their vomer and in the position of the metatarsal tufts.

(13) Thirty-three out of the thirty-nine species of Old-world Deer are inhabitants of the Indian or East Palæarctic regions; and of the eleven subgenera into which they are divisible there is only one (*Dama*) that has no representative in these regions.

Hypothesis (continued).

tacarpal and telemetacarpal condition of limbs in existing Cervidæ. (9) It is probable that the separation between the upper and lower extremities of the metacarpals took place long after the first *Dremotherium*-like Cervidæ had found their way into North America. In these the default in ossification began in the upper third of the lateral metacarpals; (12) whilst in the Cervidæ remaining in the Old World both modes of reduction obtained a footing, the Plesiometacarpi gaining ultimately the preeminence. (10) The vomer in the early forms of Deer was, as in the existing less-specialized Artiodactyles (e. g. *Hippopotamus*, *Sus*, *Tragulus*), prolonged backwards, dividing the nasal cavity into two distinct chambers. (11) As the competition between rapidly multiplying and allied forms became severe in the Old World, specialization extended to this part of the cranium, and a reduction in the backward extension of the vertical plate of the vomer, and consequent modification of the surrounding parts, set in. It is not improbable that the limbs of the *Plesiometacarpi* had nearly reached their present stage of specialization before the form of their vomer departed from the primitive type. The Deer of the New World, being less numerous both in individuals and species, and not being subjected to such severe competitions as the Old-world Deer, retained the primitive form of vomer. The greater development of the antlers in the larger majority of Old-world Deer, as compared with those of the New-world Deer, may be

Facts (continued).	*Hypothesis* (continued).
(14) There are only twenty-two species in America; and the South-American species have remarkably simple antlers.	attributed to the same cause. (14) The Deer of South America, which, according to the theory under consideration, have been freer from contact with allied forms than species inhabiting districts nearer to, and more in direct continuity with, the centre of the family area of distribution, are remarkable for the great simplicity of their antlers.
(15) The antlers of the Cervidæ are subject to great variation; and such variations are transmissible by heredity.	(15, 16) For long periods there was no possibility of communication between the Deer of the Old and New World; and during this time the perpetuations by heredity of the more favourable varieties which arose from time to time resulted in the divergence of the Cervidæ into the clusters of species which we now term genera.
(16) Two species have a circumpolar range, and *Cervus canadensis*, a species allied to the common Red Deer of Europe, is found in North America.	(16) At length the means of dispersal was for a second time opened between Asia and North America; an interchange of species took place; the ancestors of *Cervus canadensis* passed over into North America from the Old World, and the Elk and Reindeer extended their range till it was circumpolar.

In the following synopsis I have admitted every species of whose invalidity I am not absolutely certain; and frequently, even where I have felt grave doubts as to the soundness of the claims of a species to specific recognition, I have left it distinct, if by so doing I have thought it probable that future investigation of its claims may throw light on the important problems of geographical variation and distribution. Where colour is not mentioned in the diagnoses it affords no generic or subgeneric character. Supplementary columns are absent in the molars, and the central incisors are much expanded, where the contrary is not stated. Where the metatarsal and tarsal tufts are not specially mentioned, they are present.

V. *Synopsis of the existing* Cervidæ.

A. Proximal ends of lateral metacarpals remaining.

(Plesiometacarpi.)

Posterior portion of the nasal cavity not divided by the vomer into two distinct chambers.

Tuft of hair on the external surface of the metatarsus, when present, above the centre of that bone. Tuft of hair on the inside of the tarsus always absent.

Ascending rami of the præmaxillæ articulating with the nasals. (Exception, species 3, in genus 1.)

1. Cervulus.

1816. *Cervulus*, Blainv. Bull. Soc. Phil. p. 74.

1827. *Stylocerus* (subgen.), Ham. Sm., Griff. An. Kingd. vol. v. p. 319.

1836. *Prox*, Ogilby, P. Z. S. 1836, p. 135.

Antlers half the length of the head, and placed on pedestals which nearly equal (and sometimes surpass) them in length. Brow-antler (fig. 1, *a*[1]) very short, inclined inwards and directly upwards. Terminal extremity of the beam (fig. 1, *x*), which is unbranched, curved downwards and inwards. Lacrymal pit of great depth and extent, the facial plate of the malar taking part in its floor. Anteorbital vacuity of moderate extent. Ascending rami of the præmaxillæ equalling or exceeding the nasals in length. A strong ridge passes from the root of each pedestal over the orbit, lacrymal pit, and anteorbital vacuity, serving to protect frontal cutaneous glands which lie on its inner surface. Auditory bullæ very

Fig. 1

Cervulus muntjac.

slightly inflated, the tympanohyal abutting against the paroccipital process.

Canines strongly developed in the males, and curved downwards, backwards, and outwards; in the females they are small; and in neither are the pulps persistent.

Rhinarium extensive, completely surrounding the nostrils, the upper border of its internarial portion slightly convex. Prænarial portion of the rhinarium broad, its lateral borders passing subvertically downwards to the upper lip. No metatarsal tufts. Tarsus with the navicular, cuboid, and ectocuneiform united. Phalanges of lateral digits absent in both fore and hind extremities. Young spotted (exc. species 1 ?). Stature small.

Distribution. Indian and South-eastern Palæarctic regions.

[1] Prof. Garrod, in his valuable paper to which I have so frequently alluded (P. Z. S. 1877, p. 16), has drawn attention to a law of which the various modifications of the antlers in the Cervidæ are, in his opinion, the result. I have ventured to extend, and in some slight degree to modify, Prof. Garrod's suggestion. The lettering in the woodcuts indicates the parts of the antlers which appear to me to be homologous.

1. Cervulus muntjac.

1780. *Cervus muntjac*, Zimm. Geogr. Gesch. Band ii. p. 131.
1785. —— *muntjak* et *vaginalis*, Bodd. Elench. Anim. vol. i. p. 136.
1867. *Cervulus aureus*, Jerd. Mamm. p. 264.
1873. —— *amostylis* et *tamulicus*, Gray, Hand-list Rum. Mamm. p. 165.
1874. —— *muntjac*, Brooke, P. Z. S. 1874, p. 38, fig. 3.

Range. British India, Burmah, Malay peninsula, Sumatra, Java, Hainan, Banka, Borneo.

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.

2. Cervulus lacrymans.

1871. *Cervulus lacrymans*, Alph. M.-Edw. Nouv. Arch. du Mus. t. vii., Bull. p. 93; and Rech. s. l. Mamm. p. 348, pls. 63, 64.
1872. —— *sclateri*, Swinh. P. Z. S. 1872, p. 814.
1874. —— ——, Brooke, P. Z. S. 1874, p. 40, pl. 8 & fig. 4.

Hab. Moupin (*David*); hills near Hangchow, China (*Swinhoe*). Type, Mus. d'Hist. Nat. Paris.

3. Cervulus reevesii.

1838. *Cervus reevesii*, Ogilby, P. Z. S. 1838, p. 105.
1862. *Cervulus reevesi*, Swinh. P. Z. S. 1862, p. 361.
1874. —— ——, Brooke, P. Z. S. 1874, p. 41, fig. 5.

Range. Southern China from latitude of Canton as far north as Ningpo; Formosa (*Swinhoe*).

2. Elaphodus.

1871. *Elaphodus*, Alph. M.-Edw. Nouv. Arch. du Mus. p. 93, pl. 7; and Rech. Mamm. p. 353, pls. 65–67.
1874. *Lophotragus*, Swinh. P. Z. S. 1874, p. 452.

Antlers very small, unbranched, supported on slender, long, converging pedestals. Ascending rami of the præmaxillæ very strong, and articulating broadly with the nasals, to which they are inferior in length. No supraorbital ridges or frontal cutaneous glands. Canines in the male massive and long, curved downwards, and not everted. A well-developed frontal tuft. In other respects resembles *Cervulus*, with which genus *Elaphodus* may be united to form the subfamily *Cervulinæ*, as proposed by Professor Garrod (P. Z. S. 1876, p. 765).

Distribution. South-Eastern Palæarctic region.

1. Elaphodus cephalophus.

1871. *Elaphodus cephalophus*, Alph. M.-Edw. (*loc. cit. suprà*).

Hab. Moupin (*David*). Type, Mus. d'Hist. Nat. Paris.

2. Elaphodus michianus.

1874. *Lophotragus michianus*, Swinh. P. Z. S. 1874, p. 452, pl. 59.
1876. —— ——, Garr. P. Z. S. 1876, p. 757, pl. 76.

Hab. Neighbourhood of Ningpo (*Swinhoe*). Type, Mus. Berlin.

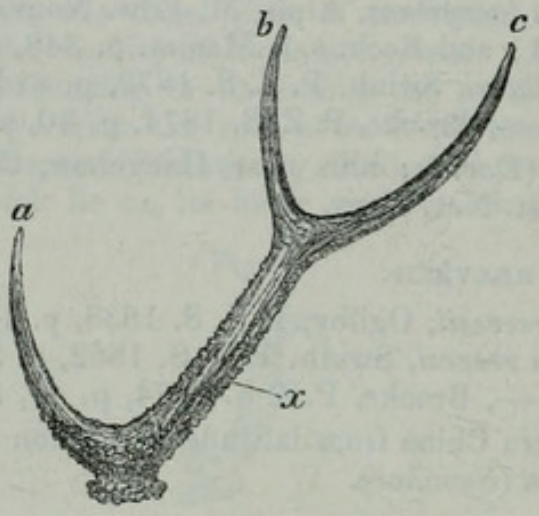
Although I feel sure that Professor Garrod is correct in uniting the genera *Elaphodus* and *Lophotragus*, I have been unable to satisfy myself that the types of the two genera are referable to the same species, as he supposes. I have therefore refrained from amalgamating the Moupin and Ningpo specimens in a single species, and have left the question for the present open.

3. Cervus.

(Rusa, subgen.)

1827. *Rusa* (subgen.), Ham. Sm., Griff. An. Kingd. vol. v. p. 309.

Fig. 2.



Cervus (*Rusa*) *aristotelis.*

Antlers twice or thrice the length of the head, supported on pedestals of moderate length. Brow-antler (fig. 2, *a*) strong, curved boldly upwards, its axis forming an acute angle with that of the beam. The beam (fig. 2, *x*) bifurcates, giving rise to two strong tines (fig. 2, *b* & *c*). Lacrymal pit of very great depth and extent, its antero-posterior diameter exceeding that of the three upper molars. Anteorbital vacuity very large. Auditory bullæ but slightly inflated and rugose externally (exc. species 8 and 9). Rudimentary canines present in both sexes (exc. species 6, 7, 8, 9). Molars with small supplementary columns.

Rhinarium resembling that of *Cervulus*, but less extensive, its upper internarial margin being slightly concave, and its infranarial portion narrower. Tail of moderate length. Neck maned (exc. species 7 and 9). Colour uniform brown (exc. 7 and 9). Stature diverse, the largest species being amongst the largest, and the smaller almost amongst the smallest of the Cervidæ. Young unspotted (exc. species 7 and 9).

Distribution. Indian region.

(*α*) *The upper tines* (*b* & *c*, fig. 2) *of nearly equal length in adult animals; in young males the outer and anterior tine* (*b*, fig. 2) *the longer.*

1. Cervus aristotelis.

1835–7. *Cervus aristotelis*, Cuv. Oss. foss. (ed. 4) tom. vi. p. 84.

Range. British India, Ceylon, Burmah, Siam, Hainan (*Swinh.*).

(*β*) *The outer tine* (*b*, fig. 2) *always surpassing the inner tine* (*c*) *in length.*

2. Cervus equinus.

1825. *Cervus equinus*, Cuv. Oss. foss. (ed. 3) tom. iv. p. 454; ib. (ed. 4) pl. 201. fig. 10.

1839–44. *Cervus equinus*, Müll. Verh. Nat. Gesch. Ned. Bez. Zool. p. 213, pls. 42–45. figs. 7–11.

Range. Borneo, Sumatra (*Müll.*); Singapore (*Brooke*).

I have seen several living specimens of this species, all of which in their much darker colour, more bushy tail, short slightly curved antlers, presented a *tout ensemble* very unlike the common Sambur. On the other hand, I have received skulls and antlers from Siam which are strikingly intermediate between typical specimens of *Cervus aristotelis* and *C. equinus*. It appears to me therefore probable that the existence of these intermediate forms may ultimately render it impossible to maintain the distinction of the species.

3. Cervus swinhoii.

1862. *Rusa swinhoii*, Sclat. P. Z. S. 1862, p. 152, pl. 17.

1862. —— ——, Swinh. loc. cit. p. 364.

1871. —— ——, Sclat. Trans. Z. S. 1871, p. 333, pl. 39.

Hab. Formosa. Type, Brit. Mus.

This species closely resembles *Rusa equinus*.

4. Cervus philippinus.

1827. *Cervus philippinus*, Ham. Sm., Griff. An. Kingd. vol. iv. p. 147, and vol. v. p. 319.

1877. —— ——, Brooke, P. Z. S. 1877, p. 51, pl. 8.

Hab. Luzon (Philippines). Type, Mus. d'Hist. Nat. Paris (No. 409 in Cat.).

5. Cervus mariannus.

1820. *Cervus mariannus*, Desm. Mamm. sp. 669, p. 436.

1877. —— ——, Brooke, P. Z. S. 1877, p. 53.

Hab. Island of Guam (Marianne Islands). Type, Mus. d'Hist. Nat. Paris (414 *a* in Cat.).

As I have stated in my paper above referred to, I feel pretty certain that this and the preceding species are identical. I am, how-

ever, now, as then, unable to substantiate this opinion satisfactorily, owing to insufficiency of material.

6. Cervus nigricans.

1877. *Cervus nigricans*, Brooke, P. Z. S. 1877, p. 57, pls. 9, 10.

Hab. Philippines (exact locality ?). Type, in my own collection.

7. Cervus alfredi.

1870. *Cervus alfredi*, Sclat. P. Z. S. 1870, p. 381, pl. 28.

1877. —— ——, Brooke, P. Z. S. 1877, p. 59.

Hab. Philippines (Luzon ?). Type, Brit. Mus.

8. Cervus kuhli.

1839–44. *Cervus kuhlii*, Müll. Verh. Nat. Gesch. Ned. Bez. Zool. p. 223, pls. 44, 45. figs. 12–14.

Hab. Bavian Islands. Type, Mus. Leyden.

This species was originally described by Müller from specimens collected by Diard in the Bavian Islands, to which locality the species, as far as is at present known, is confined. The auditory bullæ in *Cervus kuhli* are largely inflated. By this character the skull may be distinguished from that of any of the Rusine deer with the exception of *C. porcinus*. The skull of *C. kuhli* differs from that of *C. porcinus* in having the facial portion anterior to the orbits much more compressed, and the orbits much more prominent. *C. kuhli* has proportionally much longer limbs than *C. porcinus*; and all the hairs of the back and sides are annulated in the former and not in the latter species. The young of *C. kuhli* are unspotted, which is not the case with those of *C. porcinus*[1]. Both species are devoid of upper canines.

9. Cervus porcinus.

1777. *Cervus porcinus*, Zimm. Spec. Zool. Geogr. Quadr. p. 552, sp. 6.

Range. British India, Ceylon, Burmah.

10. Cervus lepidus.

1844. *Cervus lepidus*, Sund., Pec., Vetensk. Akad. Handl. p. 180, sp. 14.

Hab. Java ? Type, Mus. Frankfort ?

This is a very doubtful species. Some years ago I saw the type in the museum at Frankfort; and it appeared to me to closely resemble *Cervus sika*. Upon the occasion of my last visit to Frankfort I sought in vain for the specimen, and much fear that it has been destroyed.

[1] *Vide* Sclater, P. Z. S. 1863, p. 224.

(γ) *The inner tine* (fig. 3, *c*) *always surpassing the outer tine* (fig. 3, *b*) *in length.*

11. Cervus hippelaphus.

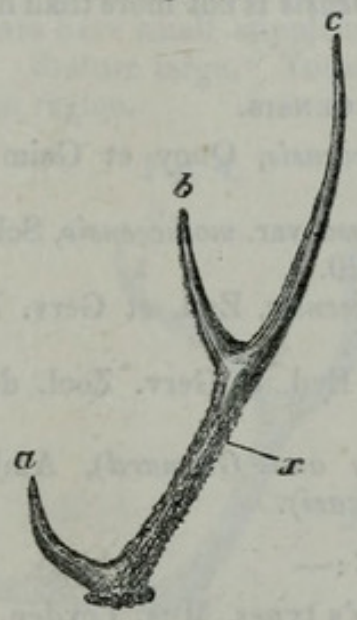
1825. *Cervus hippelaphus*, Cuv. Oss. foss. (ed. 3) tom. iv. p. 40; ib. (ed. 4) tom. vi. p. 77, pl. 166. figs. 31–34.

1839–44. *Cervus rusa*, Müll. Verh. Nat. Gesch. Ned. Bez. Zool. p. 217, pl. 43, pl. 44. figs. 1–6.

Hab. Java, Borneo (introduced).

Deer resembling *Cervus hippelaphus* in every particular excepting size are found in many of the islands in the Indo-Malayan and Austro-Malayan regions. How far these are the result of natural distribution, or how far their occurrence is attributable to artificial transportation is now most difficult to decide. The best authorities on the fauna of the East Indies, Wallace, Schlegel, and Müller,

Fig. 3.



Cervus (*Rusa*) *hippelaphus.*

are inclined to lean towards the latter alternative; and it is I think certain that the introduction of many of the larger mammals (*e. g.* Monkeys, Pigs, and Deer) into the islands of the Austro-Malayan region has been effected by the Malays, who, according to Wallace, are much given to taming animals and conveying them from island to island. At the same time, the existence of a species of *Felis* peculiar to Timor, and of the singular *Anoa depressicornis* on Celebes, seems to me to necessitate caution in accepting this solution as of universal application.

I shall therefore, for the present, keep the references to *Cervus timoriensis* of Timor and *C. moluccensis* distinct.

12. (α) Cervus timoriensis.

1822. *Cervus timoriensis*, Blainv. Journ. de Phys. vol. xciv. p. 267.

1825. —— *peronii*, Cuv. Oss. foss. (ed. 3) tom. iv. p. 46.

1833. *Cerf de Timor*, F. Cuv. Mamm. pl. 361.
1852. *Cervus peronii*, Puch. Cerf, Arch. du Mus. vol. vi. p. 409.
1839–44. *Cervus rusa*, var. *timoriensis*, Schl. et Müll. Verh. Ned. Bez. Zool. pp. 212, 220.

Hab. Timor (*Peron, Dussumier*), Samao, and Cambing near Timor (*Schlegel and Müller*).

Specimens examined:—

Type of F. Cuvier's and Pucheran's descriptions, Mus. d'Hist. Nat. Paris.
Müller's types, Mus. Leyden.
Specimen from Leyden, British Museum.
Living specimens in Zool. Gardens of Paris and Rotterdam.

The Timor Deer is a short-legged, thickset animal. The facial profile is remarkably concave, a character which I have frequently noticed in Red Deer and Fallow Deer living under unfavourable circumstances. *C. timoriensis* is not more than half the size of *C. hippelaphus*.

(β) Cervus moluccensis.

1830. *Cervus moluccensis*, Quoy et Gaim. Zool. de l'Astrolabe, tom. i. p. 133, pl. 24.
1839–44. *Cervus rusa*, var. *moluccensis*, Schl. et Müll. Verh. Ned. Bez. Zool. pp. 212, 220.
1836. *Cervus moluccensis*, Eyd. et Gerv. Mag. de Zool. tom. vi. p. 26.
1839. —— ——, Eyd. et Gerv. Zool. de la Favorite, tom. v. Mamm. p. 26.

Hab. Bouru (*Quoy and Gaimard*), Amboina (*Schlegel and Müller*), Celebes (*Beccari*).

Specimens examined:—

Schlegel and Müller's types, Mus. Leyden.
Specimens collected by Beccari, Museo Civico, Genoa.

Cervus moluccensis is a much more delicately built, graceful animal than *C. timoriensis*.

The following are the dimensions of one of Beccari's specimens (♂):—

	Eng. inches.	Metre.
Total length of skull in a straight line ..	11	0·280
From ant. rim of orbit to free extremity of præmaxillæ	5·7	0·145
Length of upper molar series	1·8	0·045
Length of upper premolar series	1·4	0·035
Greatest length of nasals	3·5	0·088
Length of præmaxillæ	2·9	0·073
Across the lower rims of orbits at the widest place	4·5	0·114
Length of humerus	7·9	0·200
Length of radius	7·2	0·183

	Eng. inches.	Metre.
Length of metacarpal cannon	6·1	0·155
Length of femur	9·7	0·245
Length of tibia	10·5	0·265
Length of metatarsal cannon.....	7	0·178

(Rucervus, subgen.)

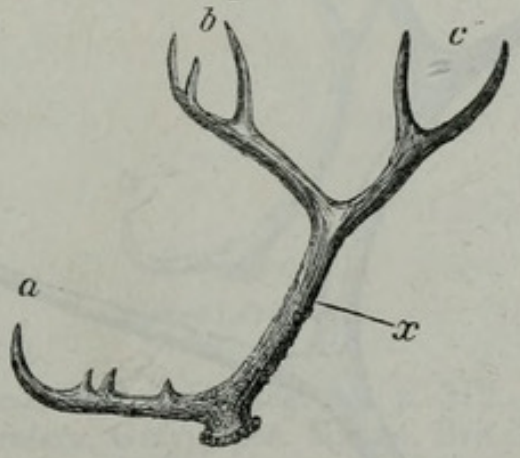
1838. *Rucervus* (subgen.), Hodgs. Ann. Nat. Hist. vol. i. p. 154; J. As. Soc. Beng. vol. x. pt. ii. p. 914 (1841).

Antlers on short stout pedestals. Brow-antlers (fig. 4, *a*) very powerful, projecting forwards at a right angle from the beam, sometimes forked, and frequently developing rudimentary tines from their upper surface. Beam curving boldly forwards along the upper half of its length, and bifurcating into two upper tines, which in their relative dimensions present specific differential characters.

Skull narrower in proportion to its length, in other respects resembling that of *Rusa*: the bullæ are moderately inflated, and the upper and under molars have small supplementary columns. Tail short. Neck maned. Stature large. Young spotted.

Distribution. Indian region.

Fig. 4.



Cervus (*Rucervus*) *duvauceli.*

13. Cervus duvauceli.

1835–37. *Cervus duvaucelli*, Cuv. Oss. foss. (ed. 4) tom. vi. p. 89, pl. 201. figs. 6–8.

1871. —— ——, Sclat. Trans. Zool. Soc. vol. vii. p. 346, pl. 36.

Hab. Nepal; Assam; Denwa valley, Mahadeo hills, Central India (*Forsyth*).

14. Cervus schomburgki.

1863. *Rucervus schomburgki*, Blyth, P. Z. S. 1863, p. 155, fig.

1867. —— ——, Blyth, P. Z. S. 1867, p. 835, figs. 6–12.

1876. *Cervus schomburgki*, Brooke, P. Z. S. 1876, p. 304, figs. 1, 2: Scl. P. Z. S. 1877, p. 682.

Hab. Siam. Types, Brit. Mus.

15. Cervus eldi.

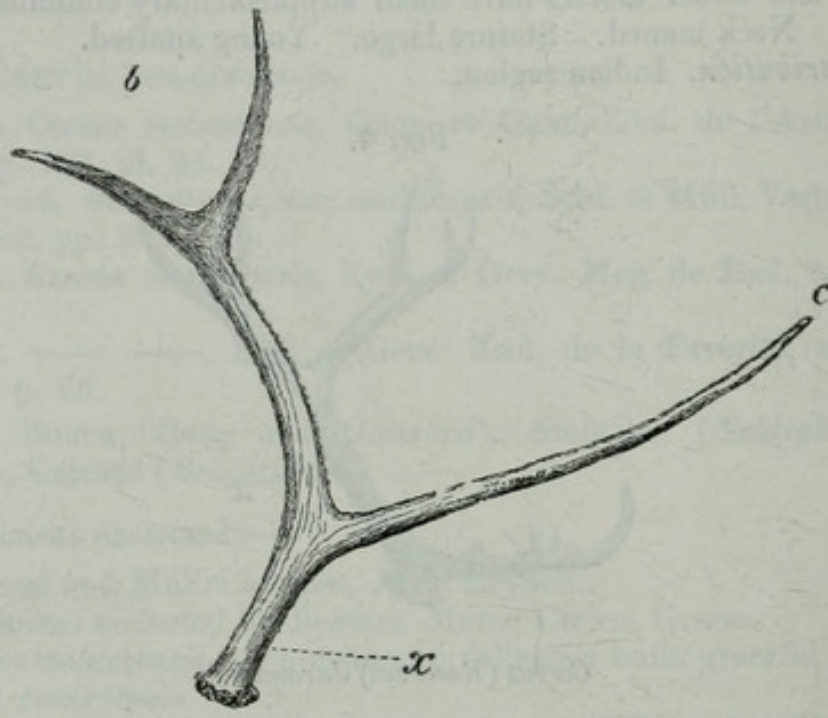
1842. *Cervus eldi*, auct. anon. Calc. Journ. vol. ii. p. 417.
1867. —— ——, Beavan, P. Z. S. 1867, p. 759.
1871. —— ——, Sclat. Trans. Z. S. vol. vii. p. 348, pls. 37, 38.
Hab. Burmah; Siam; Hainan (*Swinh.*).

(Elaphurus, subgen.)

1866. *Elaphurus*, Alph. M.-Edw. Compt. Rend., and Ann. Sc. Nat. ser. 5, tom. v. p. 380, and Nouv. Arch. du Mus. 1866, vol. ii. p. 27.

Antlers dichotomous, about twice the length of the head, pedestals short. The anterior branch of the antlers (fig. 5, *b*) more strongly developed than the posterior branch (fig. 5, *c*.), and in adult specimens bifurcating and carrying many strong tines. Facial portion of the skull much elongated. Ascending rami of the præmaxillæ of great length, articulating broadly with the nasals. Nasals long, and ex-

Fig. 5.



Cervus (*Elaphurus*) *davidianus.*

panded posteriorly between the large anteorbital vacuities, of which they form the larger part of the superior border. Lacrymal pit deep and large. Upper molars with supplementary columns. Ears small and narrow. Eye small. Tail long. Neck maned. Stature large. Young unspotted?

Distribution. North-eastern Palæarctic region?

16. Cervus davidianus.

1866. *Elaphurus davidianus*, Alph. M.-Edw. Nouv. Arch. du Mus. 1866, vol. ii. p. 27, pls. 4, 5, 6.
1871. —— ——, Sclat. Trans. Z. S. vol. vii., p. 333, pl. 28.
Hab. Mantchuria. The specimens which have reached Europe

were brought from the imperial park, south of Pekin. Types, Mus. d'Hist. Nat. Paris.

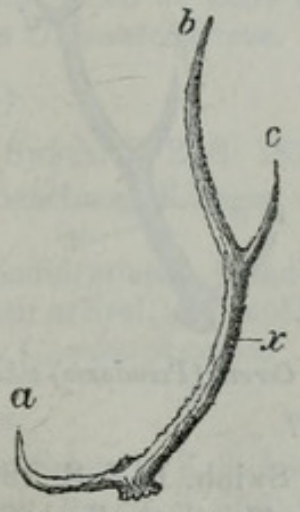
(Axis, subgen.)

1827. *Axis* (subgen.), Ham. Sm., Griff. An. Kingd. vol. v. p. 312.

Antlers about three times the length of the head, supported on slightly elongated pedestals. Brow-antler (fig. 6, *a*) rising at something less than a right angle from the beam (fig. 6, *x*), which bifurcates at a little above the half of its entire length. Of the tines thus formed, the external and anterior tine (fig. 6, *b*) is much the longer. Skull and rhinarium as in *Rusa*. Upper canines wanting. Molars with small supplementary columns. Both sexes at all ages and seasons distinctly spotted with white. Stature medium.

Distribution. Western portion of the Indian region.

Fig. 6.



Cervus (*Axis*) *axis*.

17. Cervus axis.

1877. *Cervus axis*, Erxl. Syst. Reg. An. p. 312.

1843. *Axis maculata*, Gray, Spec. Mamm. Brit. Mus. p. 178.

Range. British India; Ceylon.

(Pseudaxis, subgen.)

1872. *Pseudaxis*, Gray, Cat. Rumin. Mamm. Brit. Mus. p. 70.

Antlers about twice the length of the head, supported on short stout pedestals. Brow-antler (fig. 7, *a*, p. 908) rather short, directed upwards at a rather acute angle with the beam (fig. 7, *x*). A strong tine (fig. 7, *b*) is developed from the anterior surface of the antler at about half its entire length, and a short tine (fig. 7, *d*) from the posterior surface of its upper third.

Lacrymal pit of moderate depth and extent, its antero-posterior diameter being less than that of the three upper molars. Anteorbital vacuity moderate. Auditory bullæ moderately inflated, compressed, and smooth externally. Rudimentary upper canines present in both sexes. Rhinarium as in *Rusa*, with the exception of the internarial portion, which is slightly less prolonged upwards.

Metatarsal tuft whitish. Tail moderate. Neck maned. In summer spotted; in winter uniform brown. Black bands on each side of the pure white anal disk form a cross with the narrow black streak along the dorsum of the tail. Stature medium. Young indistinctly spotted.

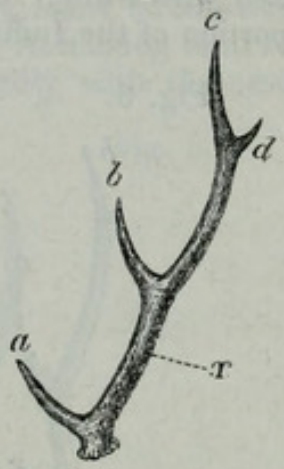
Distribution. Eastern Palæarctic region.

18. Cervus sika.

1847. *Cervus sika*, Temm, et Schl. Jap. Mamm. p. 54, pl. 17.
1860. —— ——, Sclat. P. Z. S. 1860, p. 377.
1871. —— ——, Sclat. Trans. Z. S. vol. vii. p. 346, pl. 35.

Hab. Japan. Type Mus. Leyden.

Fig. 7.



Cervus (*Pseudaxis*) *sika.*

19. Cervus euopis?

1874. *Cervus euopis*, Swinh. P. Z. S. 1874, p. 151.

Hab. North China? Type, ♂, Zool. Soc. Menag.

The type, which is still living, differs in no appreciable external characters from ordinary specimens of *Cervus sika*. It was originally received from Tientsin, China. I have not included *C. euopis* among the synonyms of *C. sika*, in the hope of attracting further attention to the subject, as it would be of considerable interest should *C. sika* be found inhabiting the mainland as well as the islands of Japan.

20. Cervus mantchuricus.

1861. *Cervus pseudaxis*, Gray, P. Z. S. 1861, p. 236, pl. 27 (nec Eydoux et Souleyet?)[1].
1864. —— *hortulorum* et *mantchuricus*, Swinh. P. Z. S. 1864, p. 169.
1865. —— *mantchuricus*, Swinh. *in lit.* P. Z. S. 1865, p. 1.
1871. —— ——, Sclat. Trans. Z. S. vol. vii. p. 344, pls. 31, 32.
—— *mandarinus*, Alph. M.-Edw. Rech. Mamm. p. 184, pls. 22, 22 a.

Hab. Neighbourhood of Newchwang. Type, Mus. d'Hist. Nat. Paris.

[1] *Cf. infrà*, p. 909.

The Society has within the last few years received living specimens of a *Pseudaxis* from Japan, which are intermediate in size &c. between *P. sika* and *P. mantchuricus*. These have, in my opinion, with excellent judgment, been labelled by the Secretary as *Cervus mantchuricus minor*. I think it probable that, when a larger series, of Pseudaxine Deer are brought together, it will be found impossible to separate them into definite species, but that it will be found necessary to regard them as one species of wide geographical range, endowed with a constitution sufficiently elastic to enable it to support very varied conditions.

24. CERVUS DYBOWSKII?

1876. *Cervus dybowskii*, Tacz. P. Z. S. 1876, p. 123, fig.
—— *axis*? Radde, Reise im Süd. von Ost-Sib. Band i. p. 286.

Hab. Upper Ussuri (Mantchuria).

It is highly probable that, when we know more of this form, it will be found inseparable from *C. mantchuricus*.

22. CERVUS KOPSCHI?

1873. *Cervus kopschi*, Swinh. P. Z. S. 1873, p. 574.

Hab. Department of Kienchang, Kiangse, China (*Swinh.*). Types, Brit. Mus.

Also a very doubtful modification. I had an opportunity of examining the types upon their arrival, and could perceive no particulars in which they differ from *C. mantchuricus*.

23. CERVUS TAËVANUS.

1862. *Cervus taëvanus*, Sclat. P. Z. S. 1862, p. 152, pl. 16.
—— ——, Swinh. loc cit. p. 362.
1871. —— ——, Sclat. Trans. Z. S. vol. vii. p. 345, pls. 33, 34.

Hab. Mountains of Formosa.

24. CERVUS CASPICUS.

1874. *Cervus caspicus*, Brooke, P. Z. S. 1874, p. 42.

Hab. Mountains S.W. of the Caspian.

Since my original notice of this supposed species, I have received no further information respecting it. The antlers are in my private collection; and I am still unable to refer them to any known species. Although I have placed the species provisionally amongst the Pseudaxine Deer, I am very far from satisfied that this is its proper location. I am chiefly influenced in doing so by an antler I have lately received from Mr. Robertson (H.B.M. Vice-Consul, Busra) from the Karun, which is of decided Pseudaxine character, and may possibly belong to the same species. It is to be hoped that, through the indefatigable exertions of Mr. Robertson, we may ere long have the advantage of seeing this species living in the Society's Menagerie.

I have hesitated in referring the *Cervus pseudaxis* of Eydoux and Souleyet ('Voy. de la Bonite,' vol. i. p. 64, pl. 12) to any species of this subgenus. The specimen is still preserved in the Muséum d'His-

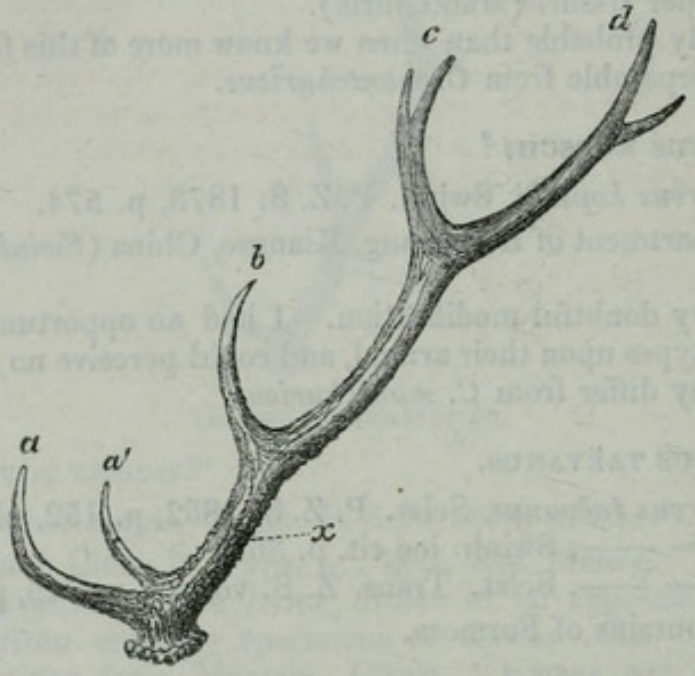
toire Naturelle at Paris; but though I have often carefully examined it, the absence of the skull and the great uncertainty of the locality where it was procured render it impossible to form a decided opinion.

(Cervus, subgen.)

1766. *Cervus*, Linn. Syst. Nat. (ed. 12) p. 92.

Antlers differ from those of *Pseudaxis* in having a second brow-antler (fig. 8, *a'*) developed above the brow-antler (fig. 8, *a*), in the brow-antler being curved forwards at a right angle with the beam (fig. 8, *x*), and in the posterior coronal tine (fig. 8, *d*) being more strongly developed than the anterior coronal tine (fig. 8, *c*). Skull as in *Pseudaxis*. Molars sometimes with small supplementary columns.

Fig. 8.



Cervus (*Cervus*) *elaphus*.

Upper border of the internarial portion of the rhinarium forming an acute angle, with apex directed forwards. Infranarial portion of rhinarium not developed; the prænarial portion much constricted, but spreading out before joining the upper lip. Tail short. Neck maned. A patch of lighter colour than that of the body surrounds the tail. Stature large. Young spotted.

Distribution. Palæarctic and Nearctic regions.

25. Cervus elaphus.

1766. *Cervus elaphus*, Linn. Syst. Nat. (ed. 12) p. 93.

1837. —— *barbarus*, Benn. List An. Gard. Zool. Soc. 13th pub. p. 31 (sine descr.).

Range. Co. Kerry (Ireland); Cumberland; Devonshire; highlands of Scotland, and following islands—Harris, Skye, Rum, Mull, Jura, and Arran; island of Hitteren (Norway); Southern Sweden;

France; Spain; Germany; Austria; Turkey; Greece; Corsica; Sardinia; Province of Constantine (Algeria); Asia Minor; Caucasus.

A comparison of the gigantic antlers of the Red Deer of the 15th, 16th, and 17th centuries preserved in the old hunting Schloss at Moritzburg (built 1540), near Dresden, with the antlers of Red Deer from the islands of Harris or Sardinia, shows in a most striking manner the great variations to which this species is subject. Some of the antlers at Moritzburg measure 50 inches along the outside curve, are 10 inches in circumference round the smallest part of the beam, and the two antlers carry from 24 to 50 points. The spread between the coronal tines of one specimen is 74 inches. Antlers from Harris and Sardinia rarely exceed 30 inches in length, their circumference being about 4 inches; they very rarely carry a larger number than 12 points; and their span seldom exceeds 28 inches.

I have considered the African Deer, *Cervus barbarus*, specifically identical with *Cervus elaphus*. Specimens from Corsica and Sardinia completely bridge over the characters which have been advanced as distinctive of the African and European races. The second brow-antler is rarely developed in the African form; but I have known instances of its occurrence.

26. Cervus xanthopygus.

1831. *Cervus elaphus*, Pall. Zoogr. Rosso-Asiat. vol. i. p. 217.
1853. —— ——, Midd. Sib. Reis. Wirb., Band ii. Th. 2, p. 120.
1859. —— ——, Schrenck, Reis. u. Forsch. Amurlande, Band i. p. 170.
1862. —— ——, Radde, Reis. im Süd. v. Ost-Sib. Band i. p. 284.
1867. —— *xanthopygus*, Alph. M.-Edw. Ann. Sc. Nat. sér. 5, vol. viii. p. 376; Rech. s. l. Mamm. p. 181, pl. 21.
1876. —— *elaphus*, Prejevalsky, Mongolia (Engl. trans.), vol. i. p. 164.

Range. From the Caucasus to the Altai, and thence round Baikal through Dauria, as far as the Lena and Witim (*Pallas*); thence to the mountains surrounding the sources of the Silimdsha and Bureja (*Middendorff*); along the Amoor, as far eastwards as the Gorin and the Chelasso, and thence southwards to the sea-coast, a few days' journey south of the Bay of Kastries (*Schrenck*); Chinghan Mountains (*Radde*); Munniula Mountains (China, lat. of Pekin) (*Prejevalsky*).

Type, Mus. d'Hist. Nat. Paris.

This species was founded provisionally by Professor Alphonse Milne-Edwards upon the examination of a single specimen, certain cranial peculiarities and the large size of the anal disk deciding him that it was expedient for the time being to keep the form separate from *Cervus elaphus*. It is by no means certain that *Cervus xanthopygus* (should the species ultimately prove distinct from *Cervus elaphus*, which I greatly doubt) is the form found in all the localities above mentioned. The exact limits of the distribution eastwards of *Cervus elaphus*, *Cervus eustephanus* (Blanf.), and *Cervus maral*

(Ogilby) remain as yet unknown; and it is fully possible that the Deer met with by some of the celebrated travellers above quoted may have appertained to one or more of these species.

27. Cervus eustephanus.

1875. *Cervus eustephanus*, Blanf. P. Z. S. 1875, p. 638, fig.

Hab. Thian-Shan mountains.

This species is only known from its antlers, which are of immense size. Specimens which I have seen, in their great size and flattened crowns so closely resemble antlers of *Cervus canadensis* that it would be impossible to decide to which species they had belonged.

28. Cervus maral.

1840. *Cervus maral*, Ogilby, Rep. Counc. Zool. Soc. 1840, p. 22.

1871. —— ——, Sclat. Trans. Z. S. vol. vii. p. 336, pl. 29.

Hab. Circassia, Persia.

Cervus maral differs in a marked manner from the allied species *C. elaphus* and *C. cashmeerianus* in the much greater length of its face, as shown by the table given below. The Red Deer of which the measurements are there given was a remarkably large old male. A pair of *Cervus maral*, which lived at large in one of my parks for some years, kept entirely apart from the Red Deer inhabiting the same park. They bred together; and during the rutting-season the species never showed the faintest desire to cross. This was the more remarkable as the old stag Maral, though considerably larger in size, lived in great fear of the Red Deer stags, which during that season roamed incessantly through the park in search of hinds, but at all times treated the female Maral with sovereign disdain, although at any moment they could have taken possession of her had they so desired.

The limits of the eastern range of *Cervus maral* are as yet undefined.

	Cervus maral.		*Cervus elaphus.*		*C. cashmeerianus.*	
	Eng. in.	metre	Eng. in.	metre	Eng. in.	metre
Total length of skull ...	18	0·457	16	0·405	16	0·405
From occ. prominence to ant. rim of orbit	7·6	0·193	7·5	0·190	7	0·178
From ant. rim of orbit to free extremity of the præmaxillæ.....	11	0·280	9	0·229	8·8	0·223
Length of upper molar and premolar series ...	5	0·127	4·5	0·114	4·5	0·114

29. Cervus cashmeerianus.

1839. *Cervus cashmeerianus*, Falconer, MS. (non vidi).

1871. —— ——, Sclat. Trans. Z. S. vol. vii. p. 339, pl. 30.

Hab. Cashmere.

The voice of the Cashmere Stag in the rutting-season differs greatly

from that of the Red Deer in the same season. In the former it is a loud squeal ending in a more guttural tone; in the latter it is a distinct roar resembling that of a Panther. The voice of the Wapiti resembles that of the *Cervus cashmeerianus*. The second brow-antler (fig. 8, *a'*) in *Cervus cashmeerianus*, with very rare exceptions, exceeds the brow-antler (fig. 8, *a*) in length, a peculiarity by which the antlers of this species may be distinguished from those of its allies.

30. Cervus affinis.

1835. *Cervus affinis*, Hodgs. Journ. As. Soc. Beng. vol. iv. p. 648, pl. 53. fig. 5.

1871. —— ——, Sclat. Trans. Z. S. vol. vii. p. 343.

Cervus wallichii, Cuv. Oss. foss. (ed. 4) tom. vi. p. 88; and F. Cuv. Hist. Nat. Mamm. pl. 356.

Hab. Choombi valley (Eastern Himalayas).

Should *Cervus wallichii*, Cuv., prove to be specifically identical with *Cervus affinis*, Hodgs., the former name, having priority, must stand. The antlers of the type of Cuvier's original description are, I believe, still preserved in the Museum of the Asiatic Society of Calcutta; F. Cuvier's plate shows them to be of decidedly abnormal growth.

31. Cervus canadensis.

1777. *Cervus canadensis*, Erxl. Syst. Règn. An. p. 305.

1857. *Cervus canadensis*, Baird, N. Am. Mamm. p. 638.

Range. Alleghany regions of Pennsylvania and Virginia, Northern Wisconsin ?, Minnesota, Dakota, Nebraska, Washington, Oregon, and California; 57° N. is its northern limit (*Baird*).

(Dama, subgen.)

1827. *Dama* (subgen.), Ham. Sm., Griff. An. Kingd. vol. v. p. 306.

Antlers about twice the length of the head, palmated, the tines on the upper half of the antler rising from their posterior surface (figs. 9 and 10). Skull resembling that of *Cervus*, but more depressed, broader proportionally, and the orbits more prominent. Auditory bullæ subglobular; no upper canines; rhinarium as in *Cervus*. Tail moderate. Prepuce furnished with a tuft of long hair. Both sexes spotted in summer, unspotted in winter. Black markings on the rump and tail as in *Pseudaxis*. Stature medium. Young spotted.

Distribution. South-western Palæarctic region.

32. Cervus dama.

1766. *Cervus dama*, Linn. Syst. Nat. (ed. 12) i. p. 93.

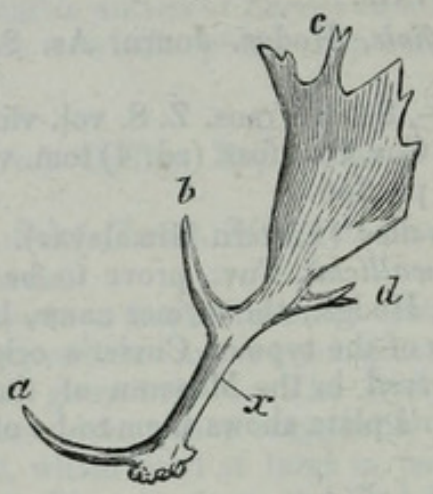
1843. *Dama vulgaris*, Gray, Spec. Mamm. Brit. Mus. p. 181.

1874. *Cervus dama*, Jeitt. Zool. Gart. 1874, p. 288, (translated by Sclater) Nature, vol. ii. p. 71; vide also Boyd Dawkins, *tom. cit.* pp. 112, 210, 226, and Brooke, *tom. cit.* p. 210, figures.

Range. Greece, Spain, Anatolia, island of Rhodes, Sardinia, N. Palestine; frontier of Tunis in Algeria ? (fide *Loche*).

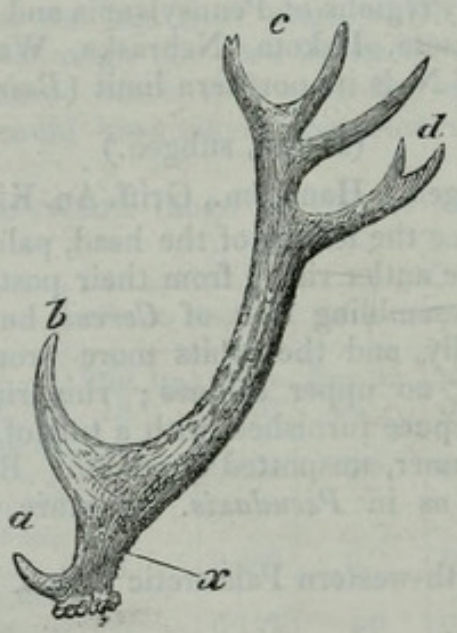
The semidomesticated life which the Fallow Deer has lead for so many generations in the parks of Europe has given rise to many permanent variations of colour. The natural colour of the species in a wild condition in summer is a brilliant fawn with white spots irregularly distributed over the upper parts of the sides and haunches, this spotted region being bounded inferiorly on the sides and posteriorly on the haunches by indefinite white lines. In winter the spots entirely disappear.

Fig. 9.



Cervus (*Dama*) *dama*.

Fig. 10.



Cervus (*Dama*) *mesopotamicus*.

33. Cervus mesopotamicus.

1875. *Cervus* (*Dama*) *mesopotamicus*, Brooke, P. Z. S. 1875, p. 265, pl. 38. figs. 1, 2.

1876. —— ——, Brooke, P. Z. S. 1876, p. 298, figs. 1–4.

Hab. Luristan hills (Persia).

Since my description of the species, the Society has received two living specimens (♂ and ♀) from Mr. Robertson, to whom I was indebted for my original knowledge of its existence. *Cervus mesopotamicus* is a very much larger animal than *C. dama*.

B. Distal ends of metacarpi remaining. (Telemetacarpi.)

Posterior portion of the narial cavity not divided by the vomer into two distinct chambers.

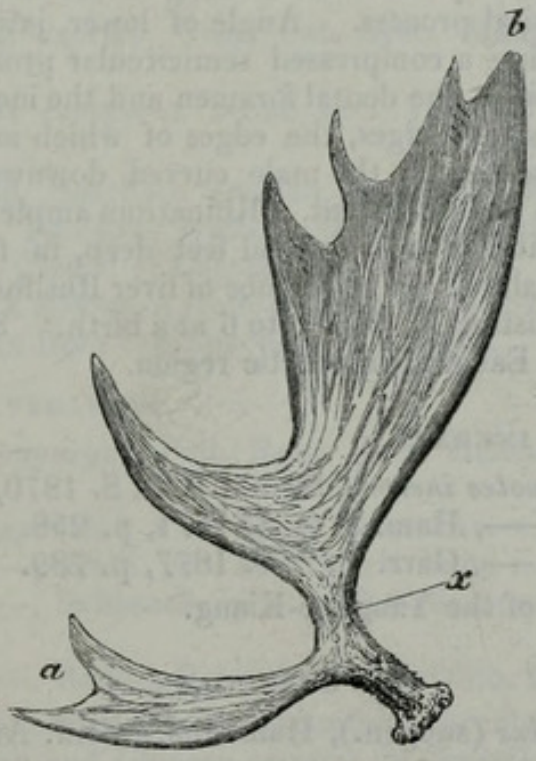
Tuft of hair on the external surface of the metatarsus when present above the centre of that bone. Tuft on inside of the tarsus absent.

4. Alces.

1827. *Alces* (subgen.), Ham. Sm., Griff. An. Kingd. vol. v. p. 303.

Antlers dichotomous, both main branches palmated, the posterior branch (fig. 11, *b*) much surpassing the anterior branch (fig. 11, *a*) in dimensions. Anterior nares of great extent, owing to the shortness of the nasals. Lacrymal pit and anteorbital vacuity moderate.

Fig. 11.



Alces machlis.

Ascending rami of the præmaxillæ long, not articulating with the nasals. Incisors decreasing gradually in size from the central to the external pair.

A very small triangular rhinarium. Head very long, neck and body short, legs very long, stature great. Young unspotted.

Distribution. North Palæarctic and Nearctic regions.

ALCES MACHLIS.

1836. *Alces machlis*, Ogilby, P. Z. S. 1836, p. 135.
1834–7. —— *americanus*, Jard. Nat. Libr. xi. p. 125.

Range. Sweden, Lithuania? Northern Russia, Altai Mountains? mountains to the west of Lake Baikal. Apple Mountains (west of Chita), Khinghan Mountains; forests of the Lower Amoor as far south as the mouth of the Ussuri, in lat. 48° (*Radde*, &c.). "West coasts of America from the shores of the Arctic Ocean nearly to the Columbia River. Further east the northern limit is about 65° and thence through Canada to Maine, New Hampshire, Vermont, and the north parts of New York" (*Baird*).

5. HYDROPOTES.

1870. *Hydropotes*, Swinh. P. Z. S. 1870, p. 90.

Without antlers in either sex. Lacrymal pit deep, small, its antero-posterior diameter about equalling that of m. 3. Anteorbital vacuity moderate. Ascending rami of the præmaxillæ strong. Orbits small and but slightly prominent, their greatest diameter less than the extent of the three upper molars. Auditory bullæ considerably inflated, a portion intervening between the tympanohyal and the paroccipital process. Angle of lower jaw much produced backwards, forming a compressed semicircular prominence. Rami of lower jaw between the dental foramen and the incisors compressed and raised into sharp ridges, the edges of which are everted. Canines of immense size, in the male curved downwards, and gently convergent, pulp non-persistent. Rhinarium ample. No metatarsal tufts. Interdigital glands in hind feet deep, in fore feet slightly developed and shallow. Spigelian lobe of liver Rusiform (*fide* Garrod). Young spotted distinctly, from 3 to 6 at a birth. Stature small.

Distribution. Eastern Palæarctic region.

HYDROPOTES INERMIS.

1870. *Hydropotes inermis*, Swinh. P. Z. S. 1870, p. 89, pls. 6, 7.
1871. —— ——, Ham. P. Z. S. 1871, p. 258.
1877. —— ——, Garr. P. Z. S. 1877, p. 789.

Hab. Islands of the Yang-tse-Kiang.

6. CAPREOLUS.

1827. *Capreolus* (subgen.), Ham. Sm., Griff. An. Kingd. vol. v. p. 313.

Antlers less than twice the length of the head. Normal number of tines 6. Brow-antler (fig. 12, *a*) developed from the anterior surface of the upper half of the antler, directed upwards. Lacrymal pit very shallow and of small extent. Anteorbital vacuity small. Ascending rami of the præmaxillæ articulating generally but not invariably with the nasals. Auditory bullæ very slightly inflated, their external surface rugose. Angle of lower jaw as in *Hydropotes*. Crowns of central incisors moderately expanded.

Upper margin of the internarial rhinarium running straight across from the upper angle of the nostrils. No infranarial rhinarium. Tail very short. In the female the clitoris is surrounded by a long tuft of hair. Interdigital glands in the fore feet rudimentary, in the hind feet deep, opening by a narrow orifice into a capacious round pouch. Stature small. Young spotted.

Distribution. Central and Western Palæarctic region.

Fig. 12.

Capreolus capræa.

1. Capreolus capræa.

1843. *Capreolus capræa*, Gray, Cat. Spec. Mamm. Brit. Mus. p. 176.

1844. *Capreolus europæus*, Sund. Pec., Vetensk. Akad. Handl. 1844, p. 184.

Range. Scotland, Southern Sweden, France, Germany, Austria, Hungary, Spain, Tuscany, Greece, Turkey, Northern Palestine, Elburz Mountains (South of Caspian).

I have received a specimen from the last-mentioned locality which differs in no respect from the European specimens.

2. Capreolus pygargus.

1771. *Cervus pygargus*, Pall. Reise Russ. Reichs, vol. i. p. 97, Append. p. 453.

1831. *Cervus capreolus*, Pall. Zoogr. Rosso-As. vol. i. p. 219.

1853. —— ——, Midd. Sib. Reis. Wirb. Band ii. Th. 2, p. 118.

1859. —— ——, Schrenck, Reis. u. Forsch. Amurlande, Band i. p. 163.

1862. —— ——, Radde, Reise Süd. v. Ost-Sib. Band i. p. 277.

Range. Suitable localities in the mountains forming the watershed between the Russian and Chinese empires, in Central Asia; Chingan Mountains (Mantchuria).

Most authors have considered *C. pygargus* to be a large variety of the common Roe. There are, however, in the British Museum two specimens purchased from Brandt and said to be from Siberia, which, in their very much larger size, larger anal disk, and much more hairy ears, differ widely from all specimens of the common species. Specimens of Roe from Mantchuria in the British and Paris Museums are very much smaller than the above-mentioned

specimens; they also differ from the larger specimens and the common Roe in some details of coloration. It is not improbable that the Mantchurian Roe may prove to be a third modification of the form.

C. Distal ends of the lateral metacarpals remaining. (TELEMETACARPI.)

Posterior portion of the nasal chamber divided by the vomer into two distinct chambers.

Tuft of hair on the external surface of the metatarsus, when present, below the centre of that bone. Tuft on the inside of the tarsus frequently present.

Ascending rami of the præmaxillæ not reaching the nasals. (Exception, subgen. *Furcifer*.)

7. CARIACUS.

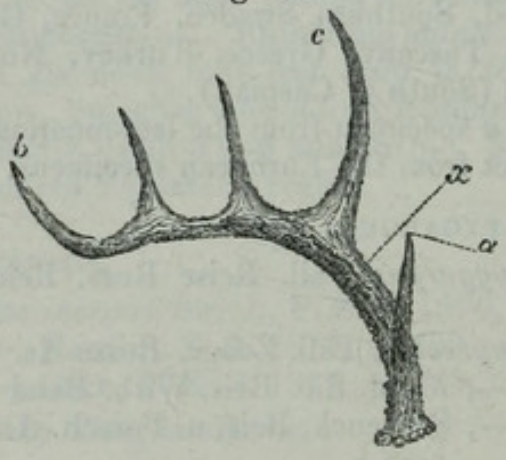
(CARIACUS, subgen.)

1827. *Mazama* (subgen.), Ham. Sm., Griff. An. Kingd. vol. v. p. 314 (nec Rafinesque)[1].

1850. *Cariacus*, Gray, P. Z. S. 1850, p. 237.

Antlers not greatly exceeding the head in length, on short pedestals. A short upright brow-antler (fig. 13, *a*) rises from the inner surface of the lower third of the antler some little distance above the burr. The antlers are curved boldly forwards, downwards, and inwards, one or more tines being developed from their

Fig. 13.



Cariacus (*Cariacus*) *virginianus*.

convex or posterior surface. Skull elongated and narrow. Lacrymal pit of moderate extent, owing to the very large anteorbital vacuity, which encroaches on the region usually occupied by the facial plate of the lacrymal. Nasals forming the larger part of the superior border of the anteorbital vacuity. Auditory bullæ slightly inflated. No upper canines; molars sometimes with small supplementary columns; central incisors bnt slightly spatulate. A tuft of long

[1] *Mazama*, of Rafinesque (1817), is too ill-defined to be used for either the Rocky-Mountain Sheep or the Pronghorn; but its publication invalidates its subsequent use in any other sense. *Cf.* Baird, N.-Am. Mamm. p. 665.

hair on the inner surface of the limb at the tarsal joint. Rhinarium as in *Cervus*. Tail long. Stature medium. Young spotted.

Distribution. Nearctic and northern portions of the Neotropical region.

(*a*) *Antlers non-dichotomous. Lacrymal of moderate depth.*

1. Cariacus virginianus.

1774. *Cervus virginianus*, Bodd. Elench. An. vol. i. p. 136 (non vidi).
1788. —— ——, Gm. L. Syst. Nat. p. 179.
1857. —— ——, Baird, N.-Amer. Mamm. p. 643, figs. 12, 13.

Range. From Maine all over the United States east of the Missouri (*Baird*).

2. Cariacus leucurus.

1829. *Cervus leucurus*, Dougl. Zool. Journ. vol. iv. p. 330.
1857. —— ——, Baird, N.-Amer. Mamm. p. 649, figs. 14–18.
1873. —— ——, Walsingham, P. Z. S. 1873, p. 561.

Range. N. California, Oregon principally east of the Cascade Mountains (*Walsingham*), Washington, Dakota west of the Missouri, Nebraska (*Baird*).

3. Cariacus mexicanus.

1827–1834. *Cervus mexicanus*, Licht. Darst. d. Thiere, Taf. 18.
1827. *Cervus nemoralis*, Ham. Sm., Griff. An. Kingd. vol. iv. p. 137, plate.
1857. —— ——, Baird, N.-Amer. Mamm. 653.

Range. Texas, Mexico, Sonora (*Baird*); Guatemala, Honduras, Nicaragua (*Salvin*); Costa Rica (*Saussure*); Panama (*Salvin*).

Lichtenstein's types, ♂ et ♀ Mus. Berlin.

The name *Cervus mexicanus* was originally given by Gmelin (Syst. Nat. p. 179) to the Mexican deer of Pennant, described in his 'Quadrupeds,' p. 110. The description and dimensions given by Pennant are reconcilable with the *Cervus mexicanus* of Lichtenstein; but the antlers figured by him (plate xi. figure 3) are certainly not referable to the same form. They appear rather to represent abnormal antlers of *Cariacus macrotis*. The specimens described by Lichtenstein were obtained by Graf von Sack in Mexico, and are in all particulars thoroughly typical of the Deer inhabiting the localities I have given in the range of this species.

I give the dimensions of a female specimen collected by Mr. Salvin in Guatemala, and of the antlers of a male collected by the same gentleman in the same locality. The latter resemble in every particular antlers collected by Mr. Salvin in Nicaragua and Panama. There are not more than six points, inclusive of the brow-antler, on both antlers in any of the specimens collected between Guatemala and Panama; but I have seen specimens from Mexico and Texas with eight and ten tines; and one splendid specimen collected by Mr. Dresser near Friedrichsburg in Texas has as many as fifteen.

The Texan deer are decidedly larger than those inhabiting Guatemala, Nicaragua, and Panama.

Dimensions of *Cariacus mexicanus*.

	Engl. inches.	Metre.
♀ Height at shoulder	27·5	0·700
Length of ears	4·3	0·110
Length of tail exclusive of hair	5·5	0·140
Total length of skull in a straight line	9·0	0·230
Length from ant. rim of orbit to free extremity of præmaxillæ	4·5	0·114
Length of molar and premolar series (upper)	2·7	0·067
♂ Length of antlers	7·5	0·190
Greatest span	8·2	0·210

4. Cariacus similis?

1852. *Cervus similis*, Puch. Nouv. Arch. du Mus. 1852, p. 357, pl. 26.

Hab. Unknown. Type, ♂ Mus. d'Hist. Nat. Paris.

5. Cariacus savannarum.

1848. *Cervus savannarum*, Cab. & Schomb. Reis. Brit. Guian. vol. iii. p. 785.

1852. *Cervus gymnotis*, Puch. Nouv. Arch. du Mus. 1852, p. 348, pl. 25, pl. 23. figs. 2–10.

Hab. Guiana, Venezuela? Type, ♂ Mus. Berlin.

6. Cariacus peruvianus.

1874. *Coassus peruvianus*, Gray, Ann. & Mag. Nat. Hist. (ser. 4) vol. xiii. p. 332.

Hab. Peru. Types, ♀ Brit. Mus., ♀ in my own collection.

The number of specimens from well-authenticated localities at present existing in European collections is far too small to enable me to form any decided opinion respecting the degree of persistency of modification in the above-mentioned forms. Notwithstanding, I think it highly probable that when we possess a sufficiently large series we shall find that *C. peruvianus* and the four preceding species are nothing more than climatic varieties of *C. virginianus*, connected inseparably by every shade of intermediate forms. Mr. Allen, in his valuable paper on the geographical variation of North-American Mammals, especially in respect to size (Bull. U.S. Survey, 1876, p. 304), has conclusively proved that a decrease in size and characteristic development takes place in all mammals the centre of whose area of distribution is in North America, as they spread southwards; and, so far as the materials at my command enable me to judge, I think it probable that the characters upon which *C. leucurus*, *C. mexicanus*, *C. similis*, *C. savannarum*, and *C. peruvianus* have been established as species may be in large measure the result of this law.

7. Cariacus gymnotis.

1833. *Cervus gymnotis*, Wiegm. Isis von Oken, p. 965.

Hab. New Granada. Type, ♂ Mus. Berlin.

This is, I think, a distinct species. The large drooping ears (naked externally), the very narrow head, and the remarkably slender, delicate form of the animal render it easily distinguishable from specimens of the allied species.

8. Cariacus toltecus.

1860. *Cervus toltecus*, Sauss. Rev. et Mag. Zool. (ser. 2) tom. xii. p. 247.

Hab. Vera Cruz.

M. Saussure gives 6·9 inches as the total length of the skull of his type specimen, which was a male of at least two years of age, as evidenced by his antlers, which are not those of the first year. If this measurement is correct, *Cariacus toltecus* is a very small species, one third smaller than *C. mexicanus* from the same locality.

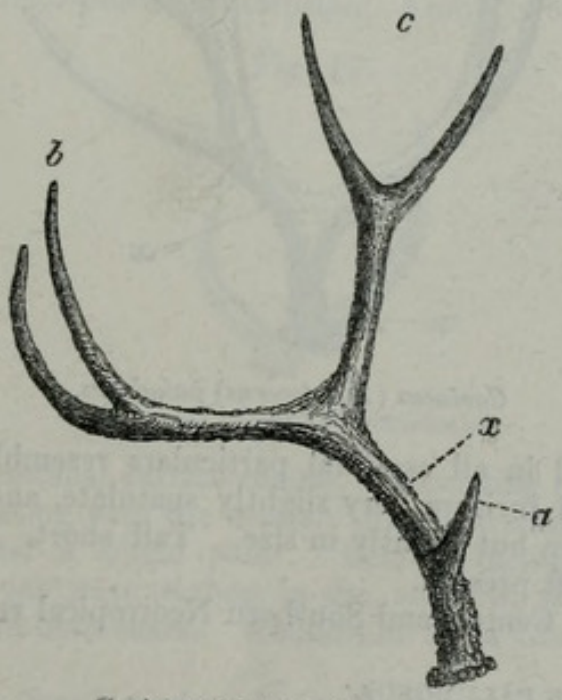
(β) *Antlers dichotomous. Lacrymal pit deep.*

9. Cariacus macrotis.

1823. *Cervus macrotis*, Say, Narr. Long's Exp. vol. ii. p. 88.
1857. —— ——, Baird, N.-Amer. Mamm. p. 656.
1873. —— ——, Walsingham, P. Z. S. 1873, p. 561.

Range. Oregon, Nebraska, Dakota west of the Missouri, Colorado, Kansas.

Fig. 14.



Cariacus (*Cariacus*) *macrotis*.

10. Cariacus columbianus.

1829. *Cervus macrotis*, var. β. *columbianus*, Rich. Faun. Bor.-Am. p. 257.

1848. *Cervus lewisii*, Peale, Mamm. Birds U.S. Expl. Exp. p. 39 (fide Baird).

1850. *Cariacus punctulatus*, Gray, P. Z. S. 1850, p. 239, pl. 28.

1857. *Cervus columbianus*, Baird, N.-Amer. Mamm. p. 659.

Range. California, Oregon, and Washington west of the Cascade Mountains.

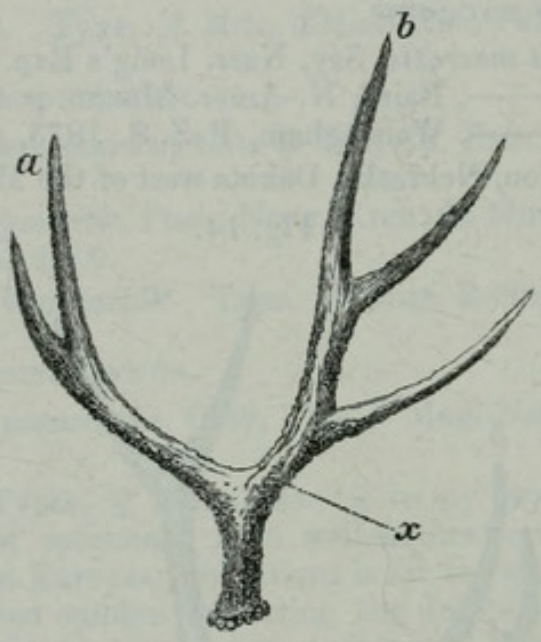
This species is about one third smaller than *C. macrotis*, which it otherwise closely resembles. The two species are found on the same ground in Washington.

(Blastocerus, subgen.)

1850. *Blastocerus*, Gray, P. Z. S. 1850, p. 237.

Antlers slightly exceeding the head in length, on short pedestals. They are dichotomous, the anterior branch (figs. 15 and 16, *a*) inferior to the posterior branch (*b*) in development. In adult specimens the former sometimes, the latter always bifurcates. Lacrymal

Fig. 15.



Cariacus (*Blastocerus*) *paludosus.*

pit deep. Skull in all essential particulars resembles that of *Cariacus*. Central incisors very slightly spatulate, and exceeding the pair next to them but slightly in size. Tail short. No metatarsal tuft. Tarsal tuft present.

Distribution. Central and Southern Neotropical region.

11. Cariacus paludosus.

1820. *Cervus paludosus*, Desm. Mamm. p. 443.

—— ——, Licht. Darst. pl. 17 (1827–1834).

1872. —— ——, Hensel, Beitr. Kenntn. Säug. Süd-Bras. p. 95.

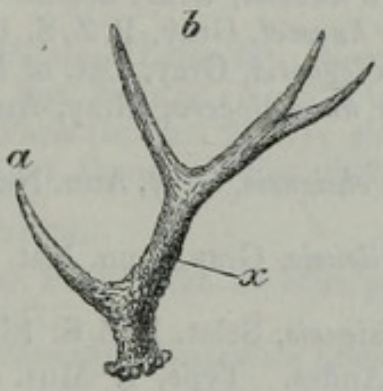
Range. South Brazil, Paraguay, Rio Grande do Sul, Uruguay.

12. Cariacus campestris.

Cervus campestris, F. Cuv. Dict. Sc. Nat. tom. vii. p. 484.
—— ——, Licht. Darst. pl. 19 (1827–1834).
—— ——, Hensel, Beitr. Kenntn. Säug. Süd-Bras. p. 96 (1872).

Range. Paraguay, Uruguay, Buenos Ayres, N. Patagonia.

Fig. 16.



Cariacus (*Blastocerus*) *campestris*.

(Furcifer, subgen.)

1850. *Furcifer*, Gray, P. Z. S. 1850, p. 236.

Antlers the length of the head, with a strong brow-antler (fig. 17, *a*) curved forwards and upwards at a right angle to the simple beam (fig. 17, *x*), which is gradually attenuated to a sharp point. The entire beam is curved gently forwards. Lacrymal pit deep, but of moderate antero-posterior extension. Auditory bullæ very slightly

Fig. 17.

Cariacus (*Furcifer*) *antisiensis*.

inflated, their external surface rugose. Ascending rami of the præmaxillæ articulating with the nasals. Free extremities of the nasals forming together a single point. Central incisors very slightly exceeding the pair next to them in size, and but slightly spatulate. Upper canines in both sexes. Rhinarium as in *Cariacus*. Stature medium.

Distribution. South-western Neotropical region.

13. Cariacus chilensis.

1846. *Cervus chilensis*, Gay et Gerv. Ann. d. Sc. Nat. 1846, p. 91.
1849. *Capreolus leucotis*, Gray, P. Z. S. 1849, p. 64, Mamm. pl. 12.

1875. *Cervus chilensis*, Sclat. P. Z. S. 1875, p. 45, figure.

Range. Andes "from Magellan to near Santiago, but far more rare in the north than in the southern portion of its range" (Reed, P. Z. S. 1875, p. 44). Type, ♀ Mus. d'Hist. Nat. Paris.

14. Cariacus antisiensis.

1834. *Cervus antisiensis*, D'Orb. Nouv. Arch. du Mus. iii. p. 91.
1869. *Anomalocera huamel*, Gray, Scient. Opin. 1869, p. 384.
1869. *Xenelaphus huamel*, Gray, P. Z. S. 1869, p. 497.
1872. *Xenelaphus leucotis*, Gray, Cat. of Rum. Mamm. p. 89.
1872. *Xenelaphus anomalocera*, Gray, Ann. Nat. Hist. (ser. 4) vol. x. p. 445.
1873. *Xenelaphus chilensis*, Gray, Ann. Nat. Hist. (ser. 4) vol. xii. p. 161.
1874. *Furcifer chilensis*, Gray, Ann. Nat. Hist. (ser. 4) vol. xiii. p. 332.
1875. *Cervus antisiensis*, Sclat. P. Z. S. 1875, p. 46.

Range. Peruvian Andes. Type, ♂ Mus. d'Hist. Nat. Paris.

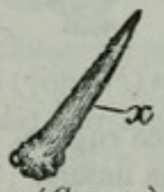
Naturalists owe a debt of gratitude to Mr. Sclater for the care and clearness with which he has unravelled the meshes of confusion in which the synonymy of the two very distinct species, *Cariacus chilensis* (Gay) and *C. antisiensis* (D'Orb.), was formerly enveloped. There is not the smallest foundation for a third species of *Furcifer*. The type of *Xenelaphus leucotis*, &c. of Dr. Gray is preserved in the British Museum, and is undoubtedly nothing but a very fine old male *C. antisiensis* with strongly developed abnormal antlers.

(Coassus, subgen.)

1827. *Subulo* (subgen.), Ham. Sm., Griff. An. Kingd. vol. v. p. 318[1].
1850. *Coassus*, Gray, P. Z. S. 1850, p. 240.

Antlers simple spikes not exceeding half the length of the head (fig. 18). Skull resembling that of *Cariacus*, the auditory bullæ less inflated and the facial profile more arched. Molars sometimes

Fig. 18.



Cariacus (*Coassus*) *rufus*.

with supplementary columns. Canines of uncertain occurrence. Rhinarium ample, resembling that of *Cervulus*. No metatarsal tuft. Tarsal tuft present. Stature small. Form heavy, with the back much arched. Young spotted.

Distribution. Neotropical region.

[1] If this name, which has been totally unused, were to be revived, it would take precedence of *Cariacus* as the title of the whole genus. But it is too close to *Subula* (Mollusca) of Schumacher, 1817.

15. Cariacus rufus.

1817. *Cervus rufus*, F. Cuv. Dict. Sc. Nat. vol. vii. p. 485.

Hab. Surinam. Types, Mus. d'Hist. Nat. Paris, ♀ ad. (No. in Cat. 532), young (No. in Cat. 527).

16. Cariacus simplicicornis.

1827. *Cervus simplicicornis*, Ham. Sm., Griff. An. Kingd. vol. v. p. 318.

Hab. Brazil (*St.-Hilaire, Lalande*), New Granada (*Brooke*). Types:—Mus. d'Hist. Nat. Paris, ♀ (No. 525 in Cat.); skull of same, Mus. d'Anat. Comp. Paris (in Cat. 2208); skull of ♂ collected by St.-Hilaire, in Mus. Anat. Comp. (in Cat. 2225).

17. Cariacus rufinus.

1851. *Cervus rufinus*, Puch. Arch. du Mus. p. 491, pl. 30; id. Rev. Mag. Zool. 1851, p. 561.

Hab. Ecuador (*Pucheran*), Guatemala (*Salvin*). Type, ♂ Mus. d'Hist. Nat. Paris.

18. Cariacus nemorivagus.

1817. *Cervus nemorivagus*, F. Cuv. Dict. Sc. Nat. vol. vii. p. 485.

Hab. Surinam. Types, stuffed head of ♂ and skull of same (Cat. 2223), Paris, in Mus. d'Hist. Nat. and Mus. d'Anat. Comp.

I append a table of the comparative measurements of the four last-mentioned species. The cranial measurements are taken from adult females.

	C. rufus.		*C. simplicicornis.*		*C. rufinus.*		*C. nemorivagus.*	
	Engl. inches.	metre.	Engl. inches.	metre.	Engl. inches.	metre.	Engl. inches.	metre.
Height at shoulder ...	27	0·685	21	0·535	19	0·485	19	0·485
Total length of skull in a straight line ...	9·2	0·235	7·10	0·200	6·5	0·165	6·2	0·157
From anterior rim of orbit to free extremity of præmaxillæ	4·9	0·124	3·10	0·098	3·3	0·083	3·1	0·078
Length of upper molar and premolar series	2·7	0·068	2·3	0·058	2·1	0·053	2	0·050
Greatest width between the orbits, measuring from the lower rim	3·6	0·090	3·2	0·080	3·	0·076	2·7	0·068

From this it will be seen that *Cariacus rufus* is considerably the largest, and *C. nemorivagus* the smallest and most delicately formed species. *C. rufus* is red at all ages, and very heavily built. *C. simplicicornis* is brown when young, never attains so brilliant a colour as

C. rufus, and is much more gracefully shaped. *C. rufinus*, when adult, is of a beautiful shining red, with the face and fore limbs strongly shaded with bluish brown, as shown in exaggeration in Pucheran's figure (*vide suprà*) ; and *C. nemorivagus* is of a dull pepper-and-salt brown, and never becomes red at any age.

19. Cariacus superciliaris.

1850. *Coassus superciliaris*, Gray, P. Z. S. 1850, p. 242, pl. 25.

Hab. Brazil (fide *Gray*).

20. Cariacus whitelyi.

1873. *Coassus whitelyi*, Gray, Ann. & Mag. Nat. Hist. (ser. 4) xii. p. 163 ; id. Hand-list Edent. &c. 1873, p. 162, pl. 32. fig. 2.

Hab. Peru. Founded on a single skull of an immature animal in Brit. Mus. (No. in Cat. 73. 6. 27. 2).

It is now many years since I commenced the study of this difficult group of Cervidæ ; but although I have examined the specimens contained in nearly all the continental museums, and made a private collection of some importance, I must confess that I am still far from a satisfactory understanding of the subject. The complete absence of cornual and cranial characters renders it exceedingly difficult to grasp the characteristic peculiarities of the different modifications of the form, six or seven of which are, I think, probably persistent, and worthy of specific recognition by naturalists. In the above list I have enumerated all the species (or supposed species) of which the types are extant, and must leave it to the future to decide whether they are valid or not. There is still much valuable work to be done amongst the Cervidæ by collectors in South America, well-authenticated specimens from Rio Grande do Sul, Paraguay, South Brazil and Bolivia being almost a blank in European museums. The type of *Coassus auritus*, Gray, not having been preserved, I have omitted the name from my list, as without the type it will be impossible to decide with any certainty upon what species Dr. Gray's name was conferred.

8. Pudua.

1850. *Pudu* (subgen.), Gray, P. Z. S. 1850, p. 242.

Antlers minute simple spikes. Lacrymal pit oval, very deep, its antero-posterior extent slightly exceeding m. 3. Ascending rami of the præmaxillæ reaching the nasals, which are considerably expanded between the moderate anteorbital vacuities. Auditory bullæ as in *Coassus*. Molars without supplementary columns. Canines absent. Central incisors slightly expanded, but exceeding those external to them very much in size. Muzzle as in *Cervulus*, but with the internarial and infranarial portions less extensive. Neither tarsal nor metatarsal tufts. Ectocuneiform, navicular, and cuboid bones in tarsus united. Stature very small.

Distribution. Chilian Andes.

PUDUA HUMILIS.

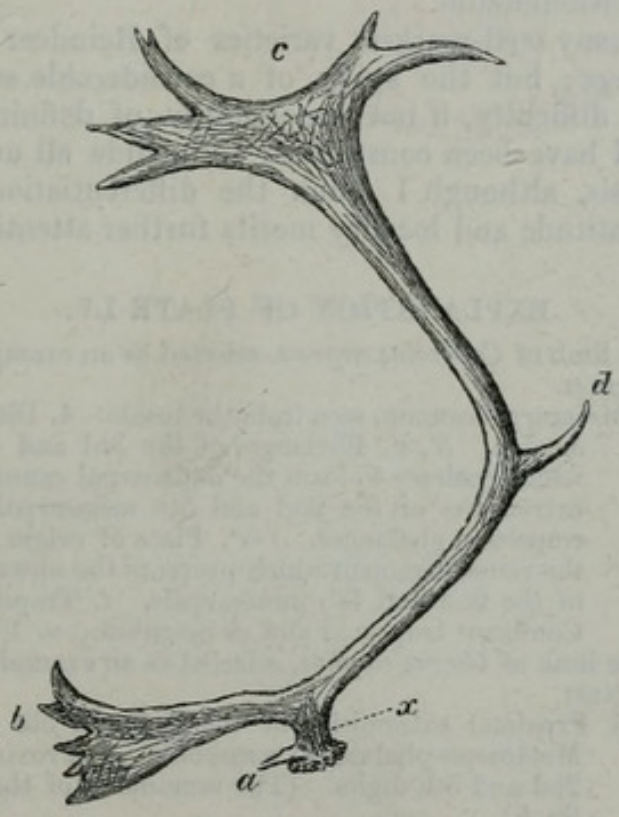
1831. *Cervus humilis*, Benn. P. Z. S. 1831, p. 27,
1871. *Cervus pudu*, Sclat. P. Z. S. 1871, p. 238, pl. 17.
Hab. Chilian Andes.

9. RANGIFER.

1827. *Rangifer* (subgen.), Ham. Sm., Griff. An. Kingd. vol. v. p. 304.

Antlers developed in both sexes; a strong brow-antler (fig. 19, *a*) is developed sometimes on both, but more frequently on only one antler, that on the other being a mere rudiment. The brow-antler, when fully developed, is directed downwards parallel with the face and palmated anteriorly. A short distance above the brow-antler another similar tine (fig. 19, *b*) is developed. Above this the antler forms a bold curve, the concavity forwards, its extremity (fig. 19, *c*) is palmated; and a short tine (*d*) is developed from its posterior surface at half

Fig. 19.



Rangifer tarandus.

its length. Portion of the skull anterior to the horns elongated, that posterior to it remarkably short. Lacrymal pit and anteorbital vacuity of moderate dimensions, the former shallow. Nasals much expanded posteriorly. All the teeth remarkably small in proportion to the skull; the incisors decrease very gradually in size from the central to the external pair, they are none of them spatulate. Vomer produced backwards nearly as far as the basilar suture. Frontal

process for the support of the antlers carried back into the parietals, this region of the skull being much restricted. No rhinarium.

Ears and tail short, neck maned, stature large. Young unspotted.

Distribution. Northern Nearctic and Palæarctic regions.

RANGIFER TARANDUS.

1766. *Cervus tarandus*, L. Syst. Nat. (ed. 12) p. 93.

1829. *Cervus tarandus* et var. *artica* et *sylvestris*, Rich. Faun. Bor.-Am. pp. 238–251 (1829).

1857. *Rangifer caribou* et *R. grœnlandicus*, Baird, N.-Amer. Mamm. pp. 633, 634; American Reindeer, Hardy, 'Forest Life in Acadie,' pp. 120–163.

Range. Norway, Lapland, Spitzbergen, Nova Zembla, Western Siberia from the Arctic Sea, about as far south as lat. 60° in Eastern Siberia, to lat. 55° in the Yablonoi Mountains, to lat. 49° on the Japanese sea-coast, and to lat. 46° on the island of Saghalien; Russian America from the Arctic Sea, somewhat further south than the Arctic circle? British America from Melville Island to Great Slave Lake in the west, and in the east from Labrador to Nova Scotia, Greenland, Newfoundland.

There are many well-marked varieties of Reindeer in this wide and varied range; but the study of a considerable series has only shown me the difficulty, if not impossibility, of defining them; and consequently I have been constrained to include all under one title in this synopsis, although I think the differentiation of the form according to latitude and locality merits further attention.

EXPLANATION OF PLATE LV.

Fig. i. Left fore limb of *Capreolus capræa*, selected as an example of the TELEMETACARPI.

3. Metacarpal cannon, seen from the inside. 4. Ditto, seen from the outside. 3′, 4′. Phalanges of the 3rd and 4th metacarpals, which coalesce to form the metacarpal cannon. 2–5. Distal extremities of the 2nd and 5th metacarpals. 2′–5′. Their respective phalanges. *r*–*r*′. Place of origin and insertion of the round ligament which prevents the upward displacement of the 2nd and 5th metacarpals. *t*. Trapezium. *tr* and *o*. Confluent trapezoid and os magnum. *u*. Unciform.

ii. Left fore limb of *Cervus elaphus*, selected as an example of the PLESIOMETACARPI.

2, 5. Proximal extremities of the 2nd and 5th metacarpals. *s*. Metacarpo-phalangeal sesamoids. *p*. Proximal phalanges of 2nd and 5th digits. (The remainder of the lettering as in fig. i.)

iii. Antler of the present Castle-Caldwell Fallow Deer, showing the excessive development of the tine, *d*, and consequent contraction of the palm, *c*.

iv. Antler of one of the males from which the Castle-Caldwell herd of Fallow Deer are descended.