

VII.—*On an abnormality in the horns of the Hog-deer, Axis porcinus, with an amplification of the theory of the evolution of antlers in Ruminants.*—By JOHN COCKBURN, *Offg. 2nd Asst. to Supdt. Indian Museum, Calcutta.*

[Read March 1882.]

The specimen exhibited to the meeting is a frontlet of the Hog-deer in which the left horn is abnormally developed as in a stag of the elaphine group. The frontlet is a specimen that belonged to the Asiatic Society's collection and is without history. There is, however, fair presumptive evidence that the horns belonged to a feral animal.* Before proceeding to any explanation of the variation a description is necessary.

The right horn is normal and measures 14" from burr to tip along the curve. The brow tine $3\frac{1}{2}$ ", the external tine 5", internal tine $2\frac{1}{4}$ ". Circumference at burr $5\frac{1}{2}$ of beam midway $2\frac{6}{8}$. The left horn has five tines on it, as in a stag of ten, and the beam describes a sweeping curve posteriorly. The burr and brow tines are normal, though the latter is slightly curved inwards; an inch and a half further up the beam is a tine measuring $3\frac{1}{4}$ " in length which I take to be representative of the bez tine. This tine, though otherwise justly proportioned, is curved inwards and backwards. Three and a quarter inches further up the beam is a third snag measuring $2\frac{1}{2}$ " along the curve; this snag though flattened and distorted I take to be analogous to the royal tine. Lastly the tip is bifurcated, its appearance being that of the sur-royal in *Cervus canadensis*. These snags are palmated and the inner furcation, which has lost its tip, grows parallel to the inner tine C on the opposite horn.

Abnormalities in Cervine horns are not uncommon. Judge Caton in his recent work "On the Antelope and Deer of America" discusses the question and attributes these growths to accidental injury to the horn, while tender and growing. Admitting that the majority of abnormal horns come under this category, I am nevertheless inclined to think that the specimen under review is to be otherwise explained. As a disciple of the doctrine of evolution it appears to me more rational to attribute the condition of the left horn to reversion or atavism. The circumstance of the variation being unilateral does not invalidate my hypothesis; polydactylism, the occurrence of supernumerary mammæ, and other phenomena of this nature being very frequently unilateral.

* The horns are bleached as if by exposure, and the polish where visible appears to me rather that of a feral than domestic animal.

The fact, however, that reversion to an extinct ancestor implies degradation in the *Rusinæ* is I confess a difficulty. The Rusine type of antler prevailed in Pliocene times, and is a comparatively elementary state. Nevertheless *Cervus dicranos*, whose antlers are described by Boyd Dawkins as “so complicated as to defy description,” existed during that epoch.

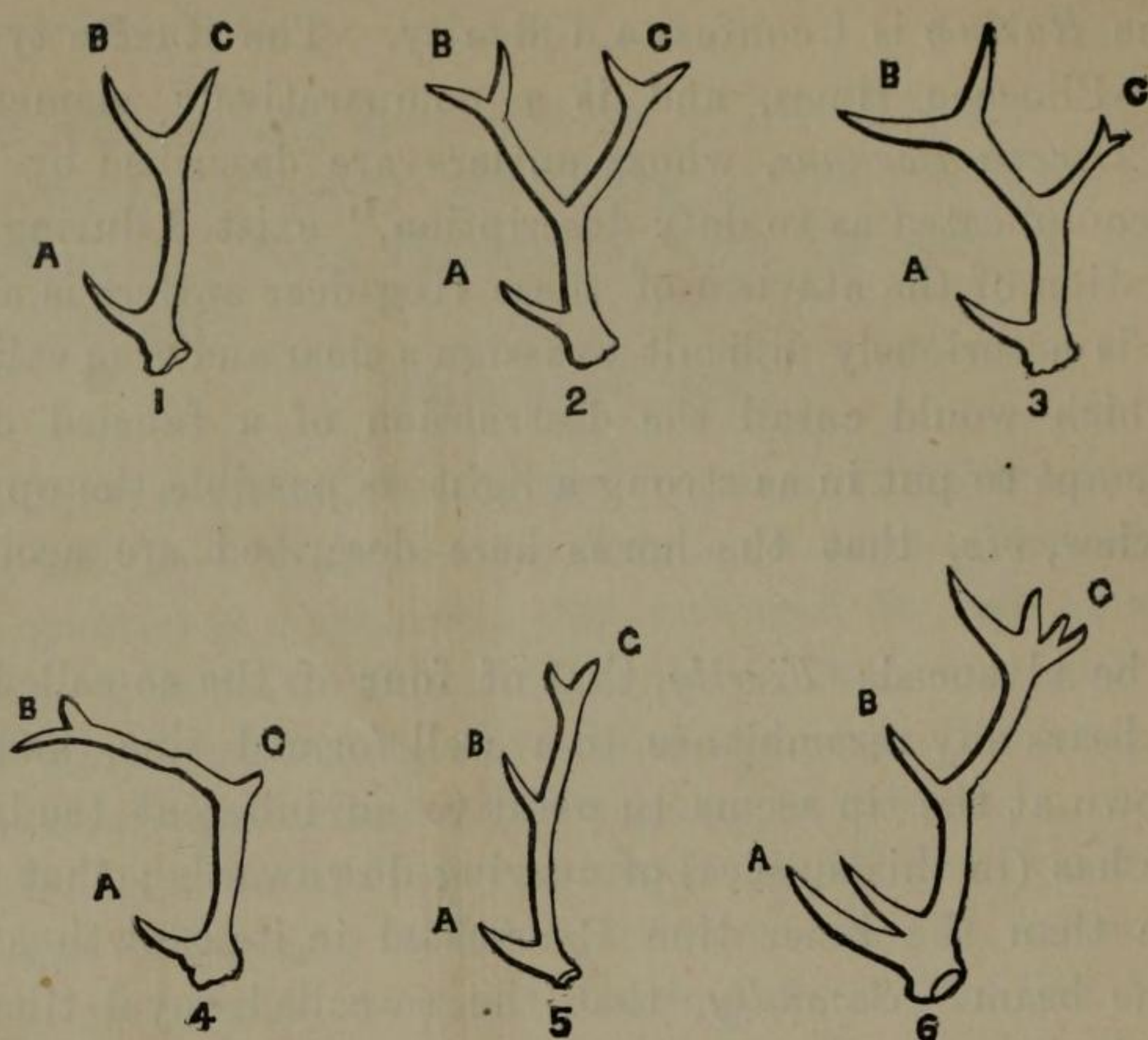
The question of the atavism of these Hog-deer antlers is an important one, and as it is notoriously difficult to assign a clear and true value to certain conditions which would entail the destruction of a fancied discovery, I shall first attempt to put in as strong a light as possible the opposite argument to my view, *viz*, that the horns here described are accidental productions.

It may be advanced: *Firstly*, that of four of the so-called tines only one, the bez, bears any resemblance to a well formed tine, and the fact of its turning down at the tip seems to point to an inherent tendency which the inner tine has (in this species) of curving downwards; that it is in fact nothing more than the inner tine C arrested in its growth at the lower portion of the beam. *Secondly*, that the so-called royal tine is on the inner side of the beam. Finally that the terminal bifurcation is due to a law announced by myself further on, that all terminal portions are capable of furcation. Other abnormalities doubtless exist in private collections of horns and this paper, if it results in no further good, may possibly have the effect of leading to the description of some of these.

The evolution of antlers in Ruminants appears capable of being brought under a theory of development. The honour of being the first to apply a definite law to the development of the horns of the *Cervidæ* belongs to the late Prof. A. Garrod, who published a paper on the anatomy of the Ruminants in the Proceedings of the Zoological Society for January 1877.

Garrod's law may be most briefly stated in his own words. “What may be called the typical antler is composed of a bifurcate beam, with a brow-antler springing from the front of its basal portion. These three parts may be termed A, B, and C as in the accompanying diagram (fig. 1.)

“They occur, uncomplicated, in the genus *Rusa*, in *C. porcinus*, *C. axis* and *C. alfredi* (fig. 1). On the assumption that most of the complicated many-pointed antlers that occur are the result of the exaggerated development of one or other, or both of the extremities B and C, their special features may be explained. For instance imagine both B and C bifurcate, remaining of equal size, and we arrive at the condition found in *Cervus schomburgki* (fig. 2). *C. duvaucelli* differs in that B is extra developed at the expense of C (fig. 3). Following out the ingenious hypothesis of Mr. Blyth, P. Z. S. 1867, p. 835, *C. eldi* only differs in the still greater development of the anterior branches of B (fig. 4). In *Cervus dama*, and in the species included in the genus *Pseudaxis* a different condi-

*Diagram of Antlers of Deer.*

tion obtains, B being greatly reduced and C correspondingly enlarged (fig. 5). In the Elaphine Deer this is carried further, the continuation of the beam C being divided terminally into many points (fig. 6). With reference to the brow-antler A, it is evident that its duplication (the bez tine) is more associated with the actual size of the antlers than with any other peculiarity." (This last assertion is by no means evident.)

Although Prof. Garrod's theory satisfactorily explains the development of a large number of Cervine antlers, it is powerless to explain the horns of the *Elaphinæ* those of *Elaphurus davidianus*, *Cervulus*, *Coassus*, &c. It is apparent that his so-called typical antler is already a complex organ possessing as it does 3 tines, while there are existing species of deer whose antlers never proceed beyond the condition of a simple spike, *Coassus rufus* for example. It therefore appears more philosophical to assume the typical antler to be a simple spike, a condition which all cervine horns exhibit in the first year's growth.

Some months after the publication of Prof. Garrod's paper on the anatomy of the Ruminants, Prof. Boyd Dawkins published a most important paper in the Quar. Jour. of the Geol. Society (Vol. XXXIV—Read 19th Dec. 1877) "on the history of the Deer of the European Miocene and Pliocene strata." The general conclusions he arrived at regarding the palæontological history of the development of antlers are given below in an abstracted form.

“In the mid-Miocene age, the cervine antler consisted of a simple forked crown only. In the Pliocene it becomes larger and longer and altogether more complex, some forms, such as the *Cervus dicranios* of Nesti, being the most complicated antlers known either in the living or fossil state. These successive changes are analogous to those which are to be observed in the development of the antlers in the living deer, which begin with a simple point and increase their number of tines until their limit be reached.” More recently (Nature Nov. 1881) he has repeated the same generalization in slightly different language which I here quote, “In other words the development of antlers indicated at successive and widely separated pages of the geological record is the same as that observed in the history of a single living species.”

Boyd Dawkins regards the antlers of the extinct *Procervulus*, which is the simplest type hitherto met fossil, as the starting point of the antlered ruminants both in the old and new worlds. But the antlers in this genus were more or less branched, and bearing the existing *Coassus rufus* in view, they can hardly be regarded as quite elementary. Considering the imperfect state of the Geological record it may be foretold that an antlered ruminant with simple deciduous spikes for horns will yet be discovered fossil.

Prof. Dawkins has not attempted to apply his theory to an explanation of the horns of existing deer as Garrod had done, but Sir Vincent Brooke who published an elaborate paper on the classification of the Cervidae, with a synopsis of the existing species, in the P. Z. S. for 1878 p. 883, has followed Garrod's theory closely.

There is therefore room for an amplification of Dawkins' phylogenetic law, which I would state thus, as bearing on both extinct and existing cervines.

The development of the antlers of individual species of cervines is a recapitulation of the history of the development of antlers in the group.

I would assume the typical antler to be a simple spike, as in *Coassus rufus*, capable of extensive furcation, reduplication, arrest and redundancy of growth in parts.

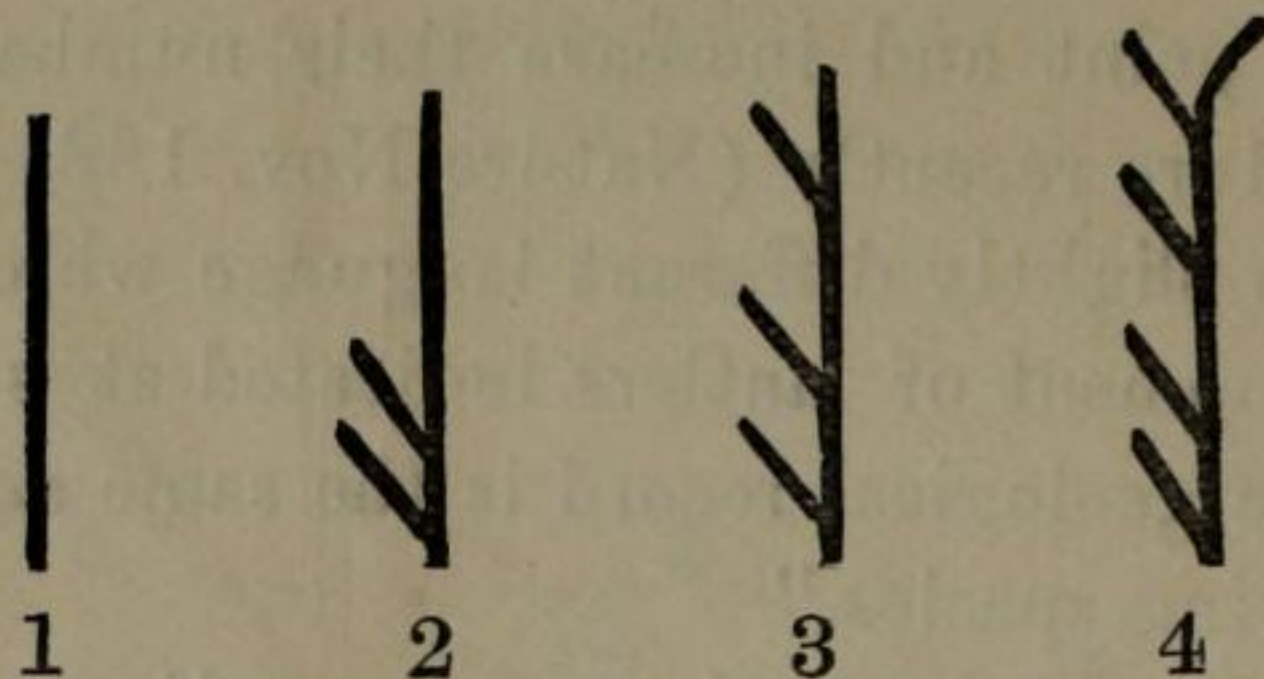
In certain species the terminal portions of the main stem, when the limit of length has been reached, have a tendency to develop an almost unlimited number of snags, possibly referable to palmation of the horns in an extinct ancestor. This tendency is markedly manifest in *Cervus elaphus* and *Panolia eldi* and in a lesser degree in *Rucervus*.*

I shall take up the development of the horns of the Wapiti, *Cervus canadensis*, to illustrate my theory.

* The fine horns of *Rucervus duvaucelli* figured by Blyth, P. Z. S. 1867, fig. 3, show this character, and also a tendency to palmation. The horns are yet in the Museum.

The growth of the antlers in the Wapiti has been carefully described by Judge Caton whose observations extended over a period of 15 years and included over 100 deer.

The horns of the 1st year are usually spikes, a condition I illustrate by fig. 1.



The second antlers have both brow and bez tines, this condition I therefore regard as a double furcation, fig. 2. The third antlers almost invariably have the Royal tine, see fig. 3. The fourth and fifth year may or may not produce the sur-royal, fig. 4.

The horns of *Cervus elaphus* and its numerous races are, I consider, the most difficult of comprehension in the whole group, and the above is I believe the first rational explanation of their development that has as yet been offered. *Capreolus caprea* and *Elaphurus davidianus* are both primitive types. In these two genera the primary bifurcation takes place on the beam at some distance from the burr. The development of the horns of *Capreolus* offer so admirable an instance of furcation from a simple beam, that the marvel is that the theory I have brought forward has not occurred to some one before.

The horns of *Elaphurus davidianus* which were a stumbling block to Prof. Garrod, who states that they were "quite beyond his comprehension," are easily explained by the same theory. The primary furcation takes place some distance up the beam, the forward branch (brow tine) subsequently furcates again, while the posterior branch, which in the stag (*Elaphus*) has hitherto been considered the beam, remains simple tapering and pointed. It thus becomes obvious that superiority of growth in either the anterior or posterior branches of the primary furcation would constitute the main stem or beam.

The tendency towards furcation of the anterior branch or brow tine is yet manifest in various existing cervines. In an extinct species of deer, *Megaceros hibernicus* the brow tine was constantly furcate at the extremity, and a tendency to this order of things is to be observed throughout the Rusine family. I would in this manner explain the studs and snags so commonly present in the brow tine of *Axis maculatus*. I observe that it exists in 8 out of 15 heads, and such being the case, it appears doubtful

whether it should not be rather considered the normal condition, and the typical antler of Garrod the reverse. In the majority of instances there is a small conical snag at the base of the brow tine, but in more than one specimen there is a double snag, and in one of these specimens the anterior snag measures $3\frac{1}{2}$ inches in length.

The extreme of this form of development is to be observed in *Panolia eldi* where the brow tine has commonly 3 snags (trifurcate). It is of less common occurrence in *Rucervus duvaucelli*, and in *R. schomburgki* exhibits the same type as in *Megaceros*, viz., a well marked furcation of the extremity of the brow tine. *R. schomburgki* has probably the most exuberant horns of any existing cervine.

The Sambar of India, *Rusa aristotelis*, can, as a rule, be distinguished from other races by the circumstance of the tines B and C being of nearly equal length, and the posterior being set on immediately behind the other. It is thus in the same plane as the furcation at the brow. In the Assam and Burmese races the outer tine B is, as a rule, longer than B which is set on the beam in a transverse direction pointing inwards and upwards. It thus approaches the horns of *Axis porcinus*. I would throw out the suggestion that as both these animals frequent grass jungles, the more or less transverse direction of the posterior tine has been produced through the resistance offered to the growing horn by the grass and that this cause operating similarly on both species through a series of generations has resulted in a permanence of the type.

With reference to the horns of *Panolia eldi*, an examination of a large series of horns in every stage of growth has convinced me that Prof. Garrod's diagram is incorrect. (P. Z. S. 1877, p. 16, fig. 4.) The tine C has no existence in the position assigned to it in any specimen I have seen. Horns of the 2nd year's growth are in the form of a C without the top stroke. The next stage is furcation of the anterior extremity. Mature horns of *P. eldi* often have as many as 9 or 10 small snags on the main beam, in addition to a terminal furcation.

This is particularly to be noticed in the Siamese race of brow-antlered deer named *Cervus platyceros* by Gray. Good figures of these Siamese horns are given by Blyth, P. Z. S. 1867, p. 841. The palmation of the extremity is evident (hence the name), and the numerous snags are, I consider, of the nature of the spillers in *Dama* and *Alces*. I cannot at present offer an explanation of these spillers beyond that already given.

