

Fig. 2.



Fig. 1.



Fig. 5

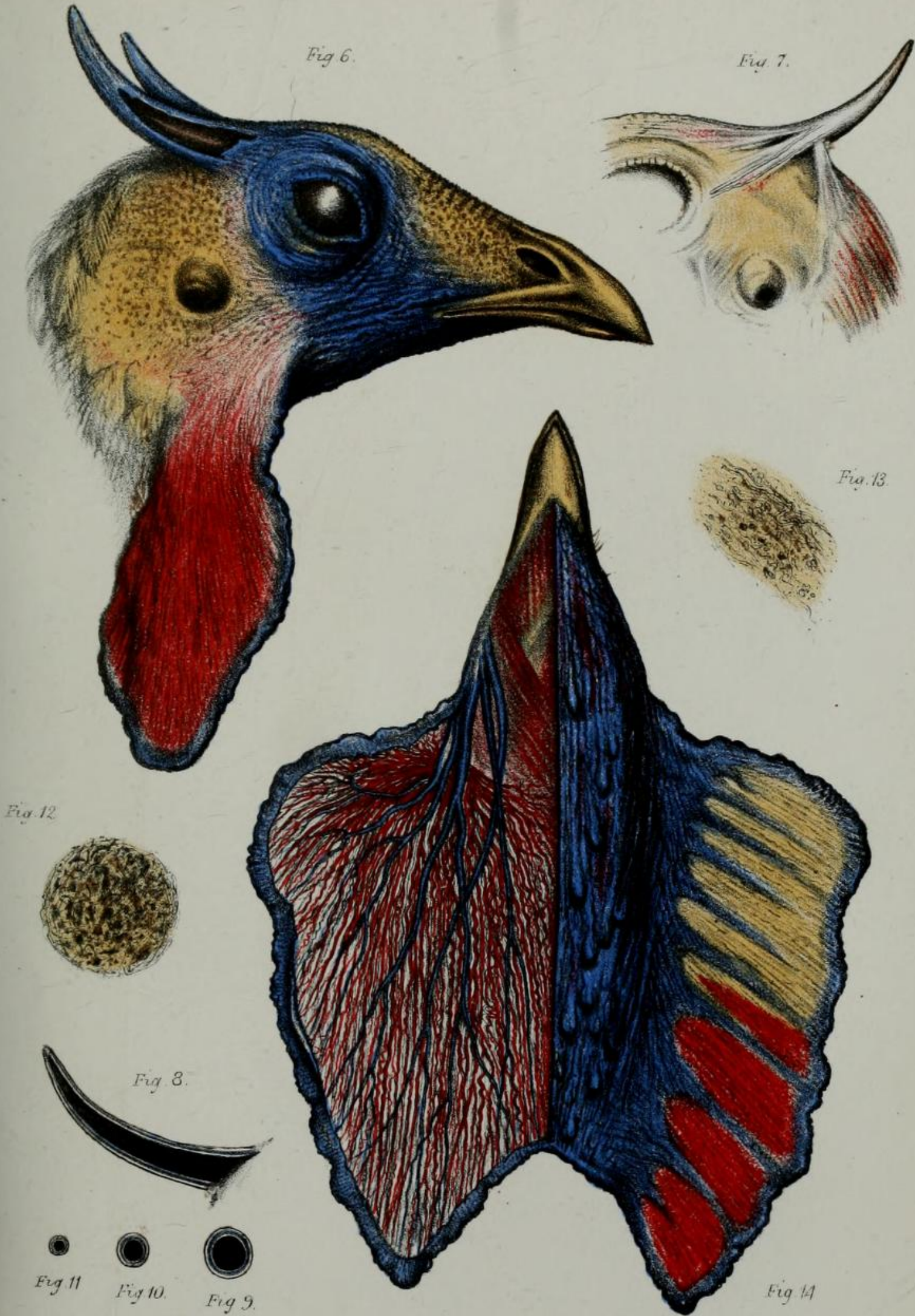


Fig. 3.



Fig. 4.





C. Bojeau lith.

M & N. Hanhart imp

STRUCTURE OF CERIORNIS SATYRA

“*Hab.* Forests of the low hills in the southern province, where it affects principally the creepers which entwine the trunks of the trees ; resorts also to small branches of low trees.

“*Food.* Seeds and pollen from the flowers of creepers.

“*Note.* A faint monosyllabic chirp like ‘tse.’”

Mr. Sclater remarked that these birds appeared to belong to a new species of the genus *Prionochilus*, for which, as Mr. Legge had proposed no name, Mr. Sclater suggested the specific term *vincens*, after one of the names of its discoverer. The discovery of a species of this Malayan group in Ceylon was quite new, and of great interest.

The following papers were read :—

1. On the Cranial Appendages and Wattles of the Horned Tragopan. By Dr. JAMES MURIE, F.L.S., F.G.S., &c.

[Received May 25, 1872.]

(Plates LX. & LXI.)

1. AS TO DISPLAY DURING COURTSHIP.

Most persons have witnessed and well know the grand display of the Turkey-Cock, when he struts majestically, with erect tail, blood-red throat, distended wattles and caruncula, the very essence of unbounded pride, anger, or lust, reaching its climax in a ludicrous gobble. The Pigeon, without obvious vascular turgidity or change of colour of the head and neck, woos his mate with dilated crop, rapidly utters an amatory note, and wheels himself about, finally rears up to full height, and rushes along, sweeping the ground with stiff outspread tail. Less known but equally characteristic are the habits of the Bustards, and especially the Australian species, which, during sexual excitement, develops an enormous wind-bag in its throat and neck. This it blows out even till almost reaching the ground, and, throwing back its head and forward its tail till they meet, the bloated bird stutters along, the very picture of stupid vanity*.

A sight which few have witnessed, yet almost a spectacle in its way as far as concerns the economy of birds, is the sexual advances of the male of the Horned Tragopan (*Ceriornis satyra*) during the breeding-season. This has been pictorially represented by two of our best zoological artists†, and lucidly described by more than one competent observer. I have myself, on more than one occasion, seen the male birds in the Society's Gardens momentarily and partially erect their horns ; but never was fortunate in being present at what may be termed a full performance. Mr. Bartlett has assured me it was a perfect surprise to him, when first he saw the Tragopan suddenly flash up a

* *Vide* P. Z. S. 1868, pl. xxxvi.

† Wolf's 'Zoological Sketches,' 2nd ser. pl. xxxix., and Mr. T. W. Wood, pl. in 'Intellectual Observer,' Sept. 1863.

a pair of blue horns and dash out a beard-like apron of bright scarlet, suggestive of a gnome or the evil one.

The male is said to "show off" in three modes * :—

1st. He stalks in front of the female; then crouching with tail bent down, the head and neck move up and down with vibratory jerks; the wings have a flapping motion, bringing the red patch into view; the horns are raised, and the great scarlet wattle unfolds with startling effect, while the bird draws himself up to full height as an object of splendour.

2nd. On some occasions he simply erects all his feathers, and elevates one shoulder without showing his head-dress.

3rd. Standing boldly on a perch he tosses the head, when the horns and wattles appear for a few moments.

I may add a fourth, viz. erection of the horns without display of the wattle.

2. OUTWARD HEAD-DRESS IN THE TWO SEXES.

It is, however, to the structure and physiology of the apparatus that I invite attention. In a study of the phenomena several specimens, and in different stages of development, have been investigated by me.

My first example was a young female, wherein externally there was only a nipple-like process, representing the so-called horn, and little or no development of wattle. On removal of the skin of the head, two small processes, arising from the parietals or postfrontals, were apparent, one on either side. These consisted only of tough, elastic, fibrous material, firmly adherent to the bone, and without any special vascularity around.

I come now to speak of the older birds, and for the sake of precision give in detail a description of two. One was bred in the Gardens in June 1864, and died of tubercle of the liver in May 1867. This adult male was in good plumage, but not so brilliant in hue as the newly imported and breeding-specimens from India. The drawings (Plate LX.), sketched from the fresh body, bring out the important points worthy of consideration.

The horns exteriorly are of a beautiful azure-blue colour, soft, yet tough and elastic to the touch. Each free portion measures 0·7 inch in length. Pressure of the finger upon the occipito-frontalis directs the horns upwards almost to the perpendicular; but when at rest or in their usual position they lie slantingly backwards. Ordinarily they are hidden by the feathers, but when erect put out between the lateral black feathers and the gorgeous red ones of the vertex of the cranium.

The superficial blue skin structure, continuous with the horn covering, runs forwards upon the upper border of the orbit, and encircles the latter, where it is partially covered by short dark-coloured feathers. It extends more strongly marked the whole length of the lower mandible from the angle forwards. It is bare, and prominently

* Bartlett, "Remarks on the Horned Tragopans," *Intellectual Observer*, Sept. 1863, where he refers to Mr. Wood's notes &c.

seen at the angle, but anteriorly is partly hidden by the short black feathers.

Beneath and between the mandibular rami the skin is very loose, baggy, and easily moved. The numerous cutaneous folds are chiefly longitudinal; but the general appearance is a sort of wrinkled puckering. The brilliant smalt-blue at this spot is modified by the short black feathers, which latter are pretty freely distributed. In this the contracted state an elevated mesial linear and laterally compressed ridge is very noticeable posteriorly. This hangs as a sort of free lappet, and is of a most brilliant shade of blue. On either side of this central lappet the rich blue skin of the gular region ends in four or five long sharp-pointed digital lines; these increase in length from within outwards. The outside one of all is very broad and remarkably finger-shaped. Its minor posterior free extremity bends towards the median lappet, which, indeed, it joins by a transverse semilunar narrow ridge, behind which the feathering commences. The intervals between the digitations are bare, pale, and flesh-coloured, but at certain seasons assume a bright red hue.

The pair of loose dependent folds or flaps, which in reality constitute the single dilatable wattle, in ordinary conditions are drawn towards each other, so that the bare blue-coloured skin is in a great measure hidden. In the pride of lust, however, these flaps increase in size, open out or dilate, and there is displayed a gorgeous blue and red gular region and wattles.

3. CRANIAL DISSECTION OF A MALE IN SEASON.

The body of the above having been disposed of for the purpose of being stuffed, I had to postpone further anatomical investigation. But another specimen at a later period yielded me a dissection of the parts. This Tragopan was in splendid order, and his wattles and horns most ample, he having been accidentally killed by concussion against the enclosure through fright in the pairing-season; for Mr. Bartlett believes these birds monogamous*. Circumstances did not permit my injecting the head and making a preparation, which I could have wished to have done. But to improve by the occasion I made dissections, the result of which I proceed to describe. The sketches supply deficiencies in the foregoing account, and show the respective areas of blue and red, with horns and wattles of full dimensions.

The blue colour, it is to be observed, is permanent, and not due to temporary venous turgescence, while the gorgeous scarlet is evanescent, and the result of flow of blood to the parts. I accentuate these facts, because I myself at first mistook the import of the difference of hue. Until instituting a thorough examination I regarded the horns as vasculo-erectile organs, which I am now prepared to show is not the case.

The whole of the area on the cheeks, supraorbital parts, horns, gular region, cross lines, and border of the wattle, which is coloured blue, is simply a tinted pellicle of the dermal covering. By ordinary

* See remarks, p. 70, in paper already quoted.

manipulation it can be easily removed with the dermis, as is shown in part, figs. 6, 7, & 14. In this respect it is analogous to the gorgeous head- and throat-covering of the Cassowary, and to the varied dermal coloration of the cheeks and wattles of many other birds. Microscopic examination shows that the colour of the said parts in *Cerionis* is caused, as in the dark races of man, by a substratum of pigment. The large pigment-cells, however, in the Tragopan, are of a deep blue; and according as they are in mass or more sparsely aggregated, so is the intensity of the shade. On the throat, and especially the broad strip of the wattle, the general outward colour is dark indigo, much deeper even in some parts by the addition of the black filiform feathers; but here and there are small oval spots of a brilliant smalt, which shine like spangles among the feathering.

(a) *Pseudo-horns, and how erected.*

The cranial appendages or horns have superficially a casing or layer of coloured skin precisely similar in composition to that I have above described. This outer sheath is adherent, but loosely attached to the parts beneath—and on maceration is easily removed *en masse*, along with the dermal tissues of the forehead and face. Beneath it there is a delicate and transparent enveloping layer of fibrous and elastic tissue, intermingled with unstriped muscular bundles, and a trace of the striped variety at the root—besides what appeared to me as vessels, and probably nerve-fibres.

Lastly, and deepest, is the long, conical, and pliant core, or horn proper. This is solid, and composed throughout of firm elastic and condensed fibro-cellular tissue, almost rivalling cartilage in density. Externally it is nearly black in colour, but on cross-section is seen to be a trifle lighter centrally. A thin transverse slice about the lower third is translucent, and, held up to the light, exhibits a grey interior, gradating outwards to a narrow rim of deeper hue. The blackish colour, however, increases higher up. Towards the upper third there is a small, more or less oval, bluish-white circumscribed spot, situate rather to one side of the centre, around which, from a sombre brownish black, the tint merges into the deeper black. Quite at the tip the light interior, or medullary-looking layer, is barely perceptible. Under the microscope, with a low power, the exterior fibres are observed to be predominantly circular in direction, those within chiefly longitudinal and oblique. The deep colour results from a meshwork of pigment-spots distributed everywhere, but are in greatest abundance at what may be termed the cortical layer. Each pseudo-horn springs direct from the cranial bones, at a roughened eminence between the junction of the postfrontal and parietal. The base is pale-coloured, and in all respects analogous to thickened periosteum. At this part in our third specimen the diameter was 0.2 inch, tapering upwards to a terminal point. Entire length 1 inch.

As regards the mode of erection, this is evidently a muscular and voluntary act, produced by the contraction and tension of a thin sheet of muscular and aponeurotic fibres, derived from the pericranial layer. At will, and during states of excitement, the bird has merely

to move the superciliary region forwards, as in the act of scowling, and possibly lower the mandible a little, when the horn perforce must be bent forwards, and become more or less erect according to traction. Undoubtedly there is no vascular erection, as in the case of the wattle, presently to be mentioned.

I know of no other such remarkable solid cranial appendage moveable at will among the bird tribe, unless it be that of the Cotinga, (*Chasmorhynchus*) and Horned Screamer (*Palamedea*). But in my examination of *Chasmorhynchus niveus* the caruncle seemed soft and spongy compared with the foregoing, suggesting the idea of vascular erection, rather than a mere muscular act.

Instead of a double whip-like comb, which may be the true homologue, we may indeed liken the said head-organs in the Tragopan to horns; for although they have not the solidity of horn as in Ruminants, they nevertheless present an intimate structure which suggests, without being strictly, a horny constitution.

(b) *Intimate Structure of the Wattle.*

The wattle of *Ceriornis satyra* is of a totally different nature, and in most respects agrees with the same organ in other birds,—its brilliant colour, magnitude, and mobility being matters rather of degree than kind. Like the horns, it is fully developed only in the adult male. As in the case of the testes in some birds, it is periodically enlarged during the breeding-season, and then, in fact, only is in perfection.

It is simply a duplication of the skin of the throat, containing, like a single papilla or a larger fold, nerves, blood-vessels, retractile and connective tissue. These increase in dimensions and complexity as the bird arrives at maturity, and under the above-mentioned conditions.

In the male Jungle-fowl, as in the domestic breed of poultry, the comb and the wattles are each a fleshy fibro-vascular organ,—the former always firm and more or less erect, the latter at all times dependent, though on occasions more fully distended with blood. In the case of the Common Turkey-Cock the wattles and caruncula dangle as loose appendages until moments of excitement, when the vascular flow towards them produces the tumid phenomena. The Tragopan's wattle differs from the preceding, inasmuch as it is thin, more membranous, and contains a double sheet of either unstriped muscular fibre or fibro-elastic tissue. The latter endows it with that wonderful retractile capacity, withdraws it out of sight, and retains it folded beneath the mandible, under ordinary circumstances, or after it has been fully expanded.

The vessels and nerves occupy chiefly the centre of the wattle. In front and behind these are the thin transparent layers of the elastic fibres and areolar tissue generally. These, again, on its two sides, superficial and deep, are covered by the upper layers of the cutis and epidermis, the blue-coloured portions coming in with the former. The vessels form a true rete mirabile, and run in nearly straight pa-

rallel lines from the root to the free extremity (see Plate LXI. fig. 14). As far as my dissection warrants me in speaking, for I labour under the disadvantage of the specimen not being injected, the arterial supply is derived from the superior cervical plexus or division of the carotid, which may be taken as such on its emergence from between the muscles of the neck. The veins are fewer, superficial, and anteriorly situate. They run forwards towards the angle of the jaw, and communicate with the jugular.

The physiology of the deflection and retraction of the wattle in the Horned Pheasant is identical with that of other vascular erectile organs. Usually the passive contraction of the fibre and elastic membrane is sufficient to retain the flaccid fold in place under the throat. During the breeding-season, however, fibre, vessels, and skin develop apace, or seem concomitantly and temporarily to increase, doubtless by a stimulus of nervous force and respective vascularity. When the period of excitement ensues, a rapid rush of blood is sent to the parts both of the gular region and head generally. The innumerable arterial channels of the rete mirabile are quickly filled; and powerful contraction of the neck-muscles follows, as may be inferred from the jerking movements of the head, mentioned in the first section. The blood thus poured into the wattle, *per saltum*, throws down the wattle, and, from the thinness and transparency of its walls, produces the magnificent scarlet tint spoken of by observers. Erection is maintained for a shorter or longer period, according as the muscles exert their pressure and prevent the return of the flow of blood. The veins, besides, being fewer in number, delay sanguineous return. The excitement having passed, relaxation follows, and the blood slacks to its normal standard. Meantime, by the contraction of the fibres within the wattle, it resumes its former place almost without an effort.

4. RÉSUMÉ OF THE MORE IMPORTANT POINTS.

1. The male of the Tragopan shows characteristic traits during the breeding-season, differing in several ways from allied forms—but principally noteworthy on account of elevating a pair of cranial appendages, and displaying momentarily a gorgeous membranous wattle.

2. In the female rudimentary horns, even in the young, are found.

3. The so-called horns, as likewise the wattle, *pari passu*, increase with age, and are only fully developed in the adult male at the breeding-season.

4. Even in the adult male the wattle is usually folded beneath the jaw, and almost hidden by the feathering.

5. Pseudo-horns, supraorbital region, cheek, portion of lower jaw, throat, and wattle are more or less clad with a bright blue skin, not due to venous turgescence or congestion.

6. The said coloration results from a pigment-layer and free granules situate in the dermis.

7. That which properly constitutes the horn is a black, solid, yet

exceedingly lithe conical body, which springs from the postfrontal bone. It is composed of densely packed fibro-cellular tissue, with a great quantity of pigment distributed throughout.

8. Growth of the pseudo-horn is apical; and elevation is through a musculo-aponeurotic act, not by vasculo-erectile tissue.

9. Deflection and exposure of the wattle follows from its arterial injection, being provided with a rete mirabile whose vessels run chiefly longitudinal and parallel. The occasional rich red hue is a sanguineous effect.

10. Retraction of the wattle is partially an involuntary act, the sequence of its containing abundance of fibro-elastic tissue and un-striped muscular fibre.

EXPLANATION OF THE PLATES.

PLATE LX.

- Fig. 1. A view of the dissected occiput and back of the neck of a young female Horned Tragopan, showing the nuchal and temporal muscles, above which are the two rudimentary horns, *h*, *h**.
2. Profile of an adult ♂ *Cerionis satyra*, Linn., the erectile horns, *h*, being partially exposed by the feathery crest being slightly raised.
3. An under view of the same head, with the wattle as it appears when the adjoining marginal feathering is tucked out a little way.
4. Exhibits a second stage of the mandibular region, with a full view of the contracted wattle, as the cheek- and throat-feathers are thrust widely out.
- All the above figures are of natural size, and drawn from the specimen immediately after death.
5. Reduced sketch of the full facial display of the male bird, after Mr. T. W. Wood, in 'Int. Obs.' as quoted, *antea*, p. 730.

PLATE LXI.

- Fig. 6. Side view of the head of the second male spoken of in the text. The feathers are partly removed; the blue skin cut open on one side of the pseudo-horn brings into view the dark core beneath. Wattle seen laterally and from behind, as if injected.
7. Dissection of the posterior half of the side of the head, the skin &c. being cut away, and exposing the pseudo-horn and tissues connected therewith.
8. A mesial longitudinal section of the horn, and its blue investment of skin.
9. A transverse section of the same near its root.
10. Another cross section from about the middle.
11. A third slice, cut transversely near the tip of the horn.
12. A magnified view of the core of the pseudo-horn cut horizontally. It shows the meshwork of pigment-material and other substance of which it is composed.
13. A small portion of the elastic fibro-cellular tissue, with its pigmentary granules teased out. Shown as a microscopic preparation under a moderate power.
14. The under surface of the mandible and throat of the same ♂ Tragopan, displaying the outspread membrano-vascular wattle. On the left moiety the skin is intact, and one portion shows the natural wrinkled condition without injection; the other coloured, as if engorged with blood. On the right side of the figure the anterior layer of skin has been dissected off to display the rete mirabile when injected.

Excepting nos. 12 and 13, the figures in this Plate are represented of nearly natural dimensions.