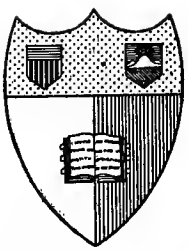

INDIAN SNAKES.

AN ELEMENTARY TREATISE

ON OPHIOLOGY

WITH A DESCRIPTIVE CATALOGUE OF THE SNAKES

FOUND IN INDIA

AND THE ADJOINING COUNTRIES.

BY

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PREFACE.

THE First Edition of this treatise was published under the disadvantageous circumstances of my being stationed in Burma at the time. Since my return to the Madras Presidency I have had but little leisure for collecting further materials and I had expected that some abler hand than mine would have taken up the subject. But as my very elementary treatise remains the only Manual of Indian Ophiology available, I have determined to diminish as much as possible the imperfections of my first attempt at familiarizing English residents in India with an interesting branch of zoology, and at clearing away the haze of fiction which still obscures it. In carrying out this purpose I have been seconded by the enterprise of the publishers; the remainder of the first edition has been withdrawn in order to make way for the present revised issue.

Whilst I have endeavoured to render this treatise as complete as possible for non-scientific readers, those desirous of studying the subject thoroughly will, I hope, find it an efficient introduction to the zoological and medical literature of the subject. The student should certainly follow up this introduction to Dr. GUNTHER'S splendid work on the *Reptiles of British India*, and, if desirous of extending his information, he may consult with advantage the following books:—Professor OWEN'S *Comparative Anatomy and Physiology of Vertebrates*, (first volume); SCHLEGEL'S *Essai sur la Physionomie des Serpents*, (La Haye, 1837); GERARD KREFFT'S *Snakes of Australia*, (Sydney and London, 1869);

Major BEDDOME'S papers in the *Madras Journal of Medical Science;* Mr. THEOBALD'S papers in the *Journal of the Linnean Society* and that of the *Asiatic Society of Bengal.* In the latter Society's Journal and in the Annals and Magazine of Natural History a mass of ophiological information is scattered. I cannot omit to mention RUSSELL'S *Account of Indian Serpents,* 1796; however antique and unfitted for the guidance of the student, it will always be of interest as the work of a pioneer in Indian zoology.

The First Edition of this Manual was sadly deficient in illustrations. This has been repaired by the addition of plates, which in every case reproduce drawings taken by me from specimens or dissections. As illustrative of the physiological part and aiding in the recognition of the principal kinds of snakes, I trust that they will be found to answer their purpose.

E. N.

BANGALORE, *April* 1874.

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INTRODUCTION.

Place in the Animal Kingdom.

Sub-kingdom.—VERTEBRATA.

Section (Huxley).	*Class.*	*Order.*
Ichthyopsida..	Pisces.	
	Amphibia.	
Sauropsida.....	Reptilia.	I.—Chelonia, *Tortoises.*
		II.—Ophidia, *Snakes.*
		III.—Lacertilia, *Lizards.*
		IV.—Crocodilia, *Crocodiles.**
		and five extinct orders.
	Aves.	
Mammalia.	Mammalia.	

The division of zoology, which treats of reptiles, is called *herpetology;* the sub-division devoted to snakes only is called *ophiology.*

Snakes may be thus defined:—

Reptiles of very elongate body, without limbs or with rudimentary hind limbs scarcely visible from without; progressing by means of abdominal plates moved by numerous ribs. The jaws, especially the lower, capable of extensive movement and great expansion; both jaws and palate generally bearing teeth. The external ear absent. The eye unprotected by eyelids. The integument scaly, and the epidermis cast at frequent intervals.

Some kinds of snakes possess perforated or grooved teeth conveying a poisonous salivary secretion into the system of animals bitten by them.

* Crocodiles differ from lizards by possessing a sternum or breast bone.

ORDER OF THE PLATES.

PART I.—PHYSIOLOGY.

CHAPTER I.—The Skeleton.

The bony parts of the snake consist of a skull, a long vertebral column and ribs. The vertebræ are very numerous, varying from about 120 to upwards of 400 in the body; those of the tail number from 4 or 5 in some burrowing snakes to as many as 200 in certain tree snakes, in no case exceeding the dorsal vertebræ in number.* The vertebræ, Plate I, figs. 2 and 3, are procœlous, *i. e.*, the bodies are articulated by ball and socket joints, the socket being in front of the body; the movement of each joint is limited by other minor joints between the adjacent 'apophyses' (or protuberances) of each pair of vertebræ; but, as a whole, the vertebral column is capable of extensive motion in every direction. Of the numerous apophyses the most obvious are the posterior or 'neural' spine and the anterior spine or 'hypapophysis.' The neural spines are most prominent in some venomous snakes; in *Bungarus fasciatus* they are unusually large and are firmly connected with the skin. The anterior spines are susceptible of a peculiar modification; in the genera *Elachistodon* (India) and *Dasypeltis* (Africa) those of the cervical vertebræ penetrate the gullet and act as pharyngeal teeth; several of them are tipped with dental crust.

* There may possibly be exceptions. I have found a specimen of the common green tree-snake to have 172 dorsal and 169 caudal vertebræ, the tail being four-tenths of the entire length.

All the cervical and dorsal vertebræ,* excepting the first two of the former, support ribs. Each pair of ribs rakes backwards, and then bending towards the median line terminates in two cartilaginous filaments attached to the ventral 'scute' or shield. The 'hœmal' arch is incomplete, the pair of ribs being connected anteriorly by integumentary tissue only. The ventral shield connected with each pair of ribs is an organ of locomotion, and the numerous shields arranged in clincher work act as legs when alternately raised and depressed by the muscles of the ribs. The snake uses these organs in different ways; when moving slowly a vermicular action along the ribs causes the ventral shields to catch the ground in succession and the means of progress is nearly imperceptible; but rapid movement is effected by the alternate contraction of a part of the muscles of either side throwing the body into an S form; at each curve one side of the ventral shields holding the ground while the other side advances. These movements are not done with any visible alternation, but in a progressive and undulating manner of considerable gracefulness. When turning round slowly, the movement becomes a kind of counter-marching, where every pair of ribs has to come up to the pivot point before proceeding in the opposite direction. In case of alarm, these movements become more sudden, the snake throws itself into sharp curves, and a jerking motion of the body changes the ordinary imperceptible gliding motion into a rapid series of wriggles. Obstacles to other animals are rather favourable to the progress of snakes; whilst they are powerless on a smooth surface, roughness aids them considerably; a stone, a root or a twig becomes a fulcrum for the anterior parts of the body, and brings the posterior parts rapidly up, so that the ground

* There is no real distinction between dorsal and cervical vertebræ, the latter term is not, therefore, to be taken in a strict anatomical sense.

most favourable for the snake to pursue or retreat is the least favourable to his prey or his pursuers.

In a few genera of venomous snakes, *Naga* (the cobra) and *Ophiophagus* (the hamadryad) especially, the cervical ribs are elongated and capable of erection from their usual supine state so much as to stretch the skin of the neck into a broad flat disk.

Three families of Indian snakes, *Tortricidæ*, *Pythonidæ*, *Erycidæ*, have rudimentary hind limbs. Each limb consists of a claw or spur protruding from a groove on either side of the anus, and internally of two small bones, which may be called the *tibia* and the *tarsus*. These relics of a former stage of development can hardly be of any use for progression; it has been thought that they were of use as auxiliary sexual organs, and this opinion is strengthened by the fact that in *Gongylophis conicus* one of the *Erycidæ*, I find that the male alone is provided with them. In five adult females which I dissected there was no trace of them; the only adult male specimen I have is well-spurred.

The skull is elongated and of somewhat oval shape, being rounded behind the jaws and tapering at the muzzle. Its broadest part is just behind the eye, where it expands above on either side to form the postfrontal bone the posterior bony ring of the orbit; the anterior limit of the orbit is formed by a similar bony process, the prefrontal bone, and it is bounded below by the maxillary and by the palate bone. This part of the head is nearly entirely occupied by the orbital cavities, which in the median line are only separated by the descending plates of the frontal bones.

The bones of the ophidian skull, exclusive of the maxillary and mandibular arches, I shall merely mention, leaving the comparative anatomist to study them in the pages of Owen.

Basioccipital, exoccipitals, and supraoccipital, } forming the walls
Basisphenoid and presphenoid, alisphenoids, } of the skull.

Mastoids, 1.*

Parietal, 2.

Frontals, 3, postfrontals, 4, prefrontals and lacrymals, 5.

Vomer, nasals, 6, and turbinals *t*.

The maxillary arch is composed of the following bones:—

The *premaxillary*, 7, a small bone wedged in the nasal interspace and, except in the *Pythonidæ*, not bearing teeth.

The *maxillaries*, 8, one on each side, of very variable shape.

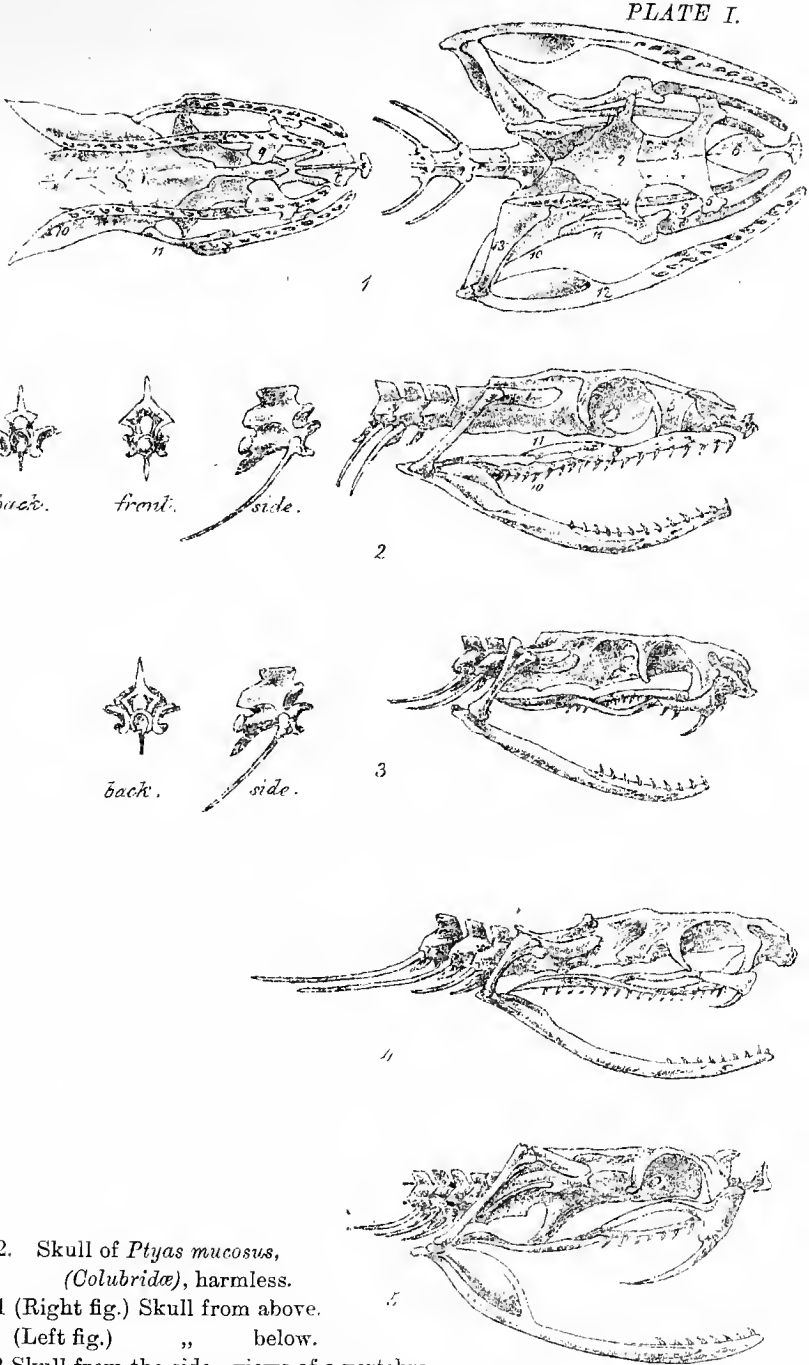
The *palatines*, 9, one on each side, lie parallel to the maxillaries between them; they bear teeth except in *Oligodon* and some earth snakes.

The *pterygoid*, 10, and *ectopterygoid*, 11, of each side form a ⋋ shaped bone (the ectopterygoid being represented by the thin stroke) they abut against the posterior extremities of the palatine and maxillary respectively, communicating motion to them. The pterygoid bears teeth continuously with the palatine row; its posterior end is loosely connected with the tympano-mandibular joint.

The mandibular arch comprises the following:

The *mandibles* or lower jaw bones, 12, connected at the chin by the geneial muscles and skin only. Each mandible is composed of two principal parts, the articular posteriorly and the dentary in front; these are connected by a wedge-shaped suture at the back of the row of teeth. The articular

* The figures refer to Plate I, figs. 1 and 2.



Figs. 1 & 2. Skull of *Ptyas mucosus*, *(Colubridæ)*, harmless.
1 (Right fig.) Skull from above.
(Left fig.) „ below.
2 Skull from the side; views of a vertebra.
Fig. 3. Skull of *Bungarus fasciatus*, *(Elapidæ)*, venomous.
Fig. 4. „ *Naga Tripudians*, *(Elapidæ)*, venomous.
Fig. 5. „ *Daboia elegans*, *(Viperidæ)*, venomous.

portion bears a deep cavity for the insertion of the temporal muscles; in the vipers a thin plate rises on the inner side of this cavity. Close to its posterior end the mandible articulates with the *tympanic* bone, 13. In the harmless snakes this is short and stout, in the venomous snakes it becomes long and slender. Its upper extremity is suspended from the mastoid, a partly detached bone of the skull.

Owing to the loose connection of the mandibles at the chin, and to there being three joints connecting successively the mandible, the tympanic and the mastoid to the skull, the lower jaws have an extensive range of motion both perpendicularly and horizontally, and are also to a certain extent independent of one another. The maxillary and palatine of either side being also loosely connected to the base of the skull are capable of being pushed forward or retracted by the pterygoid bones, themselves loosely attached posteriorly. Each of the four half-jaws being then capable of independent motion a snake is able to advance them one at a time, the prey he is swallowing being securely held by the other three. Also, the action of the pterygoid bones being to push forward the maxillary and palatine, if either of these be fixed at one point, the to and fro motion will become converted into a circular motion with the point of attachment as a centre. This is the principle on which the poison-fang is erected in venomous snakes.

CHAPTER II.—The Mouth and Teeth of harmless Snakes.

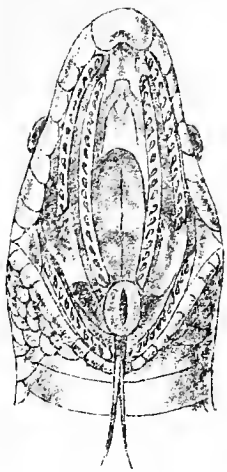
The gape of the mouth is very considerable and, owing to the multiplication of joints between the skull and the mandibles, the upper and lower jaws can be separated until they form nearly a straight line. The mouth is never opened except for the purpose of seizing prey or in defence or sometimes in yawning, after food or drink; a chink in

the rostral shield permits the slender-forked tongue to dart in and out with a rapid quivering motion. On separating the upper and lower jaws, one cannot fail to be struck with the exact fit of these two parts. Every relief on one surface fits into a corresponding depression on the other surface, and accurate apposition of every part is obtained. The roof of the mouth is divided into three parts by the four rows of teeth (Plate II.) These three depressions receive the three prominences of the lower jaw, on each side the mandibular teeth, in the middle the windpipe. The prehensile apparatus is thus composed, on each side, of a row of lower teeth fitting between two rows of upper teeth; the middle space being occupied by the windpipe, or rather its upper extremity, the larynx. This, however, only occupies the two posterior thirds of the middle space, as the anterior third is occupied, above by the nasal fossæ the floor of which forms a low fore-palate, below by the sheath of the tongue. The posterior aperture of the nasal fossæ is therefore just in front of the aperture of the larynx (the glottis) and air passes in a straight course from the nostrils to the windpipe. Beneath the skin of the lips, especially at the angle of the upper jaw, are numerous small salivary glands, but their orifices are too small to be detected.

The salivary glands extend along the dentary portions of both jaws and transude their contents through small orifices within the mucous fold surrounding each tooth.* They are usually four in number on each side, the maxillary, mandibular, lacrymal, and nasal, but their size and disposition vary considerably. The latter two supply the palatine and pterygoid teeth with saliva, but the lacrymal, according to Cloquet, furnishes also the small quantity of lubricating fluid required between the eyeball and is epidermal covering.

Every Indian snake, except the genus *Oligodon* and some

* Such is my impression both from dissection and from analogy.



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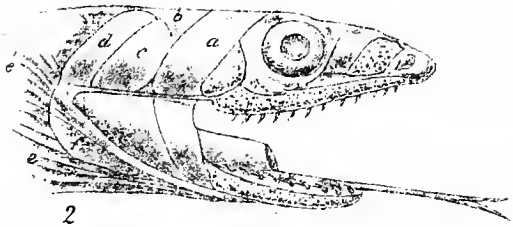

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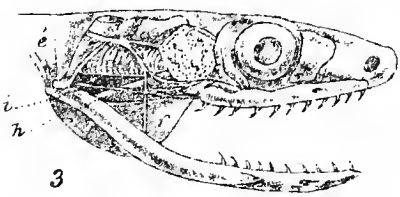

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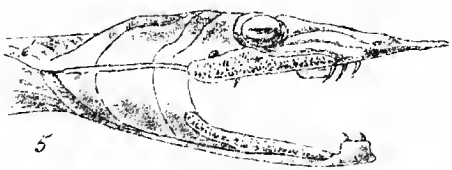

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Mouth and teeth of harmless snakes.

Fig. 1. *Ptyas mucosus*; gape of the jaws.
Fig. 2. „ „ superficial dissection of the jaws; the dotted parts are salivary glands.
Fig. 3. „ „ deep dissection.
Fig. 4. „ „ „ „ showing palate and pterygoid regions.
Fig. 5. *Passerita mycterizans.*
Fig. 6. *Simotes bicatenatus.*
Fig. 7 [illegible]on.

of the small burrowing snakes, has six rows of teeth. Of these, two are on the maxillaries (and occasionally on their posterior continuations the ectopterygoids), two run parallel to these along their inner side, on the pterygo-palatine lines of bones; the other two are the mandibular teeth in the lower jaw.

The pterygopalatine row of teeth is always the longest, the maxillary row is shorter. The former row may contain from ten to thirty teeth, the latter from five to twenty or more; the mandibular row is nearly equal in number to the maxillary.

It is by no means easy to determine the number of teeth possessed by a snake owing to their non-permanent character and to the difficulty in distinguishing the new from the old.

Some snakes have teeth of equal or nearly equal size (isodont) whilst in other kinds the teeth are irregular, or gradually increase or decrease from before hindwards. A very common form of dentition is for the teeth to increase gradually and to terminate by a long tooth at the hinder end of the maxilla (coryphodont.)

These teeth are all directed more or less backwards, and oppose a formidable obstacle to any resistance on the part of prey once seized; they are composed of a horny substance impregnated with bone-earth, formed originally on a vascular centre, hollow in structure, and in the form of an elongated cone, curved backwards at the base.

Each tooth springs from a dental matrix in the bone, protected externally by a mucous envelope; the greater portion of the tooth is concealed by this envelope which is however sufficiently loose to offer no resistance to the use of the teeth. Inside this fold will be found a number of other

teeth in a more or less advanced state, each of which will in its turn become fixed to the bone, by the successive shedding of its predecessors.

The jaws are moved by the following muscles:

		Action.
1.	Masseter (superficial temporal) *a*	Flexor of the mandible.
2.	Temporal (deep) *b*	do.
3.	Posttemporal *c*.....	do.
4.	Tympano-mandibular *d*.....	Extensor of the mandible.
5.	Costo and neuro-mandibular *e* ...	do.
6.	Ectopterygoid, *f*	Depressor of the maxillary.
7.	Entopterygoid, *g*.....	do.
8.	Postfrontopterygoid, *h*	Erector of the maxillary.
9.	Presphenopterygoid, *i*	do.
10.	Presphenopalatine, *j*	Depressor of the maxillary.
11.	Presphenovomerine, *k*	Depressor of the premaxillary
12.	Intermandibulary, *l*	Attractor of the mandibles.
13.	Masto-tympanic	Levator tympanici and extensor of the mandible.
14.	Basispheno-tympanic.....	Depressor tympanici and attractor of the mandible.
15.	Trachelo-tympanic	Extensor of the mandible.

Besides the primary actions given above, these muscles have secondary actions in the attraction and devarication of the mandibles, &c.

No written description of these muscles will convey such a good idea of their situation and action as the figures in Plates II, III and IV. I would only make a few remarks on those which cannot well be figured. The presphenovomerine is a thin tendinous muscle passing along the roof of the mouth. The masto-tympanic is by no means easy of discovery, and the basispheno-tympanic is, as a rule, only to be found in venomous snakes. The muscle which I have given as trachelo-tympanic is the trachelo-mastoid of Owen, but as I always find it inserted into the tympanic, I prefer the former name.

On removing the skin from the cheek and lips of a harmless snake the first structure to be observed is the long ligament leading from the back of the maxillary to the tympano-mandibular articulation; this ligament is in reality formed by a thickening of the fascia covering the temporal muscles. These muscles are the superficial and posterior temporal muscles and the tympano-mandibular; on removing them the deep temporal is seen, its two heads divided by the maxillary nerve. The large lacrymal gland is also exposed on removal of the superficial muscles.

The maxillary is suspended posteriorly by the jugal ligament (a structure corresponding perhaps to the zygoma in man) to the postfrontal bone; in venomous snakes this ligament becomes of considerable importance. The muscles of the palato-pterygoid region are covered by the rugate mucous membrane of the mouth and pharynx; on removing this, we expose the muscles, and also, between the palatine and maxillary rows of teeth, the floor of the orbit; in this space the maxillary vessels are seen.

CHAPTER III.—The Mouth and Teeth of Venomous Snakes.

To the disciple of Darwin the modifications we are about to study have been developed by natural selection. Several harmless snakes have long simple fangs for the purpose of holding tough-skinned prey, others, including nearly all the tree-snakes, have grooved fangs, though, as far as we know, without any modification in the quality of the saliva. With these facts before us, and with the knowledge that in some animals the saliva becomes poisonous under certain conditions, there can be little difficulty in accounting for the development of the most perfect poison-apparatus. Neither in the fangs, in their mucous envelopes, in their

erector muscles, in the poison gland, is there any new or special organ; in each case there is a clearly marked gradation of development.*

Roughly speaking there are four stages in the development of poison apparatus :—

1°. The presence of grooved fangs in snakes which are either unprovided with poisonous saliva or whose venomous quality is so slight that its effect has not been observed.† (Nearly all the tree-snakes; the fresh water snakes.)

2°. The possession of a salivary gland secreting poison and of a grooved tooth in front of the other maxillary teeth. Little modification in the shape or mobility of the maxillary. (The Sea snakes *Hydrophidæ,* and the *Elapidæ* of Australia).

3°. The maxillary is shortened, it contains one fang with a perfect canal, and often one or two simple teeth behind the fang. It possesses a degree of mobility sufficient to raise the fang from a semi-erect to a nearly perfectly erect position; the angle moved through being less than 45°. (The Indian *Elapidæ*).

4°. The maxilla is higher than it is long, and contains only one tooth, a fang several times its own length. It is very

* I am well aware that my opinion is by no means general; indeed I may say that I have not seen it mentioned by other naturalists; but this I ascribe to the maze of errors in which our ideas on snakes have so long been enveloped, to the fascination which the marvellous still has, and the few opportunities possessed by European zootomists for investigating the subject. I earnestly beg the medical profession in India to study this subject by dissection of different snakes; there is a distressing absence of information and our text books of comparative Anatomy are all but silent on these points to which the hypothesis of Darwin gives especial importance.

† These snakes have by some naturalists been classed as the section *Suspecta* between the sections *Innocua* and *Venenosa*.

mobile and, when pushed forward by the ectopterygoid, the fang usually lying supine becomes perfectly erect, the angle moved through being little short of 90°. (The *Viperina*).

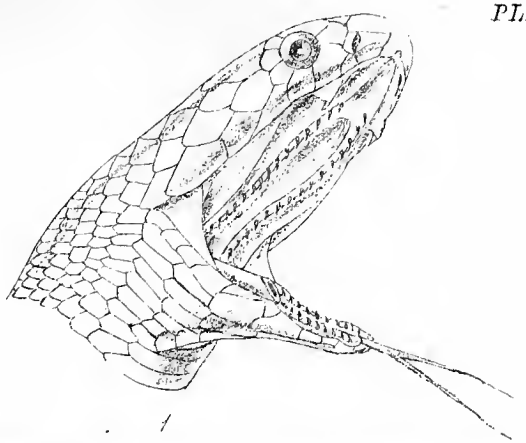
These stages of development are far from being abrupt; when the fauna of Australia is taken into consideration, we find steps between them, both as regards development of maxillary and fangs, and degree of venomous quality.

The poison apparatus is best studied in the large and well developed examples afforded by the cobra and the chain-viper. On examining the mouth of the cobra, dissections of which are given in Plate III, the peculiarities to be remarked are—the gingival envelope of the fang, the depression in the lower lip for the reception of the fang when the mouth is shut, and the absence of any teeth (except a rudimentary one) behind the fang. Slit up this gingival fold and the fang will then be exposed; it will be seen to be fixed in very much the same position as a dog's fang, though curving more backwards, and to fit into a depression in the lower lip. Now dissect the skin off the cheek of the cobra, from the nostril in front to the angle of the mouth behind. A large flask-shaped gland will be exposed on the cheek, extending for half an inch or more behind the eye; it is continued by a duct along the lower edge of the orbit as far forwards as the nostril; a dense fibrous sheath covers the gland and forms a point of attachment to fibres of the temporal muscles. Cut through the duct at its beginning, just behind the eye, and a canal of very small calibre will be seen in its axis; pass a fine bristle down the canal, and by careful manipulation this probe will be seen to go to the end of the maxilla, turn downwards over it, and enter the mouth inside the gingival envelope of the fang, and in front of an orifice in the base of the fang. This examination requires careful dissecting

and skilful manipulation in the *Elapidæ*, but in the vipers the arrangement is on a larger scale and much easier of demonstration.

If we now dissect away the soft parts and expose the maxillary, we shall see a great modification in its form compared with the normal type. It barely reaches as far back as the hinder part of the orbit, its shortness being compensated by increased length of the ectopterygoid. A short tooth is found at its hinder part, but this is rarely perceptible until dissected down to, and appears to be rudimentary. The shape of the maxillary resembles that of a comma ~ the open space protected by the thin curved part being occupied by the matrix of the fang; the thick part in front bears the fang. This part of the bone is thick and wide, and it bears, side by side, depressions for two fangs; one, the outer socket, is generally occupied by the fang in use, the other by the fang in course of growth. When the fang in use has only recently set it may be found to occupy the inner socket, whilst the outer socket, from which the old fang has just fallen is vacant, and remains so until the new fang has worked its way outwards. Sometimes these two fangs are found perfect at the same time, then one of them, generally the outer or old fang, will be loose. This occurs at the time of casting the skin, and I have several times removed the old fangs easily with the finger and thumb or a small forceps.

The fang is slightly curved backwards and inserted at an angle so as to form a hook in the jaw. It is in shape like a short elephant-tusk and does not exceed 28-hundredths of an inch in the longest specimen I have seen. In structure it differs from other teeth in having, when fixed, two orifices communicating with the interior. The pulp cavity is atrophied, and in front of it there is a complete canal. Both orifices of this canal are in front, the upper close to and forming part of the base, the lower at a distance from



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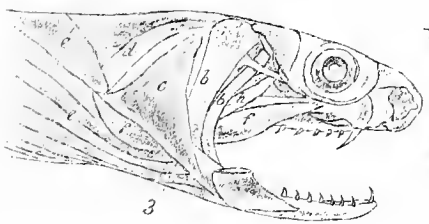

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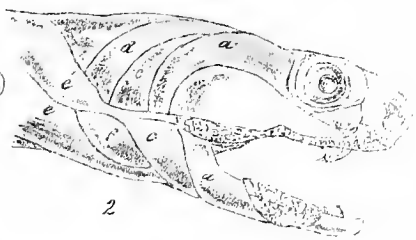

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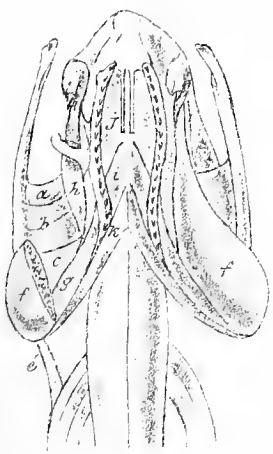

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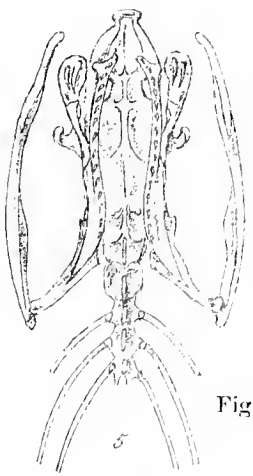

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Anatomy of the jaws of the cobra.

Fig. 1. Gape of the jaws.
Fig. 2. Superficial muscles and poison gland.
Fig. 3. Deep muscles, the glands removed.
Fig. 4. Palate and pterygoid muscles.
Fig. 5. Base of the skull.

Fig. 6. Poison fang of the cobra.
a. Back view.
a. „ part of the outer layer removed.
b. Front view.
c. Section, enlarged.
Fig. 7. Poison fang of the *Daboia* viper.

the point equal to about one-tenth of the length of the fang; a groove connects the orifices, or rather did connect them during the growth of the fang, at which time the canal, originally open in its entire length, became closed. The canal only occupies the front of the fang; the hinder part is a bony column giving considerable strength to the structure.

In the *Viperine* snakes a transition takes place, gradually culminating in the most perfect form of poison-apparatus, viz., a long fang usually lying supine along the jaw, but capable of full erection The genus *Trimesurus* is not nearly so complete as this, the fang is long, but the erection imperfect; the maxillary consists of an open shell communicating with the exterior of the cheek and forming the pit characteristic of the crotaline snakes. But it is in *Daboia* that we see the perfection of mechanism; on removal of the skin covering the cheek, we come at once across the strong jugal ligament lying below the eye; it binds the upper part of the maxillary to the prefrontal and postfrontal bones, thus affording a fulcrum for the action of the erectile apparatus. The maxilla is found to be considerably modified in form; it is no longer placed below the orbit, this position is occupied by the elongated ectopterygoid, whilst the maxillary, only one-fifth of an inch long (in a large *Daboia*) but double that in height, is placed at the end of this bone like a hammer-head at the end of its handle.

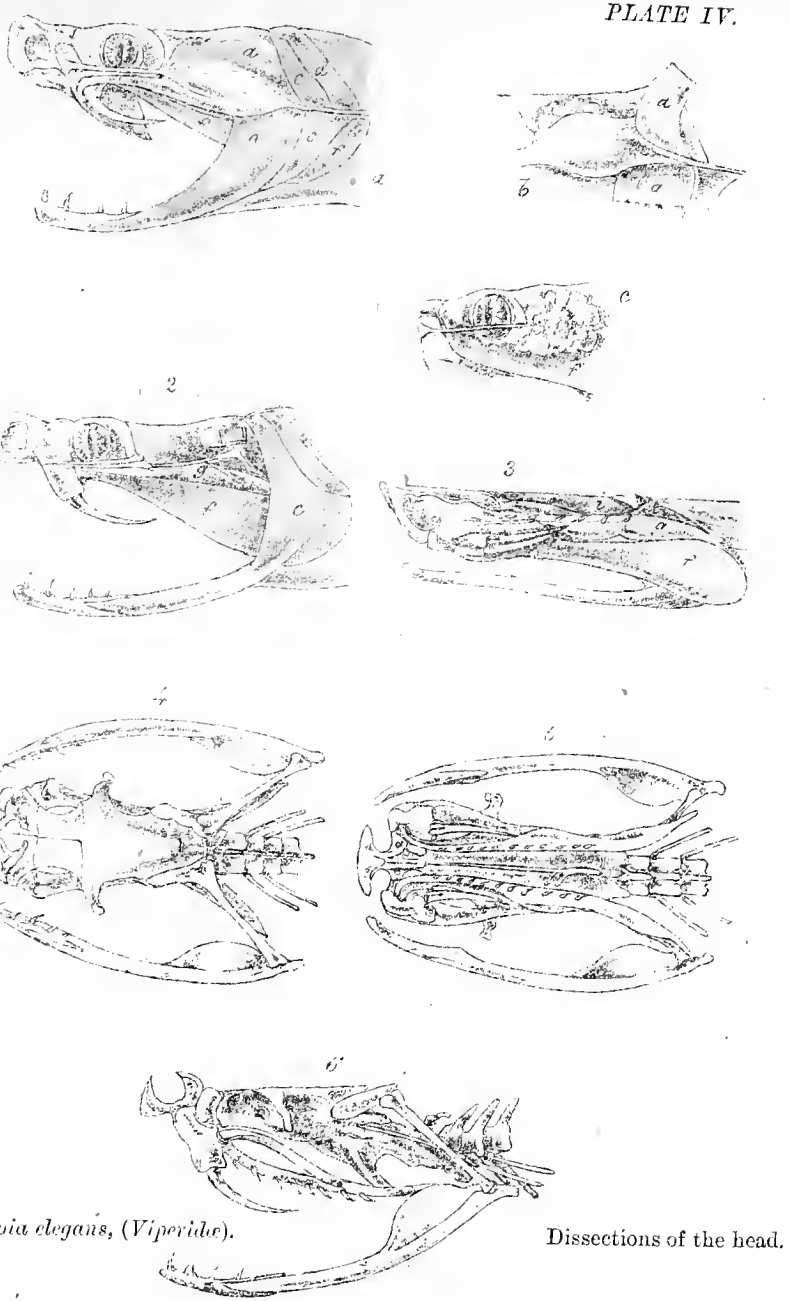
Imagine a hammer-head with the claw downwards (representing the fang,) and hinged at its junction with the handle (the ectopterygoid bone). Now if the top of the hammer-head be fixed by a ligament to a fulcrum, protrusion or retraction of the handle will cause the claw to be either erected or depressed.

The muscles by which the ectopterygoid bone is thus

moved forwards in order to erect the maxillary and fang are the same as those which move the ectopterygoid and maxillary bones in harmless snakes while swallowing their prey. The action is principally effected by the postfrontopterygoid and presphenopterygoid muscles (*h* and *i* in the plates) and these are antagonized by the ectopterygoid, entopterygoid and presphenopalatine muscles, *f*, *g* and *j*.

In the vipers the fang is much longer than in the cobra and other *Elapidæ*, but its length has been greatly exaggerated, as it rarely exceeds half an inch in the largest species. It is however so long that it cannot, as in the *Elapidæ*, be received semi-erect into a pit in the lower lip; hence the necessity for its complete depression when the mouth is shut. This is effected by the aid of a slip of the ectopterygoid muscle passing to the mucous envelope. The tube of the fang is also of larger calibre and the poison duct is plainly seen to open into the mouth just in front of the basal orifice; the duct winds round a groove in the surface of the maxillary, (Plate IV) and a bristle passed along its canal, from behind forwards, will be seen to pass out by the orifice at the base of the mucous envelope of the fang.

The mechanism of the bite of a poisonous snake may differ somewhat in the viperine families from that usual with the *Elapidæ*. The cobra bites just as a dog does, the re-curved position of the fangs rendering a slip impossible; whilst the vipers, though biting also, are able to strike sideways with their long erected fangs. In either case the effect is the same, though a bite will be much more effectual than a mere prick without any counterpressure from the lower jaw. The mucous envelope of the fang is mechanically puckered up, and by its contraction forces the poisonous saliva, as it issues from the duct, to flow into the canal of the fang by its basal orifice. Muscular pressure and spasmodic action of the gland cause an ejection of poison



Daboia elegans, (*Viperidæ*). Dissections of the head.

Fig. 1. *a*. Skin and part of gingival envelope removed.
b. Poison gland exposed.
c. Lacrymal gland exposed.
Fig. 2. Deep dissection.
Fig. 3. Palate and pterygoid muscles.
Figs. 4, 5 & 6. Skull from above, below, and left side.

into the fang and through it into the wound. But if there be no obstacle to pucker up the mucous envelope, then the poisonous saliva finds its way into the mouth just like the saliva of the other glands, running down the inside of the gingival fold along the outer surface of the fang. I have seen the saliva ejected by an enraged cobra in quantities which could not have passed through the fang, for experiments enable me to affirm that a cobra could not inject through the fang with more force than would be necessary to expel one drop (a minim) in three seconds, so fine is the inferior orifice of the fang. A viper, however, could inject the same quantity in half a second, and fluid may be forced through its fang in a fine stream, whilst small single droplets can alone be ejected from the cobra's fang.

The poison of the venomous snakes is secreted by the large parotid gland. But a curious observation has been made by Mayer and corroborated by Mr. Stolicska of the Indian Geological Survey, that a species of *Callophis* (*C. intestinalis*) has supplementary poison glands in the thoracic cavity; they extend one-third down the body, keeping close to the gullet on the ventral side, and reach as far as the heart where they are thicker than above. I am not aware, however, of any experiments as to the character of the secretion furnished by this gland. I suspect it is a salivary gland to the gullet.

There is no difficulty in forcing a venomous snake to yield the poison accumulated in the parotid glands. Pressure on the glands while the fangs are erected over the edge of a watch-glass will cause a flow of the saliva, generally in large drops from between the fang and the mucous envelope, more rarely in a fine jet from the apical orifice of the fang. This is a viscous yellowish fluid, of faintly acid re-action; exposed to the air it dries rapidly, the film cracking all over and thus separating into yellow crystals not unlike

those of santonine. The crystalline form is only apparent, it is analogous to that of the various pharmaceutical citrates of iron, which though uncrystallizable appear to be crystalline from the solution having been evaporated on glass plates.

A recently captured cobra will yield from six to twenty grains weight of poison, the quantity being greatest in wet weather; the crystalline residue is from twenty to sixty-six per cent. on the fluid poison. The following extremes and average were obtained in the course of some hundreds of experiments:

A cobra gave	8 grains	of poison, yielding	1·6 grains	residue.
Do.	7	do.	4·7	do.
Do.	22	do.	6·6	do.
Average quantities	6	do.	2	do.

When being brushed off the watch-glass on which it was dried, the fine particles of dried poison have a pungent action on the nostrils; the taste is slightly bitter and causes an increase of saliva having a feel of frothy soapiness. I have never found any ill effects from tasting it or from the action on the nostrils; but if any gets into the eye it causes a painful inflammation which however soon passes off.

The properties of this substance will be given more fully in Part III, Chapter IV.

Before concluding this part of my subject, I may give an account of the structure of the poison fang, prefacing it with the description given by the first odontographer of the age, Professor Owen.*

"A true idea of the structure of a poison fang will be formed by supposing the crown of a simple tooth, as that of a boa, to be pressed flat and its edges to be then bent towards each other and soldered together so as to form a hollow cylinder, or rather cone, open at both ends. * * * * * The duct which conveys the poison, though it runs through the

* Anatomy of Vertebrates, Vol. I, p. 397.

centre of a great part of the tooth, is really on the outside of the tooth, the canal in which it is lodged and protected being formed by a longitudinal inflection of the dentinal parietes of the pulp-cavity. This inflection commences a little beyond the base of the tooth, where its nature is readily appreciated, as the poison duct there rests in a slight groove or longitudinal indentation on the convex side of the fang; as it proceeds it sinks deeper into the substance of the tooth, and the sides of the groove meet and seem to coalesce so that the trace of the inflected fold ceases, in some species, to be perceptible to the naked eye; and the fang appears, as it is commonly described, to be perforated by the duct of the poison-gland. In the *Hydrophis* the groove remains permanently open. From the position of the poison-canal it follows that the transverse section of the tooth varies in form at different parts of the tooth: at the base it is oblong, with a large pulp-cavity of a corresponding form, with an entering notch at the anterior surface; further on, the transverse section presents the form of a horse-shoe, and the pulp-cavity that of a crescent, the horns of which extend into the sides of the deep cavity of the poison-fang: a little beyond this part the section of the tooth itself is crescentic, with the horns obtuse and in contact, so as to circumscribe the poison-canal; and along the whole of the middle four-sixths of the tooth the section * * * shows the dentine of the fang inclosing the poison-canal, and having its own centre or pulp-canal in the form of a crescentic fissure situated close to the concave border of the inflected surface of the tooth. The pulp-cavity disappears, and the poison-canal again resumes the form of a groove near the apex of the fang and terminates on the anterior surface in an elongated fissure."

On one point this description is somewhat imperfect and, I may venture to say, unsatisfactory; it speaks of "a canal in which it [the poison duct] is lodged and protected" and

further on, Professor Owen says "the inflected surface of the tooth can be exposed to no other pressure than that of the turgescent duct with which it is in contact." Now, according to my observation, the poison duct ends at the bottom of the mucous envelope of the tooth and between its orifice and the basal orifice of the tooth there is no continuity; the two orifices are in apposition and, at the moment of a bite, the saliva, having no other exit, passes through the fang-canal. A continuous canal could not exist when we consider that it would be broken at the first shedding of the fang and there is no ground for supposing any peculiar reparative powers inherent in this duct. No explanation on this point is given in Professor Owen's account of the development of the fang.

"In the posterior part of the large mucous sheath of the poison-fang, the successors of this tooth are always to be found in different stages of development; the pulp is at first a simple papilla and when it has sunk into the gum, the succeeding portion presents a depression along its inferior surface, as it lies horizontally, with the apex directed backward; the capsule adheres to this inflected surface of the pulp and the base of the groove of the loose growing poison-fang is brought into the same relation with the duct of the poison-gland as the displaced fang which has been severed from the duct." This description of the growth of the fang is perfectly correct.

I may add that the inflected part of the capsule lining the cavity of the poison-fang appears to play a great part in its nutrition; while the pulp-cavity becomes obsolete (or nearly so) from the apex backwards as fast as the fang grows, the capsule remains vascular until the fang is nearly perfect. The more highly developed the fang, the greater this nutritive function of the capsule appears to be. Thus, in the cobra, the pulp-cavity is visible for more than half-way

down the full-grown fang, whilst in the *Daboia* this cavity disappears very quickly, and is only marked by the darker appearance of the centre of the tooth. In fact the remains of the obliterated cavity are just traceable along the posterior wall of the canal and only appear plainly below the termination of the latter.

The structure of the poison-fang can be studied in the imperfect fangs often met with in the cobra; it frequently happens that the fang is found divested of a part of the outer wall of the pulp-cavity, so that the wall of the poison-canal is seen nearly isolated from the outer part of the fang except at the base.

CHAPTER IV.—Internal Organs.

The cavity, thoracic and abdominal in one, of snakes may be divided into four parts, of nearly equal length. The first part contains the windpipe, gullet, heart and lungs, the second contains the liver, the third contains the stomach with the pancreas, spleen; gall-bladder and small intestine, the fourth contains the large intestine and the urino-genital organs. See Plate V.

In front of the windpipe lies the sheath of the tongue; to the lower extremity of the sheath is attached the point of the long V shaped hyoid bone; the upper parts of this slender bone being acted on by the geniohyoid muscle and the sheath itself by the genioglossal muscle, the tongue is jerked up and protruded.

The windpipe has numerous incomplete cartilaginous rings in its structure. The lungs consist of a lacework of air-cells lining the walls of large air cavities spread out along the back of the abdominal cavity from the heart to the liver. Their shape and extent vary considerably; they are most extensive in the sea-snakes, a kind naturally

requiring a large supply of air to be able to stay long under water. In most snakes there is but one lung, the other being atrophied. They breathe at considerable intervals; and many kinds can remain under water for nearly half an hour at a time. During the intervals between each inspiration, respiratory movements of the ribs will be observed; the lungs acting as reservoirs of air, these movements are for the purpose of changing the air in the cells of the lung-tissue. The air breathed by the nostrils passes through the *trachea* or windpipe, the upper part of which lies on the floor of the mouth and is closed by two cartilages. The vertical slit between them forming the glottis is just opposite the inner orifice of the nostrils when the mouth is shut; it is the rapid expulsion of air through the glottis which produces the hiss of some snakes when they are angry (the noise, is something between a hiss and the spit of an angry cat).

The heart is situated at about one-sixth of the distance down the body. It is composed of one ventricle incompletely divided, and of two auricles (*atria*). The division of the ventricle is sufficient to enable the pulmonary and the systemic circulation to be carried on in very much the same way as in the higher classes of vertebrata.

The stomach appears to be merely the distended part of the gullet; there is little difference perceptible between them. The combined organ is well lubricated by the secretions of the jaws and its own proper secretions and is capable of great distension. Digestion appears to go on principally at the lower end, where that part of the animal which was swallowed first passes into a state of solution and the rest gradually comes down as the space becomes vacant. The intestinal canal, very little convoluted, occupies the hinder half of the abdomen; the mesentery is plentifully loaded with fat, which becomes a reserve of nutriment for

the long fasts which snakes often undergo. The liver lies alongside of the gullet and stomach; it is a long organ, in two longitudinal lobes, of the usual hepatic colour and texture; it reaches upwards nearly as high as the heart, and terminates below opposite the middle of the stomach. The gall-bladder, with the other digestive glands, is situated a little further down, at the lower end of the stomach. The end of the bowel opens into a short cloaca, the common passage of the intestinal canal of the ureter and of the ovarian or spermatic ducts, according to sex.

Just behind the end of the intestine is a little prominence in the mucous membrane of the cloaca. Below this are the urethral, above it the ovarian or spermatic orifices.

The testes are two elongate white vesicular organs, not unlike full-grown silkworms in appearance. The spermatic ducts, of tortuous structure, descend close along side of the kidneys and thence accompany the ureters. The kidneys are elongate multilobular organs situated nearer to the vent. These four genito-urinary glands alternate, the right testis and kidney being each higher than the same organ of the left side.

In the female the ovaries when unimpregnated are found in the position corresponding to that of the testes; each consists of a series of colourless vesicles lying behind the intestines. When eggs are mature the ovary extends often more than half-way up the body quite effacing the intestine. The number of eggs found may vary from 5 or 6 to 30 and upwards. When the number is small I have generally found one ovary unoccupied.

The male snake has a double organ of copulation lodged in the tail (which is generally longest in males); when protruded by pressure from behind forwards it is seen in the form of two highly vascular protuberances armed with

spines, emerging each from a depression at the side of and behind the anus. No canal passes through these, the spermatic ducts terminating some distance within the cloaca.

Nearly all these organs are liable to be infested with entozoa. The mouth, lungs, and digestive canal bear little red round worms of several kinds; but *Tropidonotus quincunciatus* is remarkable for having its cellular tissue and abdominal cavity inhabited by numbers of small tape-worms about 6 inches in length. I believe that they are developed from cysts in frogs and fishes. Both kinds of entozoa permeate the muscular tissues; I have found them emerging from under the skin of the tail, both in the abovementioned snake and in a tree-snake.*

Perhaps this Chapter will be the most fitting place for a short notice of the monstrosities met with in this order of vertebrates. By far the commonest monstrosity is the possession of a double head, each head being perfectly formed and the two placed side by side. These double-headed snakes are by no means uncommon; they have been met with in America, Australia and Europe, they do not, however, appear to survive their birth long, the specimens to be found in museums being of small size.

There is a young two-headed *Tropidonotus quincunciatus* in the Madras Museum, its origin is unknown, as I found it amongst a large number of snakes accumulated in the store-rooms of the Museum. This monstrosity is, apparently, rather common amongst the sea-snakes. It is possible that a double-headed snake originated the fable of Ananden the thousand-headed *naga*, and his humbler representative the Sesha or seven-headed *naga* so often represented in Hindoo religious art.

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* Snakes are externally troubled with the dog-tick. This parasite gets between the scales and fastens on to the skin.

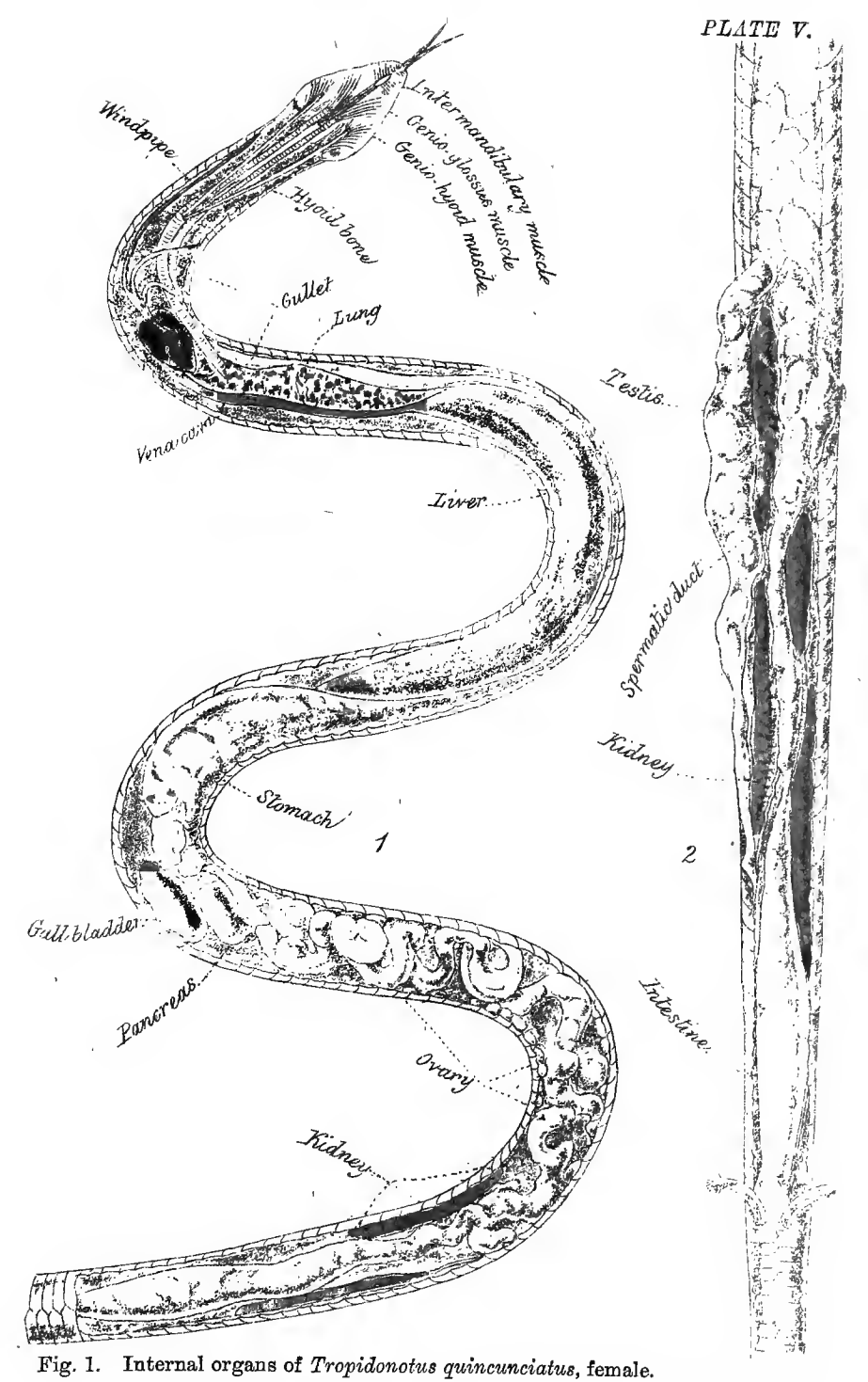

Fig. 1. Internal organs of *Tropidonotus quincunciatus*, female.

Fig. 2. Lower abdominal organs of a tree-snake, male; the intestinal fat is drawn aside.

CHAPTER V.—The Senses.

Sight appears to be the only sense which is well developed in snakes, at least according to the conventional standard. The scaly tegument can hardly be endowed with much sensibility; from their habit of swallowing food whole, it is probable that their taste cannot be very delicate; the nasal cavities are but little provided with expansions of mucous membrane; and hearing cannot be an important sense considering the rudimentary state of the external ear. The only remaining portion of this organ is a subcutaneous capsule attached to the tympanic bone; from this a long slender bone, the *stapes*,* conducts any vibrations of air that may have penetrated the scales and muscles of the head to the expansion of the auditory nerve. There is no external orifice or tympanum.

The eye is well developed in those snakes which live above ground, although it varies in size and adaptation according to the mode of life which it is destined to serve. It is covered by a transparent layer of epidermis, which is cast along with that of the general integument. It is unprovided with eyelids, and is moved to a slight extent by the usual muscles. The pupil varies in shape and size; in most snakes it is round, but it is elliptical and erect in the *Lycodontidæ*, the *Pythonidæ*, the *Viperina* and some of the tree-snakes; and in one family of the latter it is elliptical and horizontal.†

* The stapes is not readily found as it is a mere filament of elastic bone projecting backwards towards the tympano-mandibular joint, lying deep below the tympanic muscles. See Plate IV, fig. 6.

† Of the three families of colubrine tree-snakes the *Dendrophidæ* have a round pupil, the *Dryiophidæ* a horizontally elliptical pupil, the *Dipsadidæ* an erect pupil. It is doubtful whether an elliptical pupil is a sign of specially nocturnal habits. I may mention that Mr. Gerard Krefft considers it is; he calls the Australian *Dendrophidæ* 'the day tree-snakes' and the Dipsadidæ 'the night tree-snakes.' All snakes are more or less nocturnal animals.

The iris is often tinged with various colours, yellow and green being frequent; in *Lycodon*, it is so black that the shape of the pupil is most difficult to see.

In the *Typhlopidæ*, the eye is hardly visible at all, being very minute and covered by the lateral head-shields.

The tongue is probably a tactile organ; and in some snakes there is a prolongation of the snout apparently acting as an organ of feeling (*Passerita, Herpeton*).

CHAPTER VI.—The Integuments.

The skin of snakes is a smooth soft tissue, generally white, sometimes coloured, giving off numerous scales (*squamæ*) which are generally contiguous and often *imbricate* or overlapping one another to some extent. In snakes which can expand the neck this skin is seen dotted over with separate scales at some distance from one another. In most viperine snakes the scales are dull, stiff and sufficiently imbricate to make a rustling noise if the skin is crumpled; in the burrowing snakes, a cuirass of smooth polished scales leaves hardly any interval visible; in the sea-snakes, the scales become tuberculated. In most snakes the skin is shown between the interstices of the scales during the respiratory movements.

On the lower parts of the body the scales become broad (in the higher types), expanding into ventral shields (*scutæ*) and, beyond the anus, into subcaudal shields (*scutellæ*).

On the head a few snakes, *Erycidæ*, *Acrochordidæ*, *Viperidæ* and others, have scales like on the rest of the upper parts, but the majority have the head covered with plates (non-imbricate shields) varying but little from a normal pattern, and, when varying, doing so with sufficient regularity to form characteristic distinctions.

The squamous covering of these three regions, the upper parts, the lower parts and the head, afford together such a large proportion of the characters used in classification that they require attentive study.

We have already seen that each pair of ribs supports and moves a ventral shield; to each also appertains a corresponding transverse row of scales. The ribs not being fixed at a right angle to the vertebral column, but raking more or less backwards, the transverse row of scales corresponding to each pair is inclined backwards in a similar manner. If this incline is at an angle of 45°, the rows of scales will be crossed by lines at an equal angle in the opposite direction; the scales will be of a rhombic or lozenge shape, and the rows capable of being counted in two cross directions at about equal angles of inclination. But if the ribs be inclined at a slight angle to the spine, then the scales will be more nearly square; whilst an excessive incline causes them to be rhomboidal or elliptic, and the rows to be more or less longitudinally inclined. In the neck of the cobra, for instance, the ribs lie down like the ribs of an umbrella, the scales are consequently arranged in such acutely inclined rows as to become quite linear and imbricate; when the snake raises the ribs, expanding the skin of the neck into what custom calls the hood, the scales are seen dotted like long grains of linseed on the stretched surface.

The number of scales in each transverse series is variable but very regular. The extreme range is from 12 to 100 or thereabouts, but 13 to 25 is the range in the great majority of snakes. A number above 31 is only found in the *Erycidæ*, *Pythonidæ*, *Acrochordidæ* some of the *Homalopsidæ* and *Hydrophidæ*. In conjunction with other characters, the number of scales in each transverse series, or, as it is com-

monly called, the number of rows (longitudinal)* of scales is a valuable distinctive character, as it is comparatively rare that individuals of the same species should have a different number of rows.

In Part II it will be seen that the number of rows of scales is generally the first element in the diagnosis of species. When the physiognomy of a snake does not indicate its family the collector begins at once to count the number of scales in a transverse series along the course of a pair of ribs; but in the tree-snakes and some others it will be found more convenient to count across the ribs.

This number is nearly always odd, the vertebral row being *azygos*, and often of a different shape; in only two genera (*Zaocys* and *Peltopelor*) is there a double row of vertebral scales, and, consequently, an even number in the transverse series. An even number of scales consequent on the doubling of the vertebral may be present as an anomaly in individual snakes. I have a *Dipsas gokool* with 22 rows of scales instead of 21. The number of rows should be counted at a distance from the head equal to about one quarter of the length of the body, as the number on the neck exceeds the normal number by two or more; the number settles down at a point varying from the tenth to the thirtieth ventral shield and remains constant for at least half-way down the body; then, sooner or later, the scales begin to diminish, always in uneven number, down to the root of the tail. There several rows may be observed without corresponding ventrals, three or four being rudimentary or deficient where the anal orifice is covered by its large shield. The number of scales on the tail is nearly always even, beginning with about ten and diminishing by pairs to four or two.

* The number of transverse series is not counted; the number of ventral shields is, practically, more constant and is stated instead, at least in the snakes with ventral shields.

In some snakes the number of rows of scales settles down very soon to the normal number which continues till very near the tail, in other snakes barely four-tenths of the trunk is occupied by the normal number. Thus, in *Bungarus fasciatus* and the genus *Callophis*, the number of rows settles down, at about the tenth ventral, to the normal number 15, and remains at that quite down to the vent; but the more common arrangement is shown in the following diagram, dividing into tenths the body of a snake with 19 rows of scales :—

Tenths. *Head.*	1	2	3	4	5	6	7	8	9	10	*Tail.*			
No. of rows.	21	19	19	19	19	19	17	17	17	15	10	8	6	4

We have seen that the scales may be more or less overlapping or *imbricate*; another important character is the presence or absence of a raised keel along the centre of each scale. This keel is very capricious in its presence or absence, and does not correspond to the habits of the snake. It is found in ground-snakes, in water-snakes, and in tree-snakes, indifferently, and in each of these groups, the snakes with smooth scales appear to progress just as well as those with keels. The viperine snakes have generally strongly keeled scales. These keels are generally most marked on the dorsal rows, they become faint towards the abdomen, and rarely appear on the outer row of scales. This row is generally of larger size than the others. In the *Erycidæ*, the keels on the caudal rows of scales are so strongly marked as to form sharp longitudinal ridges; and as they rake backwards like the teeth of a ratchet-wheel, they would apparently be of great use as aids to progression in burrowing.

The presence of an opposite feature—grooves—is frequently noted; they are far from obvious, and are best seen by letting the light glance off the scales; they are then visible as one or two minute gougings at the apex.

The ventral shields are narrow at their first appearance between the chin shields; the first one or two are often bifid, and as many as ten to twenty rows of ordinary scales often intervene before they begin. (All the scales which intervene between the last pair of geneial shields, and the first undivided ventral are called gular scales). The ventrals are absent, rudimentary or narrow in the burrowing snakes, the grovelling snakes, the pythons and the sea-snakes, whilst they are most developed in tree-snakes and others of active habits. In these latter they become broad, turned up at the sides, and often have on each side a lateral keel so well developed as nearly to divide them into three sections. The last of the ventral series is the anal shield; it is generally bifid, and this character, when it occurs, is very regular. Still more regular is the single or double condition of the subcaudal shields, *scutellæ;* they are generally double, being divided down the centre by a zigzag line.

To this rule the following are exceptions:—

Families.	Genera.	
Calamaridæ	*Aspidura*, *Haplocercus*.	
Lycodontidæ	*Cercaspis*.	
Amblycephalidæ ...	*Amblycephalus*.	
Erycidæ	*Eryx*, *Gongylophis*.	
Elapidæ	*Bungarus*, *Megærophis*, *Ophiophagus*,	anteriorly only.
Viperidæ.....	*Echis*.	

In *Ophiophagus*, and occasionally in *Naga*, the last few ventrals may be double, though the anal is always single.

The number of ventrals and subcaudals corresponds closely with that of the vertebræ. The number is variable, not

only in different species, but in individuals of the same species; yet it is a valuable diagnostic mark. In some species the number of ventrals does not vary more than five per cent., in others it is very variable. Thus *Tropidonotus quincunciatus* has very constantly either 137 or 145 ventrals, whilst *T. stolatus* has from 121 to 161. The genus *Ablabes* is most irregular in this respect, the species having from 122 to 245 ventrals. And the genus *Tragops*, a well-defined genus of tree-snakes, consists of three species having respectively about 151, 190 and 220 ventrals. The number of subcaudals is very variable, it is generally greater in males than in females owing to the increased length of the tail in the former sex.

The tail ends in a single shield. In most snakes this shield is not remarkably developed, but in the *Uropeltidæ* it becomes a broad disk either naked or covered with keeled scales, and in *Plectrurus* it ends in a forfical bispinous shield. In some snakes with rather short tails, it may be found quite pointed, sufficiently so to prick the skin slightly if roughly handled. The *Crotalidæ* have this point well developed, though the tail is not provided with the rattling appendages peculiar to some American genera of the family. It is remarkable however that the Indian *Crotalidæ* have a habit of vibrating the tail when excited, and if it strikes against any hard substance a slight noise is produced.

In the sea-snakes the tail is compressed laterally forming a vertical fin like that of an eel.

The extremity of the tail is liable to accidental mutilation, and it frequently happens, in consequence, that the number of subcaudals is found much below the regular number.*

* The Indians have a fable that the cobra loses an inch of its tail each time that it bites a man. Stumpiness of tail is not however confined to this snake and amongst the less agile species a large

The head is covered either with scales like on the rest of the body, or with large plates of regular form, or with various gradations between these two classes of covering.

In the greater number of vipers, there is no trace of the regular-shielded crown possessed by the majority of snakes, the head being scaly like the rest of the body; the *Erycidæ* and *Acrochordidæ* have also scaly heads; the burrowing snakes have an incomplete shielded covering. In two snakes of very opposite habits, the head-covering is composed of large scales simulating the arrangement of shields; *Xenopeltis unicolor*, a burrowing snake, and *Peltopelor macrolepis*, a tree-viper, both solitary species of their genus, have large triangular scales occupying with considerable regularity the place of the head-shields; in the latter snake they may indeed be said to be shields simulating scales. The lowest family of snakes, the *Typhlopidæ*, is distinguished by a type of head-shielding quite different from that found in other families; these 'blind' snakes have become degraded by an entirely subterranean life. The normal arrangement of head-shields, about to be described, is sketched out in the skinks, a family of lizards of Ophidian appearance, from which the snake-class has evidently developed.

The head-shields appear to have formed round a central shield, the *vertical*, which is of a shape departing but little from that of a pentagonal heraldic shield, base in front, apex behind. It sometimes becomes bell-shaped by the rounding of the posterior angles or hexagonal by the addition of a salient angle in the base-line. Behind this are the two *occipitals*, large, elongated, and either rounded

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proportion are found to be deficient in this member. I have seen several cobras with as little as two inches left of tails which should have been nine inches in length. It is probable that this mutilation is caused by a mungoos biting off the tail of a snake which has fled into a hole not quite large enough to shelter his whole length.

or truncated behind. In front of the vertical are two pairs of shields, the *posterior frontals* more or less square, and the *anterior frontals* of similar form, but smaller and liable to encroachment in front and at the sides. On either side of the vertical are the two *supraciliaries*, of regular and crescentic shape, shading the eyes. They complete the oval of the crown, covering the space between the postfrontal and prefrontal bones.

These four pairs of shields with their centre, the vertical, form the crown; the other shields are on the sides of the face.

The muzzle is covered by a convex triangular shield, the *rostral*, which often extends up a little way between the anterior frontals; it is broad at its base with a slight chink in the middle for the exit of the tongue without the mouth being opened.

Behind the rostral on either side are two series of shields, one above the other; the lower series is that of the *labials, (upper)* varying ordinarily from five to nine in number, and increasing in size from before hindward. One or more of them enter the orbit when there is no subocular. In the *Pythonidæ*, the labials and rostral are indented with deep pits in the shape of a comma.

The shields between the labials and the crown on either side are the *nasals*, the *loreal*, the *oculars*, and the *temporals*. The *nasal* is sometimes single, being pierced by the nostril, but more frequently there are two nasals with the nostril between them. In the water-snakes, *Homalopsidæ* and *Hydrophidæ*, where the nostrils are superior, the nasals of either side are often contiguous, excluding the anterior frontals from contact with the rostral.

The *loreal* (*frenale*) is absent in the venomous snakes; and in some harmless snakes, the *Calamaridæ*, *Tetragonosoma*, *Xenopeltis* and several genera of tree-snakes it is

either absent or merged into the neighbouring shields. But in the harmless snakes it is present, as a rule, and in some it is double or triple (*Ptyas, Zaocys.*) Sometimes it wedges itself between the preoculars into the orbit; and conversely a preocular sometimes wedges it out from contact with the labials. This irregularity is frequently found in *Tropidonotus plumbicolor.*

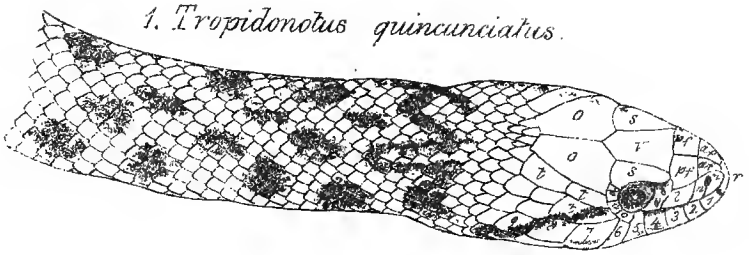
The *preoculars* (or *preorbitals*) are variable in number; one or two is the usual number; the upper is generally the larger and often reaches on to the crown, and more rarely as far as the vertical; the lower is smaller and often seems to be a fragment of a lower labial. The *postoculars* number usually from one to three, and extend lower down than the preoculars. The lower border of the orbit is sometimes occupied by a subocular, but this completion of the orbital ring is rare (*Zamenis*, certain *Homalopsidæ* and *Amblycephalidæ*);* the rule is for one or more labials to enter the orbit.

Behind the postoculars are the *temporals*, variable in number, shape, and arrangement. They are counted backwards in vertical rows; thus "2 + 2 + 3 temporals" means that behind the postoculars are two shields, one over the other, then two more, similarly placed, and lastly a set of three. They sometimes have to be counted thus $\frac{2}{1} + \frac{1}{2}$; this verges on total irregularity.

These temporals are often irregular as they are transitional to ordinary scales. In one snake *(Ophiophagus)* the temporals join in a complete ring round the occipitals by the addition of two large shields behind them. This sometimes occurs in the cobra, a snake to which *Ophiophagus* is closely related.

* I have observed this once in a cobra; it was an aberrant specimen in other respects. See note to *Naga*, Part III.

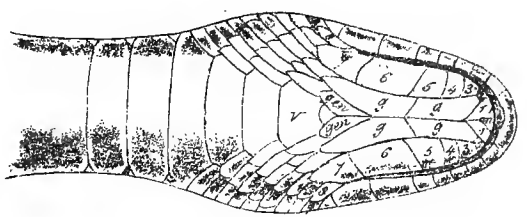
1. *Tropidonotus quincunciatus.*



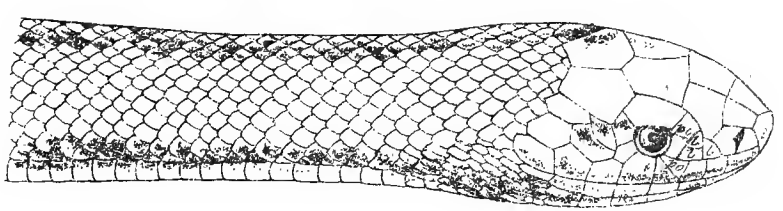
o.o Occipitals.
v Vertical.
s.s Supraciliaries.
p.f. Posterior frontals.
a.f. Anterior frontals.
r. Rostral.

n.n. Nasals.
l Loreal.
a.o Preocular.
p.o. Postoculars, 3.
1 to 9 Labials 9, the 4th & 5th entering the orbit.
t. Temporals 2+2. in this specimen they are $2+\frac{1}{\infty}$ (∞ means irregular.)

1 to 9 Lower Labials
m Mental.
g.g.g.g Gular shields.
gen. Genial scales.
v First ventral shield.



2. *Ptyas mucosus.*



The loreal (l.l.l.) is triple and there are 2 preoculars (p. o.)

TYPES OF THE HEAD-SHIELDING IN COLUBRINE SNAKES.

The shields covering the lower jaw are also regularly arranged. In front, corresponding to the rostral above, is a single shield, the *mental*, and from it the *lower labials* go backwards, edging the lip on either side. The pair of first labials nearly always meet in the median line behind the mental, but the other lower labials, are separated by two pairs of longitudinally disposed *geneial* shields one behind the other. The geneials of either side are separated by a tolerably deep *mental groove* in all but the lower types. One or more pairs of scales (*gular scales*) usually intervene between the geneials and the first ventral shield.

The shields above described are found in most of the higher types of snakes. Their place is sometimes filled by scales especially in the lower types, but a redundancy of shields is rarer; the multiple shields may be increased or diminished in number, but the intercalation of abnormal shields is not often met with. *Zamenis diadema* and the *Pythonidæ* offer almost the only examples of redundant shields on the crown. Sub-division of shields often occurs, but very rarely is the character constant; it is usually an individual aberrance to be commonly found in certain species.

The colour of the integument is generally resident in the scales, although it frequently happens either that the true skin partakes of the colour of the scales or that the scales show between their edges the ground colour of the skin beneath. This skin is usually white, but black cross-bands on it are not uncommon, as also reticulated patterns in yellow, red, or pale blue. The two latter colours come and go in the same manner as the colours of a turkey's wattles, and they are often interchangeable in the same individual, *e. g. Tropidonotus stolatus*. The scaly coat has generally a ground-colour of olive brown in various shades and tints. Other colours also commonly occur, black, brown, yellow, green, white and more rarely red and blue. Green

is the usual colour of tree-snakes; it is very delicate, and rapidly passes through changes from tender green to bronze and blue. In a few cases the colours are dead, but generally they are shining, even iridescent in certain lights, and afford a beautiful play of colours.

The patterns in which these colours are arranged are often very difficult to describe, and it is by no means easy to imagine the actual pattern and colours of a snake from a verbal or written description however accurate. The entrance of an interstitial pattern from the skin below, the secondary patterns produced by dark tinged margins to the scales, and the play of colours in different lights, sorely tax the word-painter's power of description.

The patterns are formed by stripes and by series of dots, of ring-spots, of ocelli or of other shaped marks in a longitudinal or in a transverse direction, or in both. The longitudinal lines may cross the transverse lines or *vice versâ*, and the points of crossing may be marked by a different colour. Cross-bars are often ocellate, that is, including eyes in their course, and a *fasciolated* pattern is common; it consists of cross-bars of variegated colour produced by darker or lighter tips to certain series of scales. It frequently happens that cross-patterns are unsymmetrical, the bars of either side not meeting exactly at the median line.

Cross-markings rarely extend all round the body, except in a few snakes encircled by rings; generally the under-parts are of a different pattern, plain, mottled, banded, or spotted. The throat is also of a different colour, lighter, often yellow. The head is sometimes marked with fillets, and streaks frequently pass downwards or obliquely backwards from the eye to the throat. Collars are very common, either > shaped (point forward) or < shaped (point backward).

The exact period at which snakes cast their skins is very variable, but about two months appears to be the average

interval between each cast. At the approach of the casting, the colours of the snake become somewhat dull, and a white film is seen over the surface of the eye. When the skin, or rather the epidermis (for it is the colourless scarf skin which separates, like in human beings after an attack of scarlet fever) is ready to be cast, the snake rubs the skin back from his nose and chin, and seeks some projecting point such as would be afforded by a split bamboo, some stiff thatch, or a heap of stones, on which to catch the loose skin; perhaps adhesion is aided by the application of glutinous saliva; anyhow the snake manages to stick the loose skin of the nose and chin to some convenient object, and then proceeds to peel himself out of his epidermis which of course remains inside out like an eel's skin after the involuntary exit of its tenant—with this difference, that the snake has had numerous opportunities, denied to the eel, of becoming used to the process. The cast skins are beautiful objects, there is often not a break in them from nose to tip. The epidermal covering of the eye comes off along with the rest of the skin, and every scale, every keel is distinctly marked; colour alone is absent,* but even without it the kind of snake to whom the skin belonged can often be identified.† They are very delicate and fragile, and are liable to destruction by mites unless kept shut up along with camphor. The cast skin of a *Ptyas mucosus*, 9 feet long, weighs 130 grains or a little over a quarter of an ounce.

* The pattern of the *Python* and of some *Dipsadidæ* is visible in their cast skins.

† When I was stationed at Kamptee in 1868, the house I occupied, jointly with a brother-officer, also gave shelter to a cobra and a pair of *Bungarus arcuatus*. I never saw them, but easily identified them by the skins they periodically cast. The cobra lived on my friend's side of the house, the other snakes lived in a hole in the wall under my dressing table.

PART II.—CLASSIFICATION.

CHAPTER I.—Principles.

The following synopsis of the families of Indian snakes with their sub-divisions is here presented in order to give a general idea of the system of classification in use, before entering into the details of the Descriptive Catalogue:

ORDER. OPHIDIA.

First Sub-order. HARMLESS COLUBRINE SNAKES.

(Serpentes colubriformes non-venenati.)

A. Snakes of low type. Ventral shields absent or narrow. Head shielding defective or abnormal.

Fam. I. Typhlopidæ. *Blind Snakes. Genera.*

Small and quite cylindrical, resembling at first sight earth-worms rather than snakes. Eyes rudimentary, no ventral shields, forepart of the head covered with shields of a peculiar type. Rudimentary hind limbs, hidden. Burrowing snakes, rarely appearing above ground. *Typhlina. Typhlops. Onychocephalus.*

Fam. II. Tortricidæ. *Short-tailed Earth snakes.*

Body cylindrical; tail very short, conical. Eye small. Head shielded, but only one pair of frontals; ventral shields beginning to appear. Palatine teeth; Median groove at the chin. Rudimentary hind limbs visible. Burrowing snakes, occasionally found above ground. *Cylindrophis.*

Fam. III. PYTHONIDÆ. *Pythons.*

Body very thick; head depressed, abnormally shielded. Labial shields pitted. Ventrals very narrow, 240 or more. Scales smooth, 65 or more. Rudimentary hind limbs visible. *Python.*

Fam. IV. ERYCIDÆ. *Sand Snakes.*

Body thick, tail very short, narrow ventrals, numerous rows of scales. Crown of the head scaled. Rudimentary hind limbs generally present. *Gongylophis. Cursoria. Eryx.*

Fam. V. ACROCHORDIDÆ. *Wart Snakes.*

Head small; eye small; nostrils superior. Entirely covered with small tubercular or spiny scales, no ventrals or subcaudals. Transitional to the sea-snakes. *Acrochordus. Chersydrus.*

Fam. VI. UROPELTIDÆ. *Rough-tailed Earth Snakes.*

Body cylindrical; head short, conical; tail very short, ending in a rough or scaly disk, generally obliquely truncated. Head shielded, but only one pair of frontals; ventral shields apparent. No palatine teeth. Burrowing snakes, living at some distance under ground. *Rhinophis. Uropeltis. Silybura. Plectrurus. Melanophidium.*

Fam. VII. XENOPELTIDÆ. *Iridescent Earth Snakes.*

Body cylindrical; tail short, tapering; head flat, depressed, covered with large triangular shield-like scales. Burrowing snakes transitional to the more highly developed families. *Xenopeltis.*

B. SNAKES OF INTERMEDIATE TYPE. VENTRAL SHIELDS FAIRLY DEVELOPED. HEAD-SHIELDING DEFECTIVE OR ABNORMAL.

Fam. VIII. CALAMARIDÆ. *Grovelling Snakes.*

Body cylindrical; head small; tail short, tapering. Eye small; ventral and subcaudal shields well developed; head shielded, but with one or more shields absent (generally one or more anterior frontals, and the loreal). Small snakes, living on the surface, under trees, stones, &c.

Calamaria.
Macrocalamus.
Oxycalamus.
Geophis.
Aspidura.
Haplocercus & 3 or 4 new genera.

Fam. IX. HOMALOPSIDÆ. *River Snakes.*

Body cylindrical; tail moderate, compressed at the root. Ventrals rather narrow. Nostrils superior, provided with a fleshy valvule. Head-shields often irregular, anterior frontals encroached on by the large nasals. The last tooth is transitional between a tooth and a poison-fang. Rarely found far from the water.

Fordonia.
Cantoria.
Cerberus.
Hypsirhina.
Ferania.
Homalopsis.
Hipistes.
Gerarda.
Herpeton.

Fam. X. AMBLYCEPHALIDÆ. *Blunt-headed Snakes.*

Body compressed, slender; head short and thick. Often a complete orbital ring of shields. Cleft of the mouth small, lower jaw not expansible, no mental groove.

Amblycephalus.
Pareas.

C. SNAKES OF HIGH TYPE. VENTRAL SHIELDS FULLY DEVELOPED. HEAD-SHIELDING NORMAL.*

Fam. XI. OLIGODONTIDÆ. *Filleted Ground Snakes.*

Head normally shielded, with peculiar markings. Teeth few in number, in one genus no palatines.

Oligodon.
Simotes.

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* With a few exceptions in the genera *Ablabes*, *Atretium* and *Zamenis*, of the family Colubridæ, the crown and orbital shields are always normal in the families of this section.

Fam. XII. LYCODONTIDÆ. *Harmless-fanged Snakes.*

Head depressed; snout spatulate and flat. Eye small, generally with vertical pupil. A large fang in front of the maxillary and mandible, but not grooved or hollow.

Lycodon.
Tetragonosoma.
Leptorhytaon.
Ophites.
Cercaspis.

Fam. XIII. COLUBRIDÆ.

This family comprises all those harmless snakes which do not present any striking character, are fair and moderate in their proportions, and have none of the qualities necessary for their admission into other families. Their head-shields are normal, with the exception of a few species on the debatable ground betwixt this family and the Calamaridæ; they have not the compressed and slender body of the tree-snakes, yet some of them climb and have a green coloration; they have not the superior nostrils and aquatic build of the true fresh-water snakes, yet some of them are amphibious. They are divided into the following groups:—

Group I.—CORONELLINA. *Ground Colubers.*

Of small size, with smooth scales; in some genera aberrant species approach the Calamaridæ in imperfect head-shielding.

Ablabes.
Cyclophis.
Odontomus.
Nymphophidium.
Elachistodon.
Coronella.

Group II.—COLUBRINA. *Agile Colubers.*

Attain a large size. Their scales are keeled, they are active enough to climb and swim on occasions, and are swift in their movements along the ground.

Coluber.
Elaphis.
Compsosoma.
Cynophis.
Ptyas.
Xenelaphis.
Zamenis.

Group III.—DRYADINA. *Bush Colubers.*

Their compressed body, numerous ventrals (200 or more), and general green coloration show that they are transitional to the families of true tree-snakes. *Zaocys.* *Herpetoreas.*

Group IV.—NATRICINA. *Amphibious Colubers.*

These lead off to the river-snakes; their nostrils are often superior; their scales are always more or less keeled; the ventrals considerably less than 200; long teeth at the back of the maxillary. *Tropidonotus.* *Atretium.* *Xenochrophis.* *Prymnomiodon.* *Cadmus.*

Fam. XIV. DENDROPHIDÆ. *Tree Snakes.*

Body slender, snout rather long but rounded fairly; eye moderate or large with round pupil. Ventrals broad with two lateral keels. *Gonyosoma.* *Phyllophis.* *Dendrophis.* *Chrysopelea.*

Fam. XV. DRYIOPHIDÆ. *Long-nosed Tree Snakes.*

Body excessively slender; head narrow with the rostral shield developed into a snout often of some length. Eye moderate with horizontal pupil. *Tropidococcyx.* *Tragops.* *Passerita.*

Fam. XVI. DIPSADIDÆ. *Broad-headed Tree Snakes.*

Body slender, much compressed. Head very distinct from the neck, short and broad. Eye moderate, with vertical pupil. *Dipsas.*

Fam. XVII. PSAMMOPHIDÆ. *Desert Snakes.*

A class of snakes resembling the tree-snakes in their form, but of terrestial habits. Body slender, head very distinct from the neck, head-shields normal. *Psammophis.* *Psammodynastes.*

Second Sub-order. VENOMOUS COLUBRINE SNAKES.

(Serpentes colubriformes venenati.)

Snakes in which the front of the maxillary is furnished with a short poison-fang always more or less erect.

Fam. XVIII. Elapidæ. *Venomous Colubrine Land Snakes.*

Land-snakes. Head normally shielded, but no loreal.

Naga.
Ophiophagus.
Bungarus.
Xenurelaps.
Megærophis.
Callophis.

Fam. XIX. Hydrophidæ. *Sea-Snakes.*

Tail compressed into a paddle. Head-shields tolerably regular, nasals generally contiguous. Ventrals narrow or none. Scales tubercular and dull. Eye small; nostrils superior.

Platurus.
Aipysurus.
Disteira.
Acalyptus.
Hydrophis.
Enhydrina.
Pelamis.

Third Sub-order. VIPERINE SNAKES.

(Serpentes viperini.)

Snakes with a long poison-fang, capable of complete depression.

Fam. XX. Crotalidæ. *Crotali* or *Pit-Vipers.*

Broad thick head, very distinct from the neck, and generally scaly or imperfectly shielded. A deep pit between the eye and the nostrils, corresponding to the *antrum maxillæ*.

Trimesurus.
Peltopelor.
Calloselasma.
Halys.
Hypnale.

Fam. XXI. Viperidæ. *Vipers.*

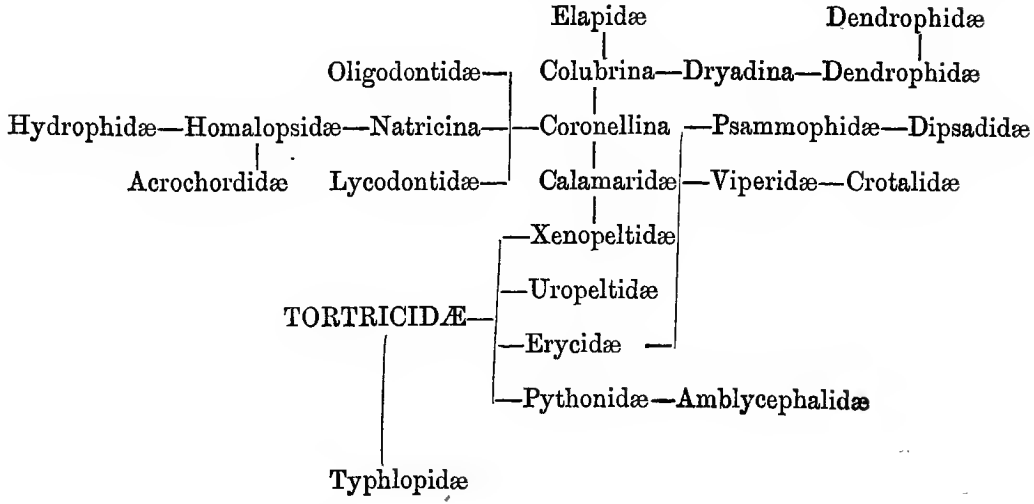
Broad thick head, scaly. No facial pit.

Daboia.
Echis.

The order in which I have arranged these families differs somewhat from that adopted by Günther; the improvement, if any, is very slight, for it is difficult, especially when the Indian genera are alone considered, to arrange the families

in groups which will show the affinities of the families which compose them. But the present arrangement is less dissonant from the order of development shown by the families when compared with the primitive lacertilian type, and it renders diagnosis of an unknown snake easier than when the families are arranged in entirely empirical order. I imagine that the process by which development has taken place must have been somewhat on the system shown below, and I have no doubt that a consideration of general ophiology and not that of India alone, would fill up many hiatus at present evident.

Scheme of development from the original type represented by the family TORTRICIDÆ.



CHAPTER II.—Diagnosis of an unknown Snake and method of description.

The student of Ophiology should take some common and well-known snake such as *Ptyas mucosus* and practise making the description of it with a view to familiarize himself with the various characters. He should also practise drawing the head-shields; to do this correctly, he must begin by drawing the vertical, and then gradually build up the other shields round it; to draw a snake full length in a natural attitude is a difficult task to any but a cunning limner; but an exact representation of the head and neck is possible to any one who will take a little trouble about it. Colouring the drawing accurately is far from an easy task, and requires some study of the natural process by which the colours have become blended.

When an unknown snake is required to be identified, the first step is to determine the family to which it belongs. This can be done readily by means of the synopsis given in the preceding Chapter. If the snake be found to belong to the harmless Sub-order its place in the three Sections into which I have divided the families should be first determined after which the diagnosis of family, genus and species can be completed by reference to the Descriptive Catalogue further on. If it does not appear to belong to any of the species described, an accurate description should be drawn up, while the specimen is fresh, for future reference in case it should turn out to have been hitherto undescribed.

It is necessary to lay down a system of description for snakes in general which will prevent useless details being given and direct the attention to the important points. Accurate description may be given very neatly in Latin; we must try and imitate in English the conciseness of the more

classical description. The following scheme will give an idea of the way in which the description should be arranged.

Date Place

Length———; tail———. Sex ———

Scales——rows; smooth, keeled, or with apical grooves; imbricate? rounded, oval, linear, rhombic or rhomboidal; vertebrals enlarged? at what distance in tenths of length the number diminishes.

Ventrals, number; broad or narrow (in proportion to the circumference); keeled? turned up at the sides? Anal, single or bifid. Subcaudals, number; single or double.

Head, distinct from neck? high, flat, broad, narrow; snout acute, obtuse; eye large, small, moderate; pupil round, erect, horizontal; iris, colour.

Head shields, normal? note peculiarities of crown shields; loreal present, absent, single or multiple; nasal single or multiple, position of nostril. Preoculars, number, does the upper one reach to the crown—to the vertical? (Subocular), Labials, number, how many enter the orbit, peculiarities; temporals, number, arrangement. Lower jaw—labials, number, first pair not contiguous? geneials, number of pairs; gular scales, number.

Ground colour.

Longitudinal pattern. Stripes or streaks, number, breadth, position (vertebral, dorsal, lateral). Series of spots, of ring-spots, size, margins, disposition.

Transverse pattern. Cross-bars or cross-bands, sagittal, fasciolated, quincuncial, decussating, ocellated, margined; series of rings (number).

Interstitial colouring.

Belly and ventral row of scales, throat, subcaudals—ground colour, plain, marbled, marbling, striped, spotted, &c.

Head, ground colour; cross-bands, fillets, > or < markings; postocular, subocular or nuchal streaks.

Teeth, number (fixed), equal, increasing, decreasing; any longer teeth before or behind; separated by any interval; palatine teeth.

CHAPTER III.—Descriptive Catalogue.

In the following catalogue I have considerably abbreviated the full description, giving in most cases only the colour and the distinctive features. In the more common kinds of snakes, such as are ordinarily met with, this description is somewhat enlarged in order to admit of their more ready recognition, whilst in those of which only one or two specimens exist in museums, I have given a description just sufficient to show the specific differences, but yet full enough, I hope, to cause their recognition as rarities in case they should be perchance met with.

I have given the descriptions as succinctly as possible, and to avoid any mistake I may remind the reader that the lateral halves of a snake being symmetrical, I have, as a rule, described only one side. If I say that a snake has a vertebral, a dorsal and a lateral stripe, it must be understood that on *each* side of the single vertebral stripe there is a dorsal and a lateral stripe.

First Sub-order. HARMLESS COLUBRINE SNAKES.

Family I.—TYPHLOPIDÆ.

Of small size; body cylindrical, thicker behind; tail not longer than the breadth of the head, ending in a minute spine. Body covered with equal scales, no ventrals. Head

covered with shields of a peculiar type. The rostral is prolonged backward; on either side of it, are four labials and four large shields, the nasal, the fronto-nasal, the preocular, the ocular; behind it, are some small frontal and supraciliary shields. The eye is rudimentary, often quite invisible through the ocular shields. Mouth very inferior, jaws hardly dilatable, no mental groove, a few maxillary teeth only. Rudiments of hind limbs, not visible being hidden beneath the skin.

TYPHLINA, *Wagler.*

Rostral large, rounded in front; *no preocular;* nostril inferior.

T. LINEATA, *Boie.*

Scales 22. Transverse rows, 405. Length 18 in., diameter $\frac{1}{45}$ (of length.) Reddish olive with numerous brown lines; snout and belly yellow.

Straits.*

TYPHLOPS, *Duméril and Bibron.*

Rostral large, rounded in front; nostril lateral.

T. NIGRO-ALBUS, *D. and B.*

Scales 26. Transverse rows, 326-353. Length 14 in., diameter $\frac{1}{35}$. Bluish black, belly yellowish.

Straits.

T. HORSFIELDII, *Gray.* Plate VII, fig. 1.

Similar to the preceding, but nasal and fronto-nasal united above, and colour shading more gradually below. In Burma, I have found a snake with the character of this species, but colour pearl-grey above, white below.

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* When the Straits are mentioned as a habitat, they include the Malayan Zoological province generally.

T. BOTHRIORHYNCHUS, *Günther.*

Scales 24. Diameter $\frac{1}{42}$. Four sutural grooves in the lower part of the snout. Uniform brownish olive.

Penang.

T. STRIOLATUS, *Peters.*

Scales 24. Each scale with a yellow, posteriorly black-edged, cross-streak.

Bengal.

T. SIAMENSIS, *Gthr.*

Scales 22. Diameter $\frac{1}{42}$. Greyish olive, yellowish below.

T. BRAMINUS, *Daudin.*

Scales 20. Diameter $\frac{1}{40}$. Fronto-nasal not in contact with labials. Brown, paler below.

T. PAMMECES, *Gthr.* Plate VII, fig. 2.

Similar to the preceding. Diameter $\frac{1}{75}$.

Madras.

T. MIRUS, *Jan.*

Scales 18. Diameter $\frac{1}{50}$. A subocular present. Brown with yellow snout.

Ceylon.

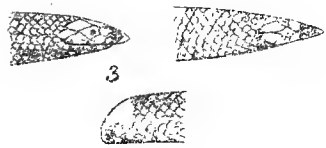
ONYCHOCEPHALUS, *D. and B.*

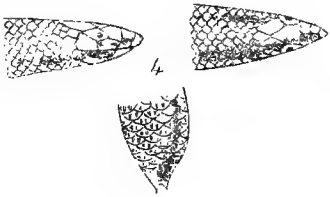
Nostril inferior. *Rostral with an anterior trenchant edge.*

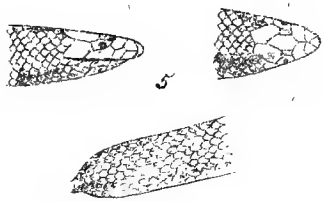
O. ACUTUS, *D. and B.*

Scales 28-29. Longitudinal rows, 500. Diameter $\frac{1}{44}$. Light bronze, each dorsal scale has a pale centre; yellowish below.

South of India.







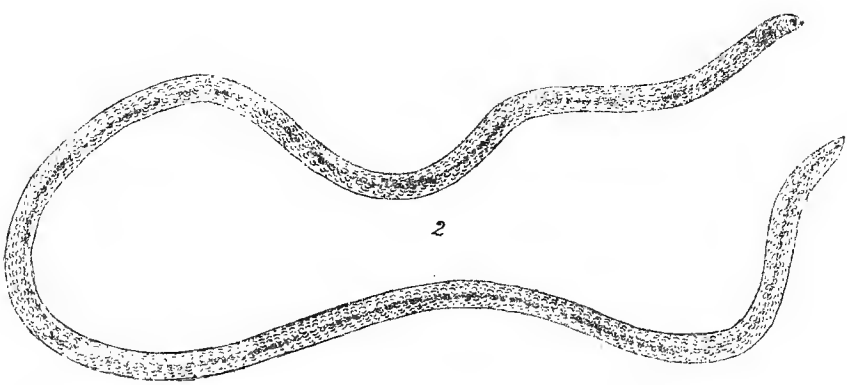


Fig. 1. *Typhlops horsfieldii.*
Fig. 2. *T. pammeces.*
Fig. 3. *Rhinophis sanguineus*, with a view of the tail from one side.
Fig. 4. *Silybura ocellata.* Do. do. above.
Fig. 5. *Plectrurus perrotetii.* Do. do. one side.
Fig. 6. *Geophis microcephalus.*

Family II.—TORTRICIDÆ.

Body cylindrical; depressed rounded head not distinct from neck; tail very short, conical, its end smooth. Rudiments of hind limbs visible. Scales smooth, polished; ventral row little larger than the others. Head shielded, but only one pair of frontals; six labials. Eye small. Cleft of the mouth moderate; palatine teeth; mental groove.

CYLINDROPHIS, *Wagler.*

Nasals single, contiguous. Occipitals small. Frontal enters the orbit.

C. RUFUS, *Laurentius.*

Width between the eyes greater than the length of snout. Scales 19-21. Ventrals 184-200, subc. 6-9. Brown; belly has irregular white cross-bands extending up the sides.

Burma and Straits.

C. MACULATUS, *Linnæus.*

Width between the eyes equal to the length of snout. Scales 21. Ventrals 186-196, subc. 5 or 6. Brown, with a network of black lines and cross-bands. White below.

Ceylon.

Family III.—PYTHONIDÆ.

Body rounded; head distinct from the neck; snout long, rounded. Eye moderate, pupil erect. Head shielded. Some of the labials pitted. Scales numerous, smooth. Ventrals narrow. Rudimentary hind limbs visible. Premaxillary teeth present.

PYTHON, *Daudin.*

Body stout; grows to a large size. Occipitals rudimentary; forepart of the crown with intercalated shields. Rostral and labials pitted. Anal entire. Ventrals very narrow.

P. RETICULATUS, *Schneider. The Malayan Python.* Plate VIII, fig. 3.

Scales about 75. Ventrals 300-330, subc. 82-102. Two or three pairs of shields intercalated between the vertical and posterior frontals. Labials about 15 (7)* first 4 pitted. Brown with an irregular vertebral chain of black rings, from each of which depends a black bar enclosing a white ocellus. A thin black line prolonged along the median line of the head; postorbital streak. Grows to 10 feet and upwards; probably 20 feet is the maximum; tail one-eighth.

Burma, Straits.

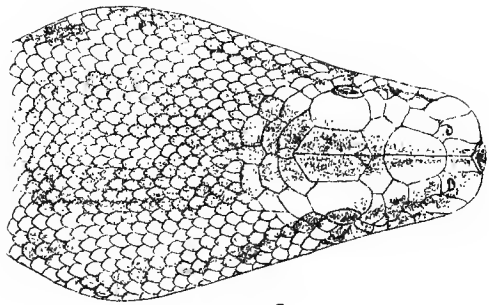
P. MOLURUS, *L. The Indian Python.* Plate VIII, figs. 1 & 2.

Scales about 65. Ventrals 242-262, subc. 60-72. Intercalated crown shields. Labials about 12, first 2 pitted. A subocular sometimes present. The pattern consists of three rows of quadrangular brown spots (one median), separated by narrow buff lines; or it may be considered as brown with longitudinal dorsal buff stripes, and irregular transverse bands above and below. A brown spot formed by a buff or yellow ≻ offset of the reticulations occupies the head. Size about the same as the preceding.

India, Burma.

NOTE.—I think that the exaggeration of travellers as to the length of these snakes arises from the disproportionate thickness of adult specimens. When in Rangoon I kept a *Python molurus* which in the middle was fully as thick as a stout man's arm; and a person deriving his ideas of proportion from large Colubridæ would naturally suppose, on seeing a snake of this thickness either coiled up or moving through the jungle, that it must be at least 20 feet long; yet it was in reality only 9 feet long, very little longer than a *dhāman* of an inch and a half in diameter. The capacity of these creatures' jaws is also exaggerated. The above-mentioned individual had a throat only wide enough to take in a fish of about 8 inches long; so that it is probable that his prey when at liberty consisted rather of rats and birds than of goats or deer.

* (7) means that the seventh labial enters the orbit.



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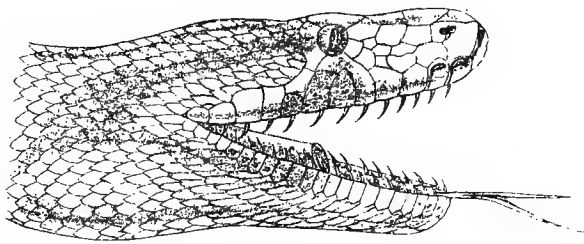

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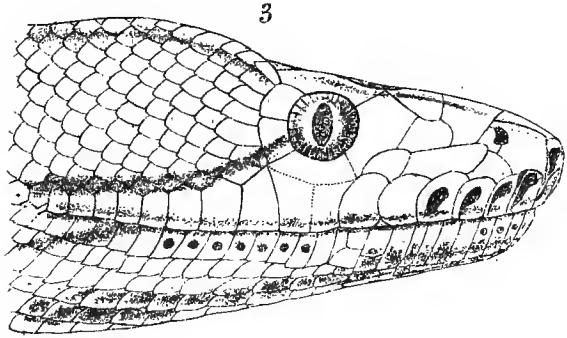

Fig. 1. *Python molurus*, one-sixteenth of life-size.
Fig. 2. „ „ head of young specimen (5 feet), full-size.
Fig. 3. *P. reticulatus*, „ „ full-size.

Family IV.—ERYCIDÆ.

Body moderate, rounded; *tail very short;* head with a broad snout. Eye small with vertical pupil. *Head scaled.* Scales small in numerous rows. Ventrals narrow, subcaudals single. Rudimentary hind limbs visible, as in the Python, but only in the male.

GONGYLOPHIS, *Wagler.*

Head flat, oblong, scarcely distinct. Scales keeled. Chin scaled, *without mental groove.*

G. conicus, *Schneider. The Red Sand-Snake.* Plate IX, fig. 3.

Scales 41-53. Ventrals 168-186, subc. 17-23. Small labials, 15, a rostral and two small frontals are the only head-shields; the orbit is surrounded by scales. Grey with an irregular vertebral chain formed by dorsal coalescing rows of reddish brown blotches; belly white. Grows to 3 feet, of which the tail 1¾ inches.

Common in Southern India.

CURSORIA, *Gray.*

Similar to the preceding genus, but with smooth scales.

C. elegans, *Gray.*

Scales 36. A solitary museum specimen.

ERYX, *D. and B.*

Head hardly distinct, snout obtusely conical, with a sharp transverse edge. Scales keeled, but much less than in *Gongylophis.* A *mental groove.*

E. johnii, *Russell. The Black Sand-Snake.* Plate IX, fig. 4.

Scales 50-65. Ventrals 189-209, subc. 19-36. Similar to *Gongylophis* but the scales are much smoother and the tail more cylindrical. Dark olive above and below with numerous black blotches or unsymmetrical cross-bars.

It is by mutilating the stumpy tail of this snake that exhibtors of double-headed snakes manufacture their specimens. Grows to four feet, of which tail one-twelfth. Much less common than *Gongylophis*.

Family V.—ACROCHORDIDÆ.

Body moderate, rounded, or slightly compressed; tail short; head small, not distinct. Eye small. Nostrils superior. Head scaled. Scales small wart-like, tubercular, or spiny. No ventrals.

ACROCHORDUS, *Hornstedt.*

Tail slightly compressed, without any fold of skin below. Each scale with a triangular keel, ending in a spine.

A. JAVANICUS, *Hornstedt.*

Nasals simple, contiguous. The mouth has a bull-dog arrangement of the lips, there being a central notch above, and a notch below on either side, with corresponding protuberances. Brown with large confluent dark spots. This extraordinary snake grows to 8 feet, is quite terrestial (and even frugivorous) though of pelagic appearance and viviparous.

Java, Straits.

CHERSYDRUS, *Cuvier.*

Tail compressed, and expanded by a fold of skin running along the lower side. Each scale with a short tubercular keel.

C. GRANULATUS, *Schneider.*

Scales above a hundred. Only the ventral scales are spiny; otherwise like *Acrochordus*. Dark grey above, yellowish below, each colour sending out short alternate cross-bands. Aquatic.

Rivers and coasts of Burma and the Straits.

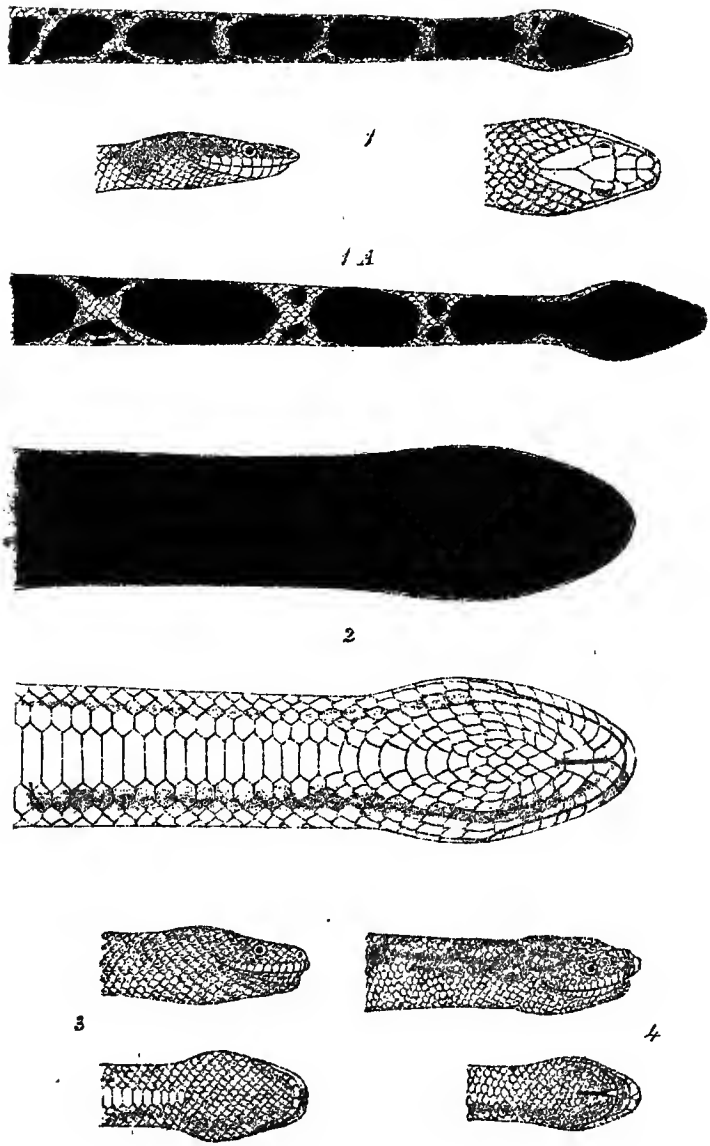

Fig. 1, 1A. *Lycodon aulicus.*
Fig. 2. *Xenopeltis unicolor.*
Fig. 3. *Gongylophis conicus,* half natural size.
Fig. 4. *Eryx johnii,* do. do.

Family VI.—UROPELTIDÆ.

Body cylindrical, with a short narrow head not distinct from the neck; tail very short, truncated, terminating in a rough naked disk or covered with keeled scales.

Scales round, polished; ventral row scarcely larger than the others.

One pair of frontals; four labials. Eye very small. Maxillary and mandibular teeth, no palatine; generally no mental groove.

RHINOPHIS, *Hemprich.*

Tail cylindrical, covered with smooth scales and ending in a convex, scaleless, rough shield. Head conical; supraciliary and postocular confluent; *nasals separated by the rostral.* Scales 17-19. Ventrals 150-228; subcaudals 4-10. Length 10-14 inches.

Ceylon.

R. OXYRHYNCHUS, *Schneider.*

Rostral nearly half as long as head, keeled above. Nearly uniform brown.

R. PUNCTATUS, *Müller.*

Similar to the preceding. Yellowish with black scale-dots.

R. PHILIPPINUS, *Cuvier*, (PLANICEPS, *Peters.*)

Rostral shield not half as long as head, and without keel. Short. Uniform blackish olive.

R. TREVELYANUS, *Kelaart.*

Similar to the preceding. Black, with white triangular lateral spots; belly white, black spotted.

R. SANGUINEUS, *Beddome.* Plate VII, fig. 3.

Similar to the preceding; rostral shorter. Black above; belly with lateral scarlet streak; caudal shield black with yellow streak and red margin.

R. BLYTHII, *Kelaart.*

Caudal shield small, not half size of head, sometimes keeled.

Common in Ceylon.

R. PULNEYENSIS, *Beddome.*

Snout obtuse; caudal shield very small. Brown with yellow lateral band and spots.

UROPELTIS, *Cuvier.*

Head conical; nasals contiguous; supraciliary and post-ocular confluent. *Tail cylindrical, obliquely truncated as if severed by a knife;* the disk flat, rough, scaleless.

U. GRANDIS, *Kelaart.*

Scales 23-21. Ventrals 138-148, subc. 7-8 bifid. Length 20 inches. Brown with occasional white or yellow spots.

Ceylon.

SILYBURA, *Gray, Peters.*

Head conical; nasals contiguous; supraciliary and post-ocular confluent. *Tail subcylindrical, the scales on its upper side are shield-like and keeled,* forming a flattish disk ending in a horny bi-spinous scale. Length 6-14 inches.

Hills of South of India.

S. MACROLEPIS, *Peters.*

Scales 15. Ventrals 137. Black, with an irregular lateral yellowish stripe.

S. BEDDOMII, *Gthr.*

Scales 17. Ventrals 178. Rostral longer than the vertical, slightly keeled. Brown, lateral and ventral white dots; short yellow lateral stripe; vent and tip yellow.

S. OCELLATA, *Beddome.* Plate VII, fig. 4.

Scales 17. Ventrals 200. Rostral shorter than the vertical. Olive or brown, with numerous transverse series of four yellow, black-edged ocelli.

S. ELLIOTI, *Gray.*

Scales 17. Ventrals 143-168. Rostral shorter than the vertical. Brown, short yellow lateral streak, yellow caudal ring.

S. BICATENATA, *Gthr.*

Scales 17. Ventrals 135. Rostral very short, vertical, rhombic. Black above and below, with yellow dorsal scale dots, and yellow lateral stripe.

S. SHORTII, *Beddome.*

Scales 17. Ventrals 139, twice as broad as other scales. Fourth labial longer than high. Black with irregular white scales; yellow lateral stripe and caudal ring.

S. BREVIS, *Gthr.*

Scales 17. Ventrals 122. Body short. Brown, yellowish below, subcaudals black with white lateral line.

S. CANARICA, *Beddome.*

Scales 15. Ventrals 154. Caudal disk laterally compressed as in *Plectrurus* and, as in it also, ending in two spines one above the other. Variable colour; brownish with yellow anterior markings, yellow below.

Hills of South Canara.

PLECTRURUS, *D. and B.*

Head conical; nasals contiguous; *supraciliary and post-ocular distinct.* Posterior part of tail compressed, covered with keeled scales and *ending in a horny scale with two points one above the other.*

P. PERROTETII, *D. and B.* Plate VII, fig. 5.

Scales 15, sometimes irregular. Ventrals 147-161, subc. 10-12. Uniform brown. Length 10-12 inches.

Nilgiris.

P. GUNTHERI, *Beddome.*

Similar. Purple, yellow below; with lateral yellow triangular markings.

Nilgiris.

MELANOPHIDIUM, *Günther.*

Snout rather obtuse; nasals contiguous; supraciliary and postocular confluent. A mental groove. Tail slightly, compressed, ending in a very small, smooth, horny point slightly turned upwards.

M. WYNADENSE, *Beddome.*

Scales 15 or 17. Ventrals 180, thrice as broad as the other scales. Black, belly black and white behind.

M. BILINEATUM, *Beddome.*

Scales 15. Beautifully iridescent, with yellow lateral streak the whole length. Length 8 inches.

Peria peak, Wynâd.

M. PUNCTATUM, *Beddome.*

Scales 15. Ventrals 186-191, subc. 15-17. Iridescent, three lateral black lines; belly whitish. Length 18 inches.

Travancore.

FAMILY VII.—XENOPELTIDÆ.

Body cylindrical and stout; tail short, tapering; head depressed, not distinct from the neck, rounded. Scales large and polished. Ventrals narrow, the outer row of scales enlarged to nearly half their size. Head-shields of scale-like appearance. Eye small. Teeth small and very numerous.

XENOPELTIS, *Reinwardt.*

Head-shields simulating scales; preocular large; no loreal. Scales 15. Anal and subcaudals bifid.

X. UNICOLOR, *Reinw. The iridescent Earth-Snake.* Plate IX, fig. 2.

Ventrals 180, subc. 20-30. Behind the triangular vertical are other similarly shaped large scales. Colour brown, with remarkable iridescent effects; below white or yellowish. Grows to upwards of 3 feet, tail one-twelfth.

Common in Burma and the Straits, where it replaces the larger *Calamaridæ* and the *Erycidæ*.

FAMILY VIII.—CALAMARIDÆ.

Body more or less cylindrical; head short, not distinct from the neck; tail short, tapering. Scales 13-17 rows. Ventral shields well developed, generally less than 200, anal generally entire; subcaudals single or double. Eye small with round pupil. Normal number of head-shields always reduced by absence or confluence of one or more, generally the anterior frontals or loreal. Mental groove. Palatine teeth present. Length 12-24 inches.

CALAMARIA, *Boie.*

Nostril in a single nasal. Loreal none, merged in the frontal; 1 preocular, 1 postocular. *Only one pair of frontals,* 4 or 5 labials. Scales 13, smooth. Subcaudals double.

C. SIAMENSIS, *Gthr.*

Ventrals 179-190, subc. 12-20. Labials 4. Brown, with 7-11 black lines; black collar with white or yellow edges; belly white, brown-spotted.

Burma, Siam.

C. QUADRIMACULATA, *D. and B.*

Ventrals 136-145, subc. 13. Labials 4. Similar to preceding; 2 pairs of white caudal spots.

Java, Burma.

C. ALBIVENTER, *Gray.*

Ventrals 160-166, subc. 16. Labials 5. First pair lower labials not in contact as usual. Brown, with white (red ?) stripes and belly.

Penang.

C. NIGRO-ALBA, *Gthr.*

Ventrals 147-166, subc. 25-30. Labials 5. Upper parts black, belly white.

Penang.

C. LEUCOCEPHALA, *D. and B.*

Ventrals 136, subc. 37. Similar, but head white.

C. CATENATA, *Blyth.*

MACROCALAMUS, *Günther.*

Nostril between the nasal and the first labial. Loreal none, merged in the frontal; 1 preocular, 1 postocular; *only one pair of frontals;* 8 *labials.* Scales 13, smooth. Anal entire, subcaudals double.

M. LATERALIS, *Gthr.*

Ventrals 118, subc. 20. Brown; lateral, dark, white-dotted line.

A solitary museum specimen.

OXYCALAMUS, *Günther.*

Head narrow, pointed. Two pairs of frontals; loreal merged in postfrontal; 1 preocular, 1 postocular; 5 labials. Scales 15, smooth; subcaudals double.

O. LONGICEPS, *Cantor.*

Ventrals 131, subc. 26. Uniform brownish black.

Penang. A solitary museum specimen.

GEOPHIS, *Wagler.*

Two pairs of frontals, nostril between two nasals; 1 or 2 postoculars; *preocular and loreal confluent.* Scales 13-17, smooth, anal entire, subcaudals double.

G. MICROCEPHALUS, *Gthr.* (*Platypteryx perrotetii ? D. and B.*)
Plate VII, fig. 6.

Scales 13. Ventrals 144-148, subc. 16-30. Dark brown; lower scales and ventrals white-edged; yellow buccal streak; brown below. Grows to 2 feet, tail one-twentieth.

Madras (?) Nilgiris.

ASPIDURA, *Wagler.*

One anterior frontal; loreal merged in the frontal; 2 postocular, 1 preocular (sometimes merged in the frontal,) 5 or 6 labials, two small nasals. Scales 15-17, smooth, those near the vent sometimes keeled; anal and *subcaudals entire.* Length 14-16 inches.

Ceylon.

A. BRACHYORRHOS, *Boie.*

Scales 17. Ventrals 148-154, subc. 30. Preocular distinct. Yellow olive with two dark lateral stripes; vertebral series of white dots. Belly white.

A. COPII, *Gthr.*

Scales 17. Ventrals 128, subc. 34. Preocular merged in postfrontal; 3 pairs of gular shields. Brown with dorsal row of black spots; belly white, marbled.

A solitary museum specimen.

A. TRACHYPROCTA, *Cope.*

Scales 15. Ventrals 128-144, subc. 10-23. Preocular very small; postfrontal enters the orbit. Brown with a vertebral and two dorsal rows of dark spots.

HAPLOCERCUS, *Günther.*

One anterior frontal; loreal merged in the frontal; 2 postoculars, 1 preocular; 7 labials; two very small nasals. Scales 17, keeled; anal and subcaudals entire.

H. CEYLONENSIS, *Gthr.*

Ventrals 208, subc. 45. Brown with vertebral narrow

black stripe, and dorsal row of black spots; white black-edged neck-streak; belly yellowish.

Ceylon.

NEW CALAMARIDÆ.

Mr. Theobald has made two new genera of Calamaridæ for two aberrant specimens, a third new genus for an aberrant *Ablabes* and he restores Günther's abandoned genus *Trachischium* for *Ablabes fuscus*.

Falconeria gen. nov. (*Theobald*).

Scales 17, keeled. One anterior frontal; postfrontal enters the orbit; labials 5. Anal and subcaudals double. Loreal present. *F. bengalensis.*

Blythia gen. nov. (*Theobald*).

Scales 13, smooth. Two pairs of frontals. Loreal and preocular none, both merged in postfrontal. Anal and subcaudals bifid.

B. reticulata, formerly *Calamaria reticulata,* Blyth.

Grotea gen. nov. (*Theobald*).

Proposed for *Ablabes bicolor.*

Family IX.—HOMALOPSIDÆ.

Body cylindrical; head thick, not very distinct from the neck; tail moderate, compressed at the root. Scales often strongly keeled; ventrals rather narrow, anal bifid. Eye small, prominent. Nostril superior, small, valvulated; nasals large, encroaching on the size of the anterior frontals (which are often confluent). Head-shields generally tend to deviate from the normal arrangement. The last tooth is transitional between an ordinary tooth and a fang, but there is no evidence that the saliva is poisonous. They live in rivers and estuaries, rarely coming to land.

FORDONIA, *Gray.*

Head shielded, nostril superior in a single nasal. Anterior frontal single, small, in contact with rostral. *Five labials. Scales smooth*, 25-29.

F. UNICOLOR, *Gray.* Plate X, fig. 2.

Scales 25-27. Ventrals 140-156, subc. 26-37. Labials 5 (3). No loreal (in my specimen). Brown; belly and outer scales whitish.

Straits, Burma.

F. BICOLOR, *Theobald.*

Labials 5 (5). Yellowish grey, dark spotted; sides and belly white.

Rangoon.

CANTORIA, *Girard.*

Head shielded; anterior frontal single, in contact with rostral. Eye very small. *Orbital circle complete. Five labials. Scales* 19, *smooth.*

C. ELONGATA, *Gthr.*

Ventrals 278, subc. 84. Reddish violet, with cross-bands of white dots; whitish below.

Straits.

C. DAYANA, *Stolicska.*

Ventrals 286, subc. 56. Anterior frontal almost linear. Vertical large six-sided; 2 postoculars the lowest also subocular; Dull yellow with broad blue-black cross-bands, yellow anterior fillet; yellow below.

Amherst.

CERBERUS, *Cuvier.*

Occiput scaly. Anterior frontals two, small; nasals two, large, contiguous; *orbital circle complete;* posterior labials divided transversely. Cleft of the mouth turned up behind. Scales strongly keeled, 21-25.

C. RHYNCHOPS, *Schneider*. Plate X, fig. 1.

Scales 23-25. Ventrals 132-148, subc. 54-62. Vertical broken up; labials 9-10. Dark ash, with darker cross-bands posteriorly; under-parts whitish with marbled ash cross-bands.

Common in East Indian estuaries. It often goes some distance from the water; I have a specimen which was brought half-alive to me, having been just caught in a compound nearly two miles from the Rangoon river.

HYPSIRHINA, *Wagler*.

Head shielded; *a single anterior frontal*, nasals half-divided, large, *contiguous*. Seven or eight labials. Scales smooth, 19-23.

H. PLUMBEA, *Boie*.

Short and thick. Scales 19. Ventrals 120-131, subc. 29-44. Greyish olive, often with vertebral row of black spots; outer scales and belly yellowish, with black median subcaudal line.

Straits, China.

H. ENHYDRIS, *Schneider*, Plate X, fig. 3.

Of very variable form, the male said to be slender, the female stout with ogival snout. My specimen has a sharp triangular head, slender and very elongate neck; posterior part very stout, tail very thin. Scales 21. Ventrals 159-166, subc. 54-69. Colour variable, that of my specimen is as follows:—Plumbeous, with posterior dorsal light line; lower parts and outer scales whitish, with salmon-coloured stripe along the second row of scales, dark stripe along median and lateral line of ventrals.

Rivers and irrigated fields in Burma and Siam.

H. JAGORII, *Peters*.

Scales 21. Ventrals 128, subc. 66. Brownish grey above,

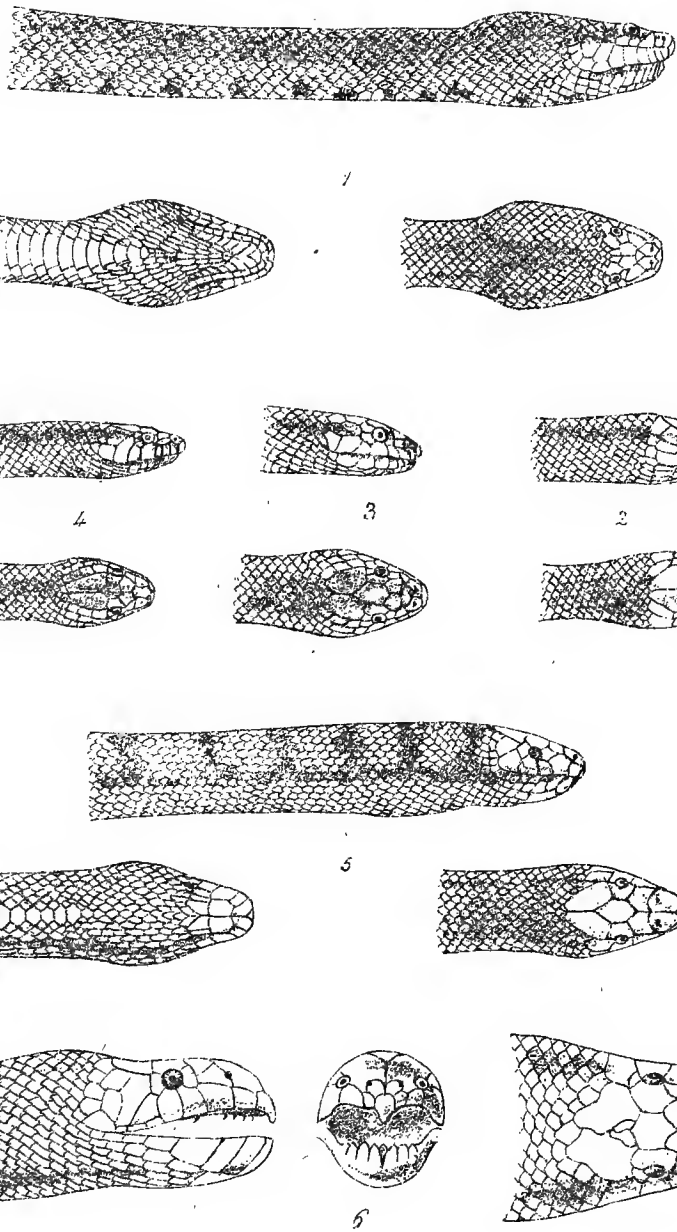

Fig. 1. *Cerberus rhyncops.*
Fig. 2. *Fordonia unicolor.*
Fig. 3. *Hypsirhina enhydris.*
Fig. 4. *Gerarda bicolor.*
Fig. 5. *Hydrophis cyanocincta.*
Fig. 6. *Enhydrina bengalensis.*

belly and four outer rows of scales blackish with a yellow lateral stripe and white median ventral stripe.

Siam. A solitary specimen.

H. BENNETTII, *Gray.*

Scales 21. Ventrals 160, subc. 50. Anterior frontal small, does not touch the loreal. Brownish grey with transverse series of black spots; belly and three outer scales white; each ventral with median and lateral black spots.

China.

H. CHINENSIS, *Gray.*

Scales 23. Ventrals 150, subc. 45. Anterior frontal as large as a posterior frontal. Blackish ash with small black spots; belly and outer scales whitish, with black lateral band.

FERANIA, *Gray.*

Head short, body stout, head shielded. Nasals large, single, contiguous. *Two small anterior frontals. Scales smooth*, 27.

F. SIEBOLDII, *Schlegel.*

Ventrals 147-156, subc. 48-55. White with about 32 (vertebral) large, brown, black edged spots; small dorsal triangular spots in the intervals. Head brown with two diverging white lines.

Bengal, Straits.

HOMALOPSIS, *Gray.*

Head flat, triangular; body stout. Head shielded; anterior frontal single; nasals single, contiguous. *Orbital circle complete.* Posterior labials transversely divided. Cleft of mouth turned upwards behind. *Scales* 37-47, *keeled.*

H. BUCCATA, *L.*

Ventrals 160-171, subc. 70-84. Brown with about 30 narrow white cross-bands. Belly and outer scales white; head markings.

Burma, Straits.

HIPISTES, *Gray.*

Head short; neck slender; tail stout, tapering. Head shielded; anterior frontal single, in contact with the rostral; nasals semi-divided. Scales smooth, 39; ventrals narrow, *with sharp lateral keel.*

H. HYDRINUS, *Cantor.*

Ventrals 153-161, subc. 34. Occipitals multiple. Greenish yellow, with about 48 black cross-bars.

Straits. Semi-pelagic.

GERARDA, *Gray.*

G. BICOLOR, *Gray.*

A snake caught at Rangoon is believed by Mr. Theobald to belong to this reputed West Indian genus.

My own specimen I at first thought to be a new Calamaria, though of amphibious appearance, as it was found in a dusty street of Rangoon. Plate X, fig. 4.

Ventrals 156, subc. 18. Scales 17. Anterior frontal single, elongate, convex-ended, concave-sided. Nostrils superior, in a single shield slightly split. Shining lead colour above, white below.

HERPETON, *Lacépède.*

Snout ends in two flexible cylindrical tentacles. Head shielded; two small anterior frontals; nasals single, contiguous. Orbital ring complete. Scales 37, keeled. Ventrals narrow with lateral keel.

H. TENTACULATUM, *Lacépède.*

Ventrals 133-136. Brown with 3 dorsal stripes; the uppermost connected with its fellow by cross-bars; belly yellowish with dark lateral stripes.

Siam.

Family X.—AMBLYCEPHALIDÆ.

Body and tail slender, strongly compressed; head thick large, very distinct. Eye moderate with vertical pupil. Nostril in a single nasal; rostral very high. Head-shields often increased above the normal number. Cleft of the mouth smaller within than without; lower jaw not expansible; chin shields unsymmetrical, no mental groove. Scales generally smooth, 13-15. Maxillary small, with few and small teeth; other teeth strong.

AMBLYCEPHALUS, *Wagler.*

Head short, thick, high, with convex lips. Crown shields have often small shields intercalated; several loreals; a complete orbital ring. Scales 13, smooth, elongate; vertebrals large, hexagonal. Anal and *subcaudals entire.* Teeth few; a long anterior palatine and mandibulary tooth.

A. BOA, *Kuhl.*

Ventrals 152-170, subc. 88-112. Loreals 3, one above the other. Purplish, marbled and dotted with brown; cheeks and lips carnation, with vertical subocular streak. Grows to 3 feet.

Straits. Climbs, and lives on insects.

PAREAS, *Wagler.*

Cleft of mouth very short. Crown shields regular. Scales 15, generally smooth; vertebrals larger. Anal entire, *subcaudals bifid.* Nasal generally simple.

P. CARINATUS, *Reinwardt.*

Ventrals 160-174, subc. 52-74. Resembles *Amblycephalus* in its tumid lips and complete orbital ring. Greyish brown, with reticulated black cross-bands; black post-orbital streak.

Java, Cochin-China.

P. MONTICOLUS, *Cantor.*

Ventrals 194, subc. 87. Loreal none, replaced by a large

preocular; orbital ring of shields incomplete below. Brown, with black nuchal ring and Y shaped cross-bars.

Assam.

P. LÆVIS, *Kuhl.*

Ventrals 150-164, subc. 34-46. Loreal none, replaced by the preocular. Two labials enter the orbit. Brown, marbled with black in irregular cross-bands; belly brown, or white with blackish lateral spots.

Java, Cochin-China, Khasya Hills.

P. MACULARIUS, *Blyth.*

Resembles *P. carinatus* in its complete orbital circle and general appearance. The young and adult differ in colour, and it is said in the disposition and shape of the head-shields. Ochrey brown, with traces of cross-bands. In the young, rich reddish brown with fasciolated cross-markings in white and claret colour; white collar, mottled with claret-red; belly brown, spotted and mottled.

Martaban.

P. MODESTUS, *Theobald.*

A band-like subocular. Posterior frontal enters the orbit. Median scales faintly keeled. Uniform brown, pale yellowish below.

Rangoon.

FAMILY XI.—OLIGODONTIDÆ.

Body subcylindrical, with a short head not distinct from the neck, tail moderate or short. Scales smooth, rounded, 15-21. Ventrals of moderate breadth, rarely above 200, generally much fewer; subcaudals double. Eye moderate, pupil round. Head-shields normal.* Teeth few, increasing; no palatine teeth in Oligodon. Head nearly always with symmetrical > markings; belly often with square symmetrical dark spots on the ventrals.

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* In a few species of *Oligodon* there is no loreal.

OLIGODON, *Boie.*

Nostril between two partly confluent nasals. One preocular, one or two postoculars. Rostral produced backwards. Scales 15-17. Length 10-20 inches. *No palatine teeth.*

O. SUBGRISEUS, *D. and B.* Plate XI, fig. 1.

Scales 15. Ventrals 180-202, subc. 48-54. Labials 7 (3 and 4).* Brown with numerous narrow dark fasciolated cross lines, crossed by a vertebral and dorsal whitish stripe; belly white; head-markings. Grows to 18 inches, tail one-seventh.

South of India, Anamullies; rather common.

O. SPILONOTUS, *Gthr.*

Scales 15. Ventrals 155-162, subc. 50. Labials 7 (3 & 4). Vertebral series of about 17 brown 8-shaped spots, with alternate thin cross lines; belly white; head-markings.

South of India.

O. ELLIOTI, *Gthr.*

Scales 15. Ventrals 156-169, subc. 30-45. Labials 7 (3 and 4). Vertebral series of about 37 large rhombic black spots giving off cross streaks, or of dark fasciolated cross-streaks; belly white; head-markings. Allied to *O. subgriseus.*

South of India.

O. SUBPUNCTATUS, *D. and B.*

8 labials (4, 5 and 6). Grey with vertebral series of round black white-edged spots; belly white with lateral black dots; head-markings.

Western Coast.

O. SPINIPUNCTATUS, *Jan.*

Scales 17. Ventrals 193, subc. 62. Labials 9 (4, 5 and 6). Similar to the preceding, but no ventral dots.

A solitary museum specimen.

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* (3 and 4) means that the 3rd and 4th labials enter the orbit.

O. FASCIATUS, *Gthr.*

Scales 15. Ventrals 180, subc. 40. Labials 7 (3 and 4). Brown; about 27 broad black-edged cross-bands; a narrow vertebral stripe; belly white with small brown spots; head-markings indistinct.

South of India.

O. SUBLINEATUS, *D. and B.*

Scales 15. Ventrals 150, subc. 32. Labials 7 (3 and 4). Brown, with dorsal series of brown white-edged spots; belly with 3 punctulated brown streaks.

Common in Ceylon.

O. AFFINIS, *Gthr.*

Scales 17. Ventrals 134, subc. 25. Loreal none. Labials 7 (3 and 4). Brownish grey, with short thin black cross-bars, belly white with square black (ventral) spots; head-markings with longitudinal streak.

Anamullies.

O. TEMPLETONII, *Gthr.*

Scales 15. Ventrals 135, subc. 31. Labials 7 (3 and 4) 5th and 7th contiguous below. Brown, with light vertebral band, and about 18 dark cross-bands, belly white, square spots.

Ceylon.

O. MODESTUS, *Gthr.*

Scales 15. Ventrals 158, subc. 41. Anal single. Labials 6 (3). Loreal none, one postocular. Brown, with posterior light vertebral stripe; light collar, belly white with square black spots; head-marking obscure.

Ceylon (?) Solitary museum specimen.

O. DORSALIS, *Gray.*

Scales 15. Ventrals 168-173, subc. 40-60. Labials 7 (3 and 4). Brown, punctulated with black; yellow vertebral stripe bordered with black spots; black dorsal line; belly white, with square black spots which often coalesce.

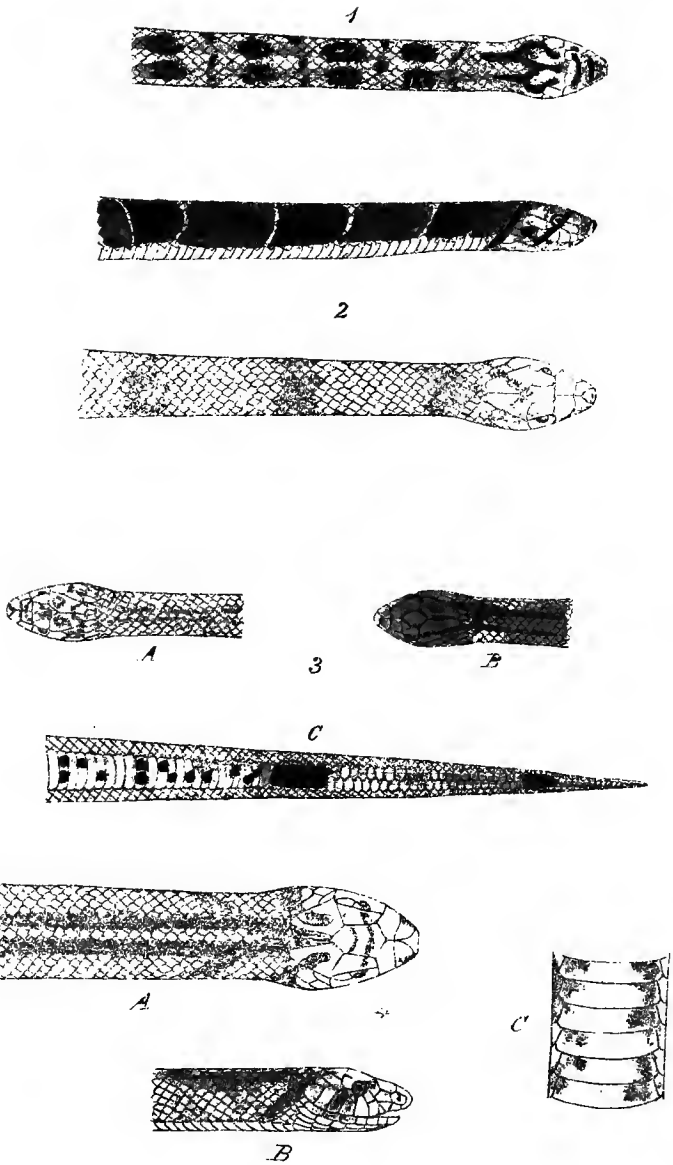

Fig. 1. *Oligodon ellioti*
Fig. 2. *Simotes russellii.*
Fig. 3. *S. cruentatus;* C, under part of the tail.
Fig. 4. *S. bicatenatus* ; C, ventrals.

O. BREVICAUDA, *Gthr.*

Scales 15. Ventrals 172, subc. 30. Only one pair of frontals; rostral reaching far backwards. Labials 7 (3 & 4). Loreal none. Greyish violet; posterior whitish vertebral stripe, bordered with black spots; black lateral stripe. Belly same colour, with square black spots; head-markings distinct.

Anamullies. Solitary museum specimen.

SIMOTES, *D. and B.*

Anterior frontals short, transverse; rostral produced backwards between them; nostril between two nasals. Scales smooth, 17-21 rows. Ventrals often have a slight lateral keel. Head-markings of the family always present. Palatine teeth. Generally 7 labials (3 and 4). Found in India, but more common in Burma, Siam, &c. Generally larger than *Oligodon*.

S. VENUSTUS, *Jerdon.*

Scales 17. Ventrals 142-145, subc. 31-35. Anal bifid. Brown, with 3 rows of round black yellow-edged spots; belly white with square black spots; head-markings.

Western Coast.

S. RUSSELLII, *Daudin.* Plate XI, fig. 2.

Scales 17. Ventrals 160-190, subc. 47-56. Anal bifid. Brown, with 20 to 30 broad black, slightly white-edged, cross-bands; belly white; head-markings very distinct; a black fillet through the eyes; a > rising from the throat, the point on the vertical, the first cross-band forming another > behind it. Grows to 2 feet, tail one-seventh.

India, Ceylon; common.

S. BINOTATUS, *D. and B.*

Scales 17. Ventrals 181, subc. 41. Anal bifid. Rhombic black-edged spots on each side of vertebral line, smaller spots in the intervals; belly white; three angular head-markings.

Western Coast.

S. ALBIVENTER, *Gthr.*

Scales 17. Ventrals 179, subc. 45. Anal bifid. Loreal none. Brown above, white below, subocular spot.

Ceylon.

S. SIGNATUS, *Gthr.*

Scales 17. Ventrals 149-157, subc. 47-59. Anal entire. Brown, with about 15 white cross-bands, the middle of each wide and pointing forwards.

S. CINEREUS, *Gthr.*

Scales 17. Ventrals 165. Anal entire. Labials 8 (4 & 5). Grey above, white below.

Cambodia.

S. SWINHONIS, *Gthr.*

Scales 17. Ventrals 158-168, subc. 35-39. Anal entire. Reddish olive with indistinct dark reticulated cross-bands white below.

China.

S. TÆNIATUS, *Gthr.*

Scales 17. Ventrals 150-166, subc. 30-44. Anal entire. Brownish olive, brown vertebral stripe inclosing a light median line; black spot on root of tail, another on tip; belly white with square black spots.

Siam.

S. CRUENTATUS, *Theobald.* Plate XI, fig. 3. *The Coral-tail Snake.*

Scales 17. Ventrals about 163, subc. 36. Anal entire or bifid. Olive brown; dark vertebral stripe, sometimes enclosing a lighter stripe; lateral thin stripe; belly greenish yellow with square blue-black spots; subcaudals coral-red with black spot at the root and near the tip. Punctulated head-markings, often not unlike a mask. In the young, there are the superior tail-marks of the preceding species.

Common in Burma.

S. TRILINEATUS, *D. and B.*

Scales 17. Ventrals 145, subc. 54. Anal entire. Brown, with a vertebral yellow stripe and a dorsal white stripe.

S. PUNCTULATUS, *Gray.*

Scales 19. Ventrals 180-202, subc. 52-62. Anal entire. Brown, with about 20 light, black-edged cross-bands or pairs of spots; belly with square spots. Head whitish, with the usual head-markings. Grows to upwards of two feet in length.

Himalayas.

S. BICATENATUS, *Gthr.* Plate XI, fig. 4.

Scales 19. Ventrals 161-180, subc. 36-47. Anal entire, slight ventral keel. Labials 6, 7, or 8. Of stout habit. Light reddish brown, with three darker stripes; the vertebral stripe encloses a light median line and extends on the vertical, separating two oblique head-markings that converge from the dorsal stripes. Fillet across the eyes. Belly white or fawn with alternate square spots. Grows to $2\frac{1}{2}$ feet.

Common in Burma.

S. ALBOCINCTUS, *Cantor.*

Scales 19. Ventrals 175-181, subc. 47-65. Anal entire. Brown, with about 18 white, dark-edged cross-bands, narrow black cross-bands alternating; belly white or spotted; usual head-markings.

Assam.

S. FASCIOLATUS, *Gthr.*

Scales 21. Ventrals 163, subc. 42. Anal entire. Yellowish, with black irregular cross-bands; light dorsal stripe, median white line on tail; belly white; usual head-markings.

Cochin-China.

S. COCHINCHINENSIS, *Gthr.*

Scales 21. Ventrals 216, subc. 47. Anal entire. Grey, with about 12 black cross-bands; belly white; head-marking black.

S. TRINOTATUS, *D. and B.*

Scales 21. Ventrals 183-189, subc. 49-51. Anal entire. Brown, with three series of dark, black-edged spots; belly yellow with square black spots; head-markings indistinct.

Straits.

S. AMABILIS, *Gthr.*

S. THEOBALDI, *Gthr.* are also recorded. Ann. and Mag. Nat. Hist., 1868.

Mr. Theobald has made species *S. obscurus* and *S. crassus* of two solitary museum specimens, but they appear to be aberrant varieties of *S. bicatenatus.* (J. A. S., 1868.) Indeed, nearly all the species of this genus may be referred to two types, *S. bicatenatus* and *S. russellii.*

FAMILY XII.—LYCODONTIDÆ.

Body moderate or slender, head distinct, moderate, with depressed and elongate snout. Eye small, generally with vertical pupil. Head-shields regular. A large fang (harmless) in front, both in the upper and lower jaws.

These snakes are a degraded family of *Colubridæ.*

LYCODON, *D. and B.*

Body rather flattened, head distinct, depressed, with flat spatulate snout. Scales 17, smooth. Pupil erect.

L. AULICUS, *L. The Lycodon.* Plate XI, fig. 1 and 1*a.*

Ventrals 183-209, subc. 57-77. Anal bifid. Antocular reaches the vertical.

Eye small and beady; so black that it is nearly impossible to distinguish the pupil. Colour chocolate brown with numerous white or yellowish cross-bands decussating laterally; the first forms a broad collar; belly very transparent white with interstitial flesh colour. Length 1-2 feet.

A common snake both in India and in Burma; it is often found climbing the angle of the jamb of a door, or about dark places in godowns. It is of uncanny appearance, but is perfectly harmless.

The coloration is variable in shade, sometimes approaching that of a light coloured *Bungarus arcuatus;* but the decussation of the cross-bars and the beady appearance of the eyes distinguishes it at once. In old specimens the cross-bars sometimes disappear.

L. LAOENSIS, *Gthr.*

Ventrals 185, subc. 68. Snout shorter and posterior frontals much shorter than in the preceding. Black with white cross-bands.

Siam.

L. STRIATUS, *Shaw.*

Ventrals 167-174, subc. 46-48. Preocular does not reach the vertical; posterior frontal short; otherwise much like *L. aulicus.*

South of India, Anamullays.

L. ANAMALLENSIS, *Gthr.*

Ventrals 202, subc. 74. Anal entire. Two loreals. Greyish brown with white brown-edged cross-bars.

A solitary specimen.

L. RUFOZONATUS, *Cantor.*

Ventrals 200, subc. 72. Loreal enters the orbit. Anal entire. Crimson, dotted and cross-banded with brown; head-shields marked with yellow; brown post orbital streak. Stout, above 3 feet.

China.

TETRAGONOSOMA, *Günther.*

Head-shields regular; *loreal none.* Scales smooth, 17. Ventrals above 200, angulated. Anal entire.

T. EFFRENE, *Cantor.*

Ventrals 215-228, subc. 72-101. Black above and below, with complete buff rings, and buff labial streak.

Solitary museum specimen from Penang.

T. ATROPURPUREUM, *Cantor.*

Ventrals 257, subc. 91. Purple, marbled with black and white.

Solitary museum specimen from Tenasserim.

LEPTORHYTAON, *Günther.*

Loreal present; *nasal single,* pierced by the nostril. Scales 17, smooth. Anal bifid.

L. JARA, *Shaw.*

Ventrals 167-175, subc. 56-63. Brown, each scale with two white dots; generally a white collar; belly white.

Assam, Ganjam, Anamullays.

OPHITES, *Wagler.*

Loreal present; preocular sometimes absent. Scales 17, *keeled.* Anal bifid.

O. SUBCINCTUS, *Boie.*

Ventrals 198-221, subc. 69-82. Loreal enters the orbit, re-placing the preocular. Black, with whitish cross-bands and collar.

Straits.

O. ALBOFUSCUS, *D. and B.*

Ventrals 256, subc. 204 (tail $\frac{1}{3}$). Preocular present. Light reddish, with broad brown cross-bands; reddish white collar.

Straits.

CERCASPIS, *Wagler.*

Scales 19, strongly keeled. Ventrals angulated; *subcaudals entire.*

C. CARINATA, *Kuhl.*

Ventrals 188-193, subc. 53-60. Black, completely encircled by white rings.

Ceylon.

C. TRAVANCORICA, *Beddome.*

Like *Lycodon striatus*, but with entire subcaudals.

FAMILY XIII.—COLUBRIDÆ.

This family is a general refuge for snakes with none of the characters necessary for their allotment to the other families. Their head-shields are normal, they have not the exceptional dentition and head-markings of the Oligodontidæ, they have no trace of fangs, they have not the compressed and slender body of the tree-snakes, nor the hydrophidian build of the true fresh-water snakes. Nevertheless, several genera lead off to other families. Some of the group Coronellina (grovelling colubers) are hardly removed from the Calamaridæ, the group Dryadina (bush colubers) lead off to the tree-snakes, and the group Natricina (water colubers) are a transition towards the Homalopsidæ. The other group, Colubrina, although ground-snakes, are exceedingly agile, and able to swim and climb with facility; they are the highest type of the Sub-order of harmless snakes. Eye moderate or large, pupil round.

Group I.—CORONELLINA.

Colubrine snakes of small size with smooth scales; some genera approach the Calamaridæ in imperfection of the head-shields.

ABLABES, *D. and B., Gthr.*

Body rather slender; head moderate, more or less distinct from the neck; tail moderate. Head-shields normal except in *A. fuscus* and *bicolor*. Nostril between 2 nasals; 1 loreal;

1 or 2 preoculars, 2 postoculars. Scales 13-17 smooth, ventrals 122 to 245, anal and subcaudals double. Teeth normal, numerous, small, equal. Length 12-24 inches.

A. BALIODIRUS, *Boie.*

Scales 13. Ventrals 122-132, subc. 65-72, labials 7 (3 & 4). Brown, with anterior dorsal series of black, white ocellated spots; belly pearl colour.

Straits.

A. TENUICEPS, *Blyth.*

Scales 13. Ventrals 137, subc. 39. Labials 6 (3 and 4). Scales about the vent and root of the tail are keeled. Blackish ash, belly white.

Himalayas.

A. FUSCUS, *Blyth.*

Scales 13. Ventrals 154-161, subc. 34-42. Labials 6 (3 and 4). Scales about the vent and root of the tail are keeled in the male. Posterior frontals united into one shield, (whence Günther at first allotted this to a new genus of Calamaridæ, under the name of *Trachischium fuscum*). Black above, whitish below.

Himalayas.

A. RAPPII, *Gthr.*

Scales 15. Ventrals 191-198, subc. 60. Labials 6 (3 & 4). Black above, white below; when young, grey with black bars and collar.

Himalayas.

A. BICOLOR, *Blyth.*

Scales 17. Ventrals 210-221, subc. 75-80. Labials 6 (3). Frontals united into two transverse plates (whence Mr. Theobald makes this a genus of Calamaridæ and has named it *Grotea bicolor*). Brown above, white below.

Assam.

A. OLIVACEUS, *Beddome.*

Scales 17. Ventrals 224, subc. 75. Labials 5 (3). Dark greenish olive, paler below; four dorsal series of small black dots.

Nilgiris.

A. SAGITTARIUS, *Cantor.*

Scales 17. Ventrals 216-245, subc. 57-70. Labials 7 (3 and 4). Reddish or greyish olive; blackish dorsal line, beneath which the colour darkens; vertebral series of dots; head brown; dark collar edged with yellow; belly yellowish, with a blue lateral line and ventral dots.

Penang, Bengal.

A. HUMBERTI, *Jan.*

Scales 17. Ventrals 175, subc. 55. Labials 10 (4, 5 & 6) 7th and 9th contiguous below. Reddish olive; punctulated dorsal line, beneath which the colour darkens; vertebral series of black yellow-edged dots; black, yellow-edged collar; belly white, dotted.

South of India, Ceylon.

A. COLLARIS, *Gray.*

Scales 17. Ventrals 177, subc. 102. Tail nearly one-third. Labials 10 (4, 5 and 6). Greyish brown, with anterior vertebral series of black dots; broad black collar with posterior yellow edge, produced forwards to the eyes; belly white, dotted.

Himalayas.

A. MELANOCEPHALUS, *Gray.*

Scales 17. Ventrals 152, subc. 65. Labials 10 (4, 5 & 6) 7th and 9th contiguous below. Light brown, with two anterior white stripes commencing from a black collar, and interrupted by square black spots; belly white, spotted; head brown, lips yellow. Tail one-third (?).

A. NICOBARIENSIS, *Stolicska.*

Scales 17. Ventrals 189, subc. 87. Loreal confluent with posterior nasal; labials 7 (3 and 4). Similar to *A. melanocephalus*, but the lateral spots are smaller and more numerous.

Nicobars.

A. SCRIPTUS, *Blyth*, an aberrant specimen of *A. baliodirus.*

The genus Ablabes approaches the Calamaridæ in the tendency of the frontal and cheek shields to fuse. Hence ingenious zoologists can make out of aberrant species, new genera enough to immortalize the names of all their friends. I confess to a wish that the Greek lexicon were not so neglected in the nomenclature of genera; specific names are quite sufficient for any amount of mutual admiration.

CYCLOPHIS, *Günther.*

Body slender, tail moderate or long, head rather distinct from the neck. Head-shields normal, but only one nasal, pierced by the nostril. Scales 15, smooth. Anal bifid. Eye moderate.

C. MAJOR, *Gthr.*

Head narrow, not very distinct. Ventrals 175, subc. 78. Uniform green, paler below.

China.

C. FRÆNATUS, *Gthr.*

Head distinct from the slender neck, broad with short snout. Ventrals 165, subc. 95. Olive with 3 anterior dorsal black stripes, the lateral pair are zigzag; yellowish below.

Afghanistan; Khasi hills.

C. RUBRIVENTER, *Jerdon.*

Ventrals 127-135, subc. 33-38. Nasal split. Two postoculars. Brown with pale lateral band from eye to tip of tail; below this a mottled brown and yellow band; throat yellow, belly red.

C. CALAMARIA, *Gthr.*

Head scarcely distinct, with obtuse snout. Ventrals 129-138, subc. 50-83. Loreal fused in the long single nasal. Frontals broad and short. Labials 7 (3 and 4). Preocular single. Light olive, with a reticulated pattern formed by a black edge to each scale. This reticulation forms two thick dorsal and two thin lateral lines; alternate with these are five white lines (on each side). Belly white. Grows to about 12 inches, tail one-fourth.

Ceylon and South of India.

C. NASALIS, *Gthr.*

Ventrals 149, subc. 77. A variety of the preceding, with the preocular divided in two.

C. MONTICOLA, *Cantor.*

Ventrals 125, subc. 44. Brown with yellow collar.

A solitary museum specimen.

Mr. Theobald makes a genus *Chlorophis* for a Cyclophis with two nasals.

Chlorophis Oldhami. Labials 8 increasing, (4 and 5). Uniform bronze-brown.

ODONTOMUS, *D. and B.*

Body slender, strongly compressed ; head moderate, distinct from the neck. Ventrals above 200, angularly bent at the sides. Scales 13-15 smooth. Head-shields regular; nostrils in a half-divided nasal. Eye moderate.

O. NYMPHA, *Daudin.*

Scales 13, apical groove. Ventrals 234-243, subc. 82-87. Labials 8 (3 and 4). White, with about 38 brown cross-bands.

South of India.

O. SEMIFASCIATUS, *Gthr.*

Scales 13, apical groove. Ventrals 232, subc. 84. Labials 7 (3 and 4). White with about 50 broad dark-brown cross-bands.

O. GRACILIS, *Gthr.*

Scales 15. Ventrals 234, subc. 81. Anal entire. Labials 8 (3 and 4). About 38 broad black cross-bands; intervals white, marbled with brown.

South of India.

NYMPHOPHIDIUM, *Günther.*

Only differing from the preceding genus by the three last teeth being strong and trenchant.

N. MACULATUM, *Gthr.*

Scales 15. Ventrals 244, subc. 107. Anal entire. Loreal long, enters the orbit. Light brown, with a dorsal series of large brown spots; lateral series of dots, belly white.

ELACHISTODON, *Reinhardt.*

A genus distinguished by the possession of gular teeth formed by the projection of the anterior vertebral spines into the gullet. The genus is sometimes grouped with an African genus possessing similar characteristics to form a family of the *Dasypeltidæ*. The necessity of this is somewhat doubtful, considering that the genus Nymphophidium has a commencement of this gular set of teeth in the "two obtusely conical prominences on the base of the skull, one behind the other, not covered by the mucous membrane of the mouth." —(*Günther*).

E. WESTERMANNI, *Reinhardt.*

Scales 15. Ventrals 217, subc. 59. Anal single. Two nasals; loreal long, enters the orbit; 7 labials (3 and 4). Teeth few, small. Brown; yellow vertebral stripe; yellow line from the snout along the crown to the angle of the mouth; yellow sagittal collar; yellow below.

The only known specimen was obtained at Rungpore. It was 31 inches long. Described by Reinhardt.

CORONELLA, *Günther.*

A genus of doubtful occurrence in India. *C. lævis* was discovered in England a few years ago.*

C. ORIENTALIS, *Gthr.*

Scales 17. Ventrals 163, subc. 65. Last maxillary tooth strong. Greyish brown, with 2 dark dorsal stripes, confluent posteriorly; narrow white collar; belly white, black spotted.

Group II.—COLUBRINA.

Snakes of moderate or large size and active habits, with scales in 15 or more rows, and generally more or less keeled. Head-shields generally regular. Eye moderate or large.

COLUBER, *Günther.*

Body rounded, of moderate proportions; tail one-fifth or less. Head-shields regular, crown shields large; 1 preocular. Scales smooth or feebly keeled in 19 or more rows. Anal bifid. Teeth equal. Peculiar head-markings.

C. RUFODORSATUS, *Cantor.*

Scales 21. Ventrals 174-178, subc. 50-52. Anterior frontals pointed. Brownish grey with 4 series of irregular brown spots confluent posteriorly into stripes. Head with 3 black bands.

China.

C. MANDARINUS, *Cantor.*

Scales 23. Ventrals 222, subc. 62. Scarlet, with a series of about 44 dorsal, black, yellow-centred, rhombic spots; head with serpiginous black fillets.

China.

C. PORPHYRACEUS, *Cantor.*

Scales 19. Ventrals 189-211, subc. 56-70. Olive, with

* Increasing the English snakes to three—the viper *Pelias berus*, the ringed snake *Tropidonotus natrix*, and *Coronella lævis*.

about 22 dark cross-bands, and posterior dorsal stripe; head with 3 black streaks, one median, the others postocular.

Assam.

C. PICTUS, *Carlyle*; C. NUTHALLI, *Theobald.*

Scales 23. Vertical and supraciliaries large. Labials 9 (5 and 6). Reddish grey with four anterior dorsal series of rhomboidal black ocellated spots; posteriorly four dorsal dark bands with white intervals. Oval black postocular spot.

The snake obscurely described by Blyth as *Platyceps semifasciatus* is here placed by Mr. Theobald and more fully described:—

C. SEMIFASCIATUS, *Blyth.*

Scales 19. Ventrals 187. Labials 9 (5 and 6). Occipitals very large; vertical with very concave sides. Pale olive grey, with anterior dark cross-bands and alternate dark spots, fading posteriorly. ⊏ mark on occipitals; belly white.

Subathoo.

ELAPHIS, *D. and B.*

Body elongate and compressed, head distinct from neck. Tail moderate. Scales 23-25 keeled. Ventrals 200 or more, plain or slightly keeled; anal bifid. Eye moderate, pupil round. Head-shields regular; 2 nasals; 2 preoculars. Maxillary teeth equal.

Central Asia and China.

E. DIONE, *Pallas.*

Brown or olive, speckled with red; dorsal series of black rings, vertebral and dorsal black stripes; head with brown oblique cross-bands.

E. SAUROMATES, *Pallas.*

Broad black cross-bands with yellow intervals. Head and belly often yellow with black markings.

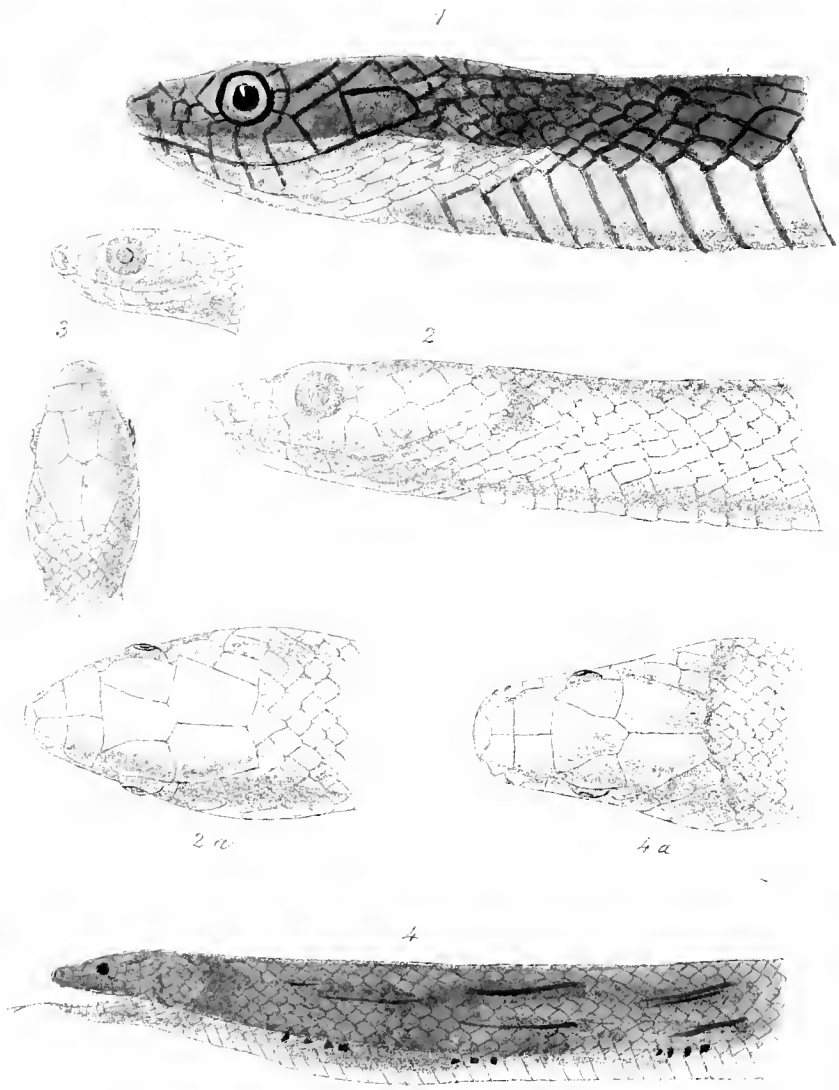

Fig. 1. *Ptyas mucosus.*
Fig. 2. *P. korros.*
Fig. 3. *Zaocys fuscus.*
Fig. 4. *Compsosoma radiatum*, half-size; 4*a* is natural size.

E. TÆNIURUS, *Cope.*

Olive, with black interrupted dorsal stripe and caudal black stripe inferiorly margined with white.

COMPSOSOMA, *D. and B.*

Body elongate, compressed, head narrow, snout long, tail moderate. Eye moderate. Scales 19-23 keeled. Ventrals above 200. Anal generally entire. Head-shields normal; generally 1 preocular; 2 nasals. Teeth numerous, equal. Of large size.

C. RADIATUM, *Reinwardt.* Plate XII, fig. 4. *The red dhāman.*

Scales 19, middle rows strongly keeled. Ventrals 222-248, subc. 67-95. Labials 9 (4, 5 and 6).

Preocular and loreal have a rough porous appearance. Frontals square. Iris golden. Colour bright chestnut, darkening posteriorly; three anterior black dorsal stripes, the upper broad, the middle interrupted, the outer interstitial. From the eye radiate three black streaks, one down, one downwards and backwards, one horizontally along the occipitals joining a broad black nuchal band. This snake puffs out its throat vertically and rises like a cobra, showing the beautiful interstitial pattern of the neck, and looking aslant. Hence known by the Burmese as the side-looking snake (gnān zow). Grows to six feet, tail one-fifth.

Common in Burma.

C. MELANURUM, *Schlegel.*

Scales 19. Labials 9 (4, 5 and 6). Brown anteriorly, black posteriorly; anterior yellow black-edged vertebral stripe; three inferior ocular streaks; belly yellow, black posteriorly.

Java and Archipelago.

C. RETICULARE, *Cantor.*

Scales 21 (or 19) rows. Anal entire. Labials 8 (4, 5 & 6). Brown, behind black; with whitish cross-bands, sometimes

reticulated; belly yellow marbled with black. The head-shields have a tendency to coalesce.

Assam.

C. HODGSONII, *Gthr.*

Scales 23. Anal bifid. Labials 8 (4, 5 and 6). Brownish olive; black interstitially.

Himalayas.

A new species *C. semifasciatum* has been described, but as it was very young (being only 11½ inches long) its position is somewhat doubtful.

Scales 19 with apical grooves. Ventrals 211, subc. 119. Anal bifid. Labials 9 (5 and 6). Olive grey, with numerous short broad transverse bands interrupted laterally, alternate lateral spots, all disappearing at the posterior two-thirds. Head brownish with dark occipital markings. Belly whitish spotted.

Simla.

CYNOPHIS, *Gray.*

Body slender and compressed; head narrow, snout elongate; tail moderate; scales 25-27, with slight keels or apical grooves. Ventrals above 200; anal entire. Eye moderate. Head-shields regular, two nasals, one preocular.

C. HELENA, *Daudin.* Plate XIII, fig. 2.

Scales 27, slightly keeled. Reddish olive, with about 30 anterior reticulated black cross-bands, each enclosing 3 white ocelli on either side; between the cross-bars is a reticulated lavender pattern; the whole principally interstitial, fading posteriorly into a broad lateral brown stripe; neck with 2 black throat stripes; black postocular streak. Grows to upwards of 3 feet, tail one-fifth.

Ceylon, South of India.

C. MALABARICUS, *Jerdon.*

This species differs from the preceding principally in its

smaller size, more pronounced ocellate cross-bars (connected by curved ventral lines) and having only 25 rows of scales. The throat streaks have a white interval, and between the two pairs is a black ⊂ mark.

Malabar and Anamullays.

This beautiful genus is closely allied to *Compsosoma;* it belongs to South India, the later being a Malayan genus.

PTYAS, *Fitzinger.*

Body elongate, somewhat compressed; tail one-fifth to one-third; head distinct from neck. Eye moderate or large, well sheltered by supraciliaries. Head-shields regular; two preoculars, the upper reaching to the crown; two or three loreals, 2 nasals. Scales 15-17, smooth or slightly keeled. Anal bifid. Maxillary teeth about 12, increasing. Of large size.

P. MUCOSUS, *L. The (stout) dhāman.** Plate XII, fig. 1.

Scales 17, the middle rows keeled towards the tail; ventrals 196-208, subc. 108-134. Head rather short and broad; 3 loreals, more rarely two; all shields, especially the 8 labials, with black margins. Brownish or yellowish olive, with interstitial skin-colouring of yellow and black; scales with black tips forming a fasciolation posteriorly and often a reticulated pattern on the tail; belly greenish or yellowish white. It is very common in India, less so in Burma. It is fierce and intractable. My largest specimen was 7½ feet (tail 2 feet) girth 5½ inches; but I have a cast skin, found by Lieutenant Kensington, R. E., at Kolar, which measures 9 feet 1 inch.

When young this snake often has a delicate green colour, unlike the adult.

P. KORROS, *Reinw. The slender dhâman.** Plate XII, fig. 2.

Scales 15, smooth, with apical grooves; ventrals 176-184,

* For Indian synonyms, see Part III.

subc. 138-147. (I have seen subcaudals 57 only). Slender neck, narrow head; eye large; loreals 2, rarely 3; colour uniform brown olive; no black margins to head-shields, slightly to the caudal scales. Grows to 6-7 feet. My largest specimen was 6 feet 9 inches, (tail 2 feet.)

Common in Burma, rare in India.

XENELAPHIS, *Günther.*

Body elongate, not compressed; tail long; head distinct, rather short. Head-shields regular, 2 preoculars. Scales 17, smooth, the vertebrals large, six-sided. Anal bifid. Teeth numerous, sub-equal.

X. HEXAHONOTUS, *Cantor.*

Ventrals 191-197, subc. 148-179. Loreal long, wedged between the preoculars. Labials 8 (4). Brown with anterior faint black cross-bands; belly yellowish.

Burma, Straits.

ZAMENIS, *Wagler.*

Body and tail elongate; head distinct, flat; eye moderate. Head-shields have a tendency to divide, the temporals to be small and scale-like; the gular scales are numerous. There are 2 preoculars, 2 postoculars, suboculars often present. Scales smooth or slightly keeled. Ventrals 200 or more, anal generally bifid. Teeth numerous, the last generally largest, and separated by an interval.

Z. DIADEMA, *Schlegel.*

Scales 29, keeled. Ventrals 237, subc. 110, anal entire. Four small shields transversely intercalated between the vertical and the frontals; 3 or 4 loreals; labials 14; orbital ring completed by 4 or 5 suboculars. Yellowish olive, with vertebral line of round brown spots, and a lateral brown stripe. Brown fillets, and head-spots.

Sindh.

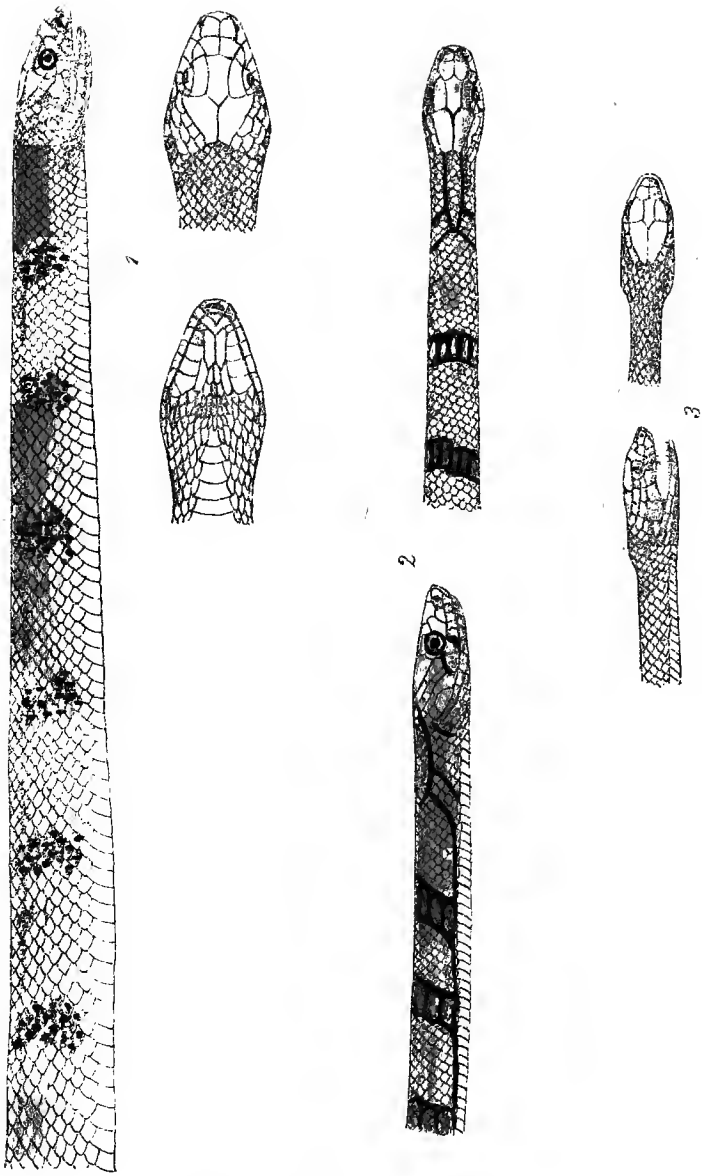

Fig. 1. *Zamenis fasciolatus.*
Fig. 2. *Cynophis helena.*
Fig. 3. *Psammodynastas pulverulentus.*

Z. CLIFFORDII.

Scales 29, smooth. Ventrals 222-236, subc. 74-80. Anal entire. No intercalated crown shields. Quincuncial pattern formed by four rows of elongate spots, the central pair coalescing.

Africa; found in collections from Aden.

Z. VENTRIMACULATUS, *Gray.*

Scales 19, smooth. Ventrals 205-220, subc. 90-102, anal bifid. Labials 9 (5 and 6). Occipitals truncated with small semi-circular post occipitals. Yellowish olive, with black cross-bars, and black head-markings; belly yellowish, laterally dotted.

South-Western Asia, found in collections from Aden.

Z. GRACILIS, *Gthr.*

Scales 21, smooth. Ventrals 219, subc. 120, anal bifid. Labials 9 (5 and 6) the fourth gives off the preocular. Yellowish olive, with vertebral row of large round black spots, becoming short cross-bars posteriorly; black fillets; belly yellow, laterally dotted.

Deccan, Sindh.

Z. FASCIOLATUS, *Shaw.* Plate XIII, fig. 1.

Scales 21-23, apical grooves. Ventrals 201-229, subc. 73-95, anal bifid. Labials 8 (4 and 5). Yellowish reddish or olive brown, with anterior, narrow, white and dark fasciolated cross-bars; belly yellowish.

South of India. Common in Mysore and as far West as Coimbatore. A specimen is recorded from Mergui.

Group III.—DRYADINA.

The compressed body of these snakes, their agility, their numerous ventral shields, and green colour, show that they lead off to the true tree-snakes, whilst their head-shields are those of the *Colubridæ.*

ZAOCYS, *Cope.*

Body elongate and compressed, tail moderate; head very distinct, high. Eye large. *Scales* 14-16, the median series sometimes keeled. Ventrals about 200, anal bifid. Head-shields regular; supraciliaries large, convex; 2 preoculars, the upper large and high. Loreal often multiple.

Z. CARINATUS, *Gthr.*

Scales 16, the 2 median rows keeled; ventrals 209, subc. 110. Labials 9 (5 and 6). Loreals 3. Anteriorly brownish olive, with reticulated white cross-bands; posteriorly black, with 2 lateral series of white spots. Grows to 10 feet.

Borneo.

Z. FUSCUS, *Gthr.* Plate XII, fig. 3.

This snake, hitherto assigned to Borneo, is, according to the opinion of Dr. Günther, the same as a snake found by Mr. Vinton in the jungle near Rangoon, and to which I intended to have given the name of *Z. fasciolatus.* The following is its description :—

Scales 16, the 2 median rows faintly keeled. Ventrals 210, subc. 123. Head oblong, high; gape wide; eye very large and prominent; pupil round, iris dark green. Loreals 3. Labials 9 (5 and 6), the sixth extending high behind the orbit. Dark green, with narrow fasciolated cross-bands of lighter and darker colour, and yellow vertebral spot on each; posteriorly the cross-bands merge into a general greenish black with 2 lateral rows of yellow spots; under-parts nearly black; head dark green, with an appearance of bloom, throat white, yellow orbital circle.

Z. DHUMNADES, *Cantor.*

Scales 14 or 16, the 2 median rows keeled. Ventrals 189-199, subc. 92-98. Loreal single. Greenish anteriorly, with a yellow, black-edged vertebral stripe; posteriorly black; indistinct black lateral stripe.

China.

Z. NIGROMARGINATUS, *Blyth.*

Scales 16, elongate and pointed, the 4 median rows keeled, others with apical grooves. Ventrals 193, subc. 126. Green above, paler below, with 2 posterior broad black stripes.

Himalayas.

HERPETOREAS, *Günther.*

Body slender, compressed; head elongate, rounded in front. Eye moderate. Scales elongate, 17 or 19 ; ventrals bent up at the sides, above 200; anal bifid. One preocular, head-shields regular. Last tooth the longest.

H. SIEBOLDII, *Gthr.*

Scales 19, slightly keeled. Ventrals 216, subc. 90. Loreal single. Labials 8 (3, 4 and 5). Greenish brown, belly yellowish.

Himalayas. A solitary museum specimen.

An ill-described snake called *Coluber prasinus* by Mr. Blyth, perhaps belongs to the above species. There is some reason to consider that the genus is a refuge for aberrant young specimens of *Ptyas mucosus.* I named three such specimens of this snake *Herpetodryas prasinus,* and did not see my mistake for a long time, though its possibility was pointed out to me by Dr. Günther.

Group IV.—NATRICINA.

These snakes lead off to the Homalopsidæ; they are ground-snakes, but many of them frequent the water, and have the nostrils rather superior. Scales always more or less keeled; ventrals considerably less than 200, anal bifid.

TROPIDONOTUS, *Kuhl.*

Body rather stout, head distinct from the neck, gape wide. Eye moderate. Scales generally 17-19, keeled, especially towards the tail. Teeth numerous, increasing.

T. QUINCUNCIATUS, *Schlegel. The Checkered Snake.* Plate XIV, fig. 1

Scales 19, keeled. Ventrals 129-149, with the subcaudals often 137 + 85 or 145 + 77, the total not being far from 222. Tail often much shortened in females. Loreal rhombic; 1 preocular, 3 postoculars, labials 9 (4 & 5); anterior frontals form a triangle. Crown narrow.

Variety a. Olive brown, with black checkers formed by 6 alternating rows of square black spots; belly cream-coloured with lateral black ventral margins; 2 black streaks go backward from the orbit.

Variety b. The outer row of checkers alone distinct; they are high, intervals red; ventrals tinged with red, black nuchal streak; 2 black post-orbital streaks.

Very common throughout the East Indies; variety *b* in its most marked form is peculiar to Burma. An intermediate form is variety *a* with the ground colour bright yellow. Generally speaking, those individuals which live nearly entirely in the water have a tendency to brighter colours. Grows to four feet; my largest specimen (Bangalore) was 51 inches, of which the tail 12 inches.

T. ANNULARIS, *Hallowel.*

Scales 19. Ventrals 158, subc. 54. Upper parts plumbeous; lower parts red with about 40 black cross-bars, extending up the sides.

China.

T. TRIANGULIGERUS, *Reinw.*

Scales 19. Ventrals 140-148, subc. 70-90. Labials 9 (4, 5 & 6). Dark brown, reddish anteriorly, with lateral triangular black spots, apex resting on the ventrals.

Straits.

[The remaining snakes of this genus have the last tooth enlarged and enveloped in a well-marked gingival fold.]

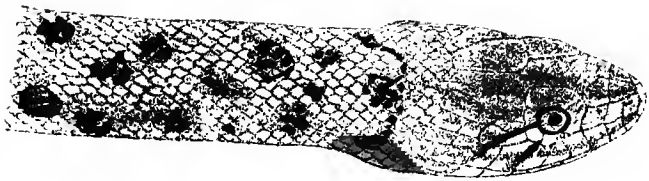

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Fig. 1. *Tropidonotus quincunciatus.*
Fig. 2. *T. punctulatus.*
Fig. 3. *Atretium schistosum.*

T. MACROPHTHALMUS, *Gthr.*

Scalés 19, nmerous on the neck, which is dilatable, like that of the cobra. Ventrals 162, subc. 78. Eye large. Dark brown dark vertebral spots and an indistinct ≻ collar; belly with anterior square spots.

Himalayas.

T. DORSALIS, *Gthr.*

Scales 17. Ventrals 143, subc. 52. Eye large. Resembles the preceding species.

China.

T. MACROPS, *Blyth.*

Scales 17. Ventrals 164, subc. 13. Eye very large. Dull red, with a vertebral series of yellow spots and black lateral spots; variable.

Darjiling.

[The following species have the last tooth enlarged and separated by a distinct interval.]

T. PLATYCEPS, *Blyth.*

Scales 19, feebly keeled. Ventrals 173-186, subc. 90-96. Brown, with a pale dorsal stripe; a red and a black lateral ventral stripe; black or yellow postocular streak; variable.

Himalayas.

T. SUBMINIATUS, *Reinw.* Plate XV, figs. 3 & 4.

Scales 19, keeled. Ventrals 142-168, subc. 61-88. Light brown, with an interstitial colouring of bright red on the neck, of black and yellow on the rest of the body; yellow ≻ collar; head green, cheeks pink, green and black double post-orbital streak, throat yellow. When young it resembles *T. stolatus* with yellow collar.

Burma, Assam, Straits.

T. HIMALAYANUS, *Gthr.*

Scales 19, strongly keeled. Ventrals 171, subc. 85. Brownish olive, with dorsal series of transverse yellow spots; yellow collar and throat.

T. ANGUSTICEPS, *Blyth.*

Scales 17. Ventrals 167-172, subc. 57-67. 2-4 antoculars, 4-5 postoculars. Head narrow. Dark, spotted uniformly with black.

Assam, Burma.

T. STOLATUS, *L. The Chameleon Snake.* Plate XV, fig. 1.

Scales 19, strongly keeled. Ventrals 121-161, subc. 50-79. Labials 8 (3, 4 and 5). Brown with numerous cross-bands of black, the intervals having an interstitial colouring of red, or of pale blue, or of both, the red prevailing in the first four or five intervals. These bars are crossed by a dorsal light brown stripe, the point of intersection of the black bars being still lighter. Belly white with lateral black dots on alternate ventrals; throat yellow; black marks on the labials.

This snake only shows these beautiful colours when excited; at other times it is brown with a light dorsal stripe. Grows to 2½ feet, tail one-fifth. The gentlest of snakes.

Very common in India and Burma.

A variety common in Madras has 121-130 ventrals; and the first one or two bars at such wide intervals as to form sagittal collars. The Burmese variety has about 150 ventrals. The varieties found in Malabar and Burma show the finest play of interstitial colours.

T. MONTICOLA, *Jerdon.*

Scales 19. Ventrals 142, subc. 82. Green, with about 28 black cross-bands, crossed by a green dorsal stripe; white spots at the intersection; white inter-orbital fillet with two white spots in front.

Wynâd.

T. JUNCEUS, *Cantor.*

Scales 19. Ventrals 154, subc. 86. Greyish olive, with

a dorsal row of round white spots; belly white with lateral dots. Throat yellow; ➢ yellow collar.

Straits.

T. CEYLONENSIS, *Gthr.*

Scales 19, strongly keeled. Ventrals 137, subc. 60. Brownish olive, with about 20 unsymmetrical cross-bands, each enclosing a lateral yellow ocellus, black post-orbital streak.

T. BEDDOMII, *Gthr.*

Scales 19, strongly keeled. Ventrals 146, subc. 70. Labials 9 (4, 5 and 6). Brown, with dorsal transverse orange bars; nuchal yellow cross-bar, and yellow black-edged post-orbital streak.

Nilgiris.

T. NIGROCINCTUS, *Blyth.*

Scales 17. Ventrals 160, subc. 81. Olive grey, passing into green near the head, with about 50 narrow black cross-bands and nuchal black band preceded by a pale or red collar; belly grey, darkening posteriorly.

Burma.

T. FLAVIPUNCTATUS, *Hallowel.*

Scales 17. Ventrals 128, subc. 78. Uniform dusky yellow, spotted with yellow above and with black below; black nuchal band, and two black post-orbital streaks.

China.

T. ZEBRINUS, *Blyth.*

Scales 15. Ventrals 137, subc. 96. Plumbeous, spotted and cross-banded with black; labials with triangular black spot at their junction above; nuchal band.

Tenasserim.

T. TIGRINUS, *Boie.*

Scales 19. Ventrals 152-168, subc. 62-80. Olive, with a vertebral and a dorsal row of square black spots, reddish

lateral intervals anteriorly; belly black-spotted; black post-orbital markings.

China.

T. LEUCOMELAS, *Gthr.*

Scales 19, strongly keeled. Ventrals 129, subc. 61. Black above, white below, with about 23 narrow white rings rising across the back; head greenish olive, with black collar, yellow-edged posteriorly.

Straits.

T. PLUMBICOLOR, *Cantor. The green ground-snake.* Plate XV, fig. 2.

Scales 25 (23-27), strongly keeled. Ventrals 150-162, subc. 35-47. The loreal sometimes wedges itself between the preoculars, entering the orbit; and conversely the lower preocular sometimes pushes in between the loreal and the labials. Bright green; a broad yellow black-margined ➢ collar; narrow black cross-bars with alternate black spots and, frequently, alternate white interstitial cross-lines. These beautiful colours are said to fade in the adult (hence *T. plumbicolor, Cantor* instead of *Xenodon viridis* the name given by Duméril and Bibron); but in Bangalore, where the snake is very common I have not observed this change. My largest specimen, 28 inches long (tail 3½ inches) was bright green only the interstitial colours beginning to fade. Belly white.

Southern India, and as far north as Nagpore.

T. PUNCTULATUS, *Gthr.* Plate XIV, fig. 2.

Scales 17, obtusely keeled. Ventrals 140-156, subc. 68-83. Tail compressed at the root. Upper parts either jet black, or (in old specimens) brown irregularly spotted with white; belly and outer 2 rows of scales white, with a zigzag black or brown line along the junction of the ventrals and outer scales; labials white; subcaudals have a black posterior margin. Grows to 30 inches.

Burma.

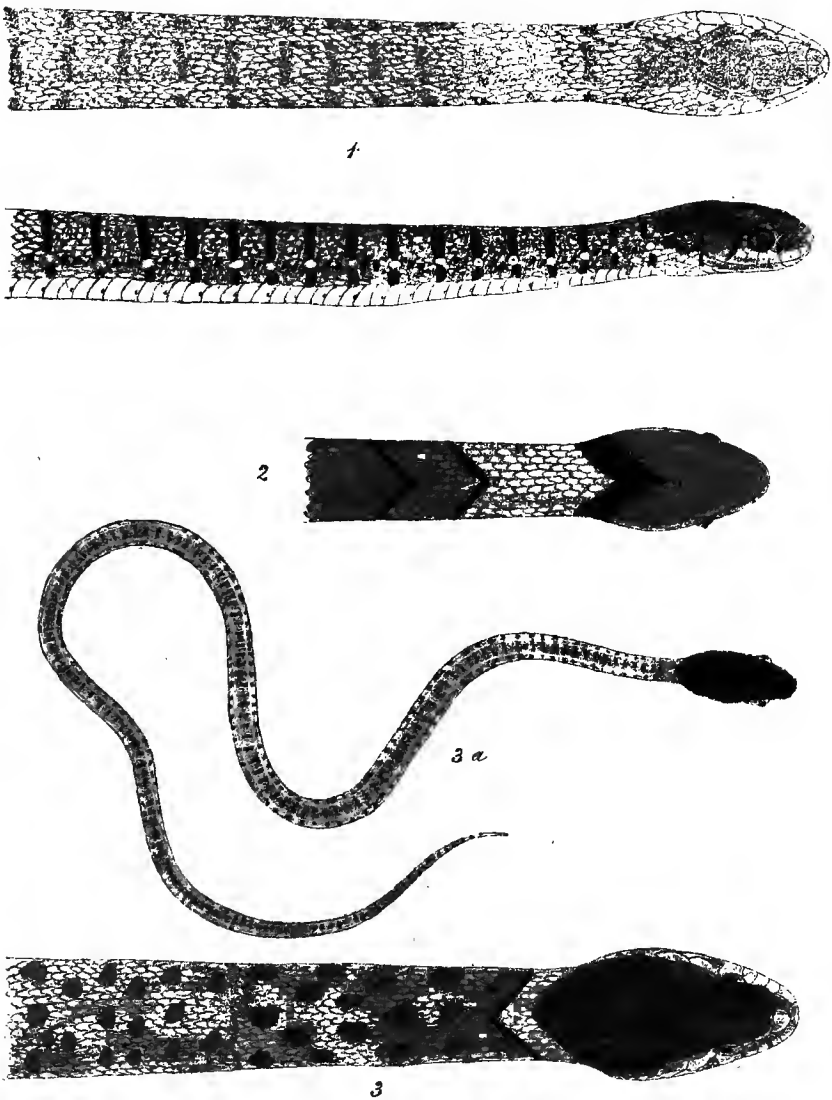

Fig. 1. *Tropidonotus stolatus.*
Fig. 2. *T. plumbicolor.*
Fig. 3. *T. subminiatus;* 3*a*, young specimen.

T. MORTONI, *Theobald.*

Scales 19, strongly keeled. Dark brown, with dark vertebral stripe and interrupted cross-bars of yellow or white spots.

A solitary museum specimen, source unknown.

T. STRIOLATUS, *Blyth.*

Scales 19. Labials 8 (3 and 4), postoculars 3 or 4. Colour pale olive brown, a dark patch below the eye, a dark leaden stripe extending from behind the eye all down the side, with a second narrower one, below it, through the second row of scales. Belly white, no spots.

A solitary specimen from the Andamans.

T. natrix is the common harmless snake of England.

ATRETIUM, *Cope.*

A Tropidonotus distinguished by having the anterior frontals united into one broad triangular shield (in contact with the rostral). Other head-shields regular. Scales 19, short, rhombic, keeled. Ventrals broad, anal bifid. Teeth numerous, increasing.

A. SCHISTOSUM, *Daud.* Plate XIV, fig. 3.

Ventrals 146-150, subc. 67-82. Dark slate-colour with interstitial crimson dorsal stripe; lips, outer 1½ row of scales and belly yellow, throat yellow, thin long black post-orbital stripe.

Grows to 2 feet, tail one-fourth. South of India, Ceylon.

Günther states, on the authority of Cope, that this is a fierce snake dilating its neck laterally when about to attack. My experience is far from confirming this. I have kept several specimens which were very gentle; they were sociable and fond of climbing on the necks of two young cobras who were at constant enmity and addicted to standing facing one another in a menacing manner.

XENOCHROPHIS, *Günther.*

A Tropidonotus with the middle teeth longest, and with

the nostril in the upper part of a single shield. Scales 19, keeled. Anal bifid.

X. CERASOGASTER, *Cantor.*

Ventrals 141-149, subc. 60-69. Shields of the crown elongate. Labials 9 (4). Brown, with lighter dorsal stripe or dorsal series of dark spots; belly purple, marbled; bright yellow lateral line beginning at the snout.

Bengal, Assam, Straits.

PRYMNOMIODON, *Cope.*

A Tropidonotus with minute teeth much enlarged anteriorly. Head-shields normal. Scales 19, keeled.

P. CHALCEUS, *Cope.*

Ventrals 152. Green. A solitary museum specimen.

Siam.

CADMUS.

A genus made by Mr. Theobald for a Tropidonotus of stout form, with 27 rows of smooth scales. Rostral large and penetrating between the small anterior frontals. Labials 7 (4).

C. CUNEIFORMIS, *Theobald.*

Olive brown, with two dorsal rows of black spots.

A solitary museum specimen.

FAMILY XIV.—DENDROPHIDÆ.

Body and tail either much compressed or very slender; head rather long, flat, and distinct from the slender neck; snout moderate or long, rounded. Eye moderate or large, pupil round. Head-shields normal; scales much imbricate; ventrals with two keels; anal bifid.

GONYOSOMA, *Wagler.*

Body long, compressed, head moderate. Loreal sometimes absent, preocular one. Scales generally smooth. Ventrals above 200.

G. OXYCEPHALUM, *Boie.*

Scales 25, elongate, with a pair of apical grooves. Ventrals 236-263, subc. 138-149. Labials about 11 (2). Green, paler below; dark labial line; tail brown, with yellow anterior ring. Length 5-7 feet.

Tenasserim and the Straits.

G. GRAMINEUM, *Gthr.*

Scales 19, with apical grooves. Ventrals 203, subc. 100. Labials 9 (4, 5 and 6). Green, paler below; tail reddish. I have a specimen, source unknown, corresponding closely to the type description. The only material difference is that the anal is single. Ventrals 208, subc. 105. Length 14 inches.

Khasya hills.

G. FRÆNATUM, *Gray.*

Scales 19, the dorsals faintly keeled. Ventrals 203, subc. 120. No loreal. Green, paler below, black labial stripe.

Khasya hills. A solitary specimen.

PHYLLOPHIS.

Body and tail elongate, much compressed. Head-shields normal; two preoculars; *nasal single,* nostril in the centre. Scales 23, keeled. Ventrals above 200.

P. CARINATUS, *Gthr.*

Ventrals 223, subc. 97. Greenish olive; dark nuchal spots, and vertebral dots, whitish below.

China; rare.

DENDROPHIS, *Boie.*

Body and tail very elongate, slender, compressed. Eye large. Head-shields regular. Scales 13-15, smooth, imbricate, the vertebral series large, polygonal. Ventrals nearly square at the keels.

D. PICTUS, *Gmelin. The blue tree-snake.* Plate XVI, fig. 1.

Scales 15. Ventrals 160-187, subc. 87-156. Eye moderate (or large when young). Colour rather variable; either deep blue, with a bright yellow lateral stripe, ventrals yellowish, with a lateral spot at regular intervals (Malabar) or, bronze with blue margins to the scales under the imbrication, yellow belly and outer scales, with dark lateral stripe from eye to vent. (Burma). Grows to 4 feet, tail one-third.

Common in India and Burma.

D. CAUDOLINEATUS, *Gray.*

Scales 13. Ventrals 183-188, subc. 105-110. Bronze, with black lateral stripe, two dorsal posterior stripes, superior and inferior median caudal stripe.

CHRYSOPELEA, *Boie.*

Body and tail slender and elongate; head elongate, snout rounded. Head-shields regular. Scales 15-17, smooth, rhombic. Ventral keels sharp, with a notch at the hind margin.

C. ORNATA, *Shaw. The golden tree-snake.* Plate XVI, fig. 2.

Scales 17. Ventrals 180-236, subc. 96-147. Head black, with yellow punctulated cross-bands; body black, with a flowered pattern formed by bright yellow dots on each scale, or with yellow punctulated cross-bars. Grows to 4 feet, tail one-fourth.

More common, I think, in Burma than in India.

C. RUBESCENS, *Gray.*

Scales 15. Ventrals 187-225, subc. 108-146. Purple, dotted with brown and black spots; head with brown stripes.

Straits.

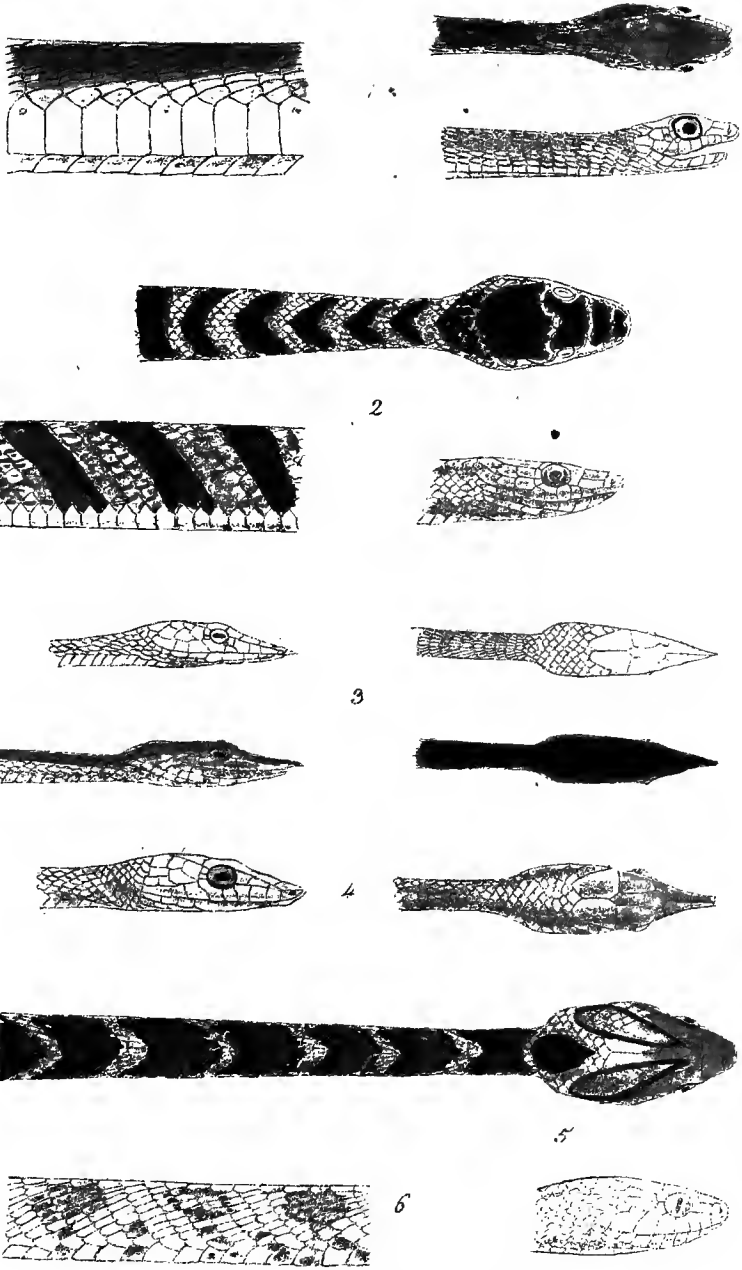

Fig. 1. *Dendrophis pictus,* (the head from a young specimen).
Fig. 2. *Chrysopelea ornata.*
Fig. 3. *Passerita mycterizans.*
Fig. 4. *Tragops prasinus.*
Fig. 5. *Dipsas gokool.*
Fig. 6. *D. multimaculata.*

Family XV.—DRYIOPHIDÆ.

Body and tail excessively slender; snout much elongated and tapering. Eye moderate, with *horizontal pupil.* Head-shields normal, nostril in a single nasal. Scales 15-17, narrow, much imbricate; the vertebral series large, fan-shaped. Ventrals broad, not much keeled. Anal bifid. Tail often nearly as long as the body.

TROPIDOCOCCYX, *Günther.*

Snout tapering, but without any appendage. *Loreal none.* Both frontals come down low and concave.

T. PERROTETI, *D. and B.*

Scales 15, smooth, last dorsals sometimes keeled. Ventrals 140-143, subc. 66-82. Grass-green; yellow lateral stripe; belly yellowish.

Nilgiris, where it replaces *Passerita mycterizans.*

TRAGOPS, *Wagler.*

Snout very long, but without any appendage. *Loreal present,* its region concave. Scales 15.

T. PRASINUS, *Reinw. The buff tree-snake.* Plate XVI, fig. 4.

Ventrals 212-234, subc. 176-203. Colour variable, sometimes green, with white lateral stripe; a not uncommon variety is light ochre, belly white, with a lateral ochre stripe, under the tail yellow, with white lateral stripe. It also occurs of a pure white, with interstitial black markings.

Bengal, Burma, where it replaces *Passerita mycterizans.*

T. DISPAR, *Gthr.*

Ventrals 151, subc. 100. Males bright green, females bronze-coloured; black interstitial skin; yellow lateral stripe.

Anamullays.

T. FRONTICINCTUS, *Gthr.*

Ventrals 190, subc. 140. Rostral small, nasals elongate, contiguous. Grass-green or bronze, with black yellow-edged lateral stripe.

Swamps in Arakan.

PASSERITA, *Gray.*

Snout very long, *ending in a flexible appendage; no loreal;* preocular region concave. Head-shields regular. Scales 15.

P. MYCTERIZANS, *L. The common green tree-snake.* Plate XVI, fig. 5.

Ventrals 172-188, subc. 140-166. Grass-green, with yellow lateral stripe; paler below; black and white cross-bands, on the interstitial skin. This is the most common tree-snake, and is sometimes called the "eye-snake," in consequence of an idea prevalent amongst otherwise sane Englishmen that it is in the habit of hanging by the tail from a branch of a tree for the purpose of hitting passers-by in the eye. It is rare in Burma and hilly parts. Grows to 6 feet in length, the tail being four-tenths.

P. PURPURASCENS, *Gthr.*

Ventrals 194, subc. 154. Brownish grey, marbled with purple and dotted with brown.

Ceylon.

FAMILY XVI.—DIPSADIDÆ.

Tree-snakes with vertical pupil, short broad head, very distinct from neck, body compressed, elongate. Head-shields regular. Scales smooth, imbricate, the vertebral series enlarged. Anal entire. Last tooth elongate and grooved; the front tooth also elongate sometimes.

DIPSAS.

D. CYNODON, *Cuvier.*

Scales 23. Ventrals 275-287, subc. 141-162. Anterior palatine and mandibulary teeth enlarged. Brown; dotted with black, and with rhombic black cross-bands; or reddish olive, with a vertebral series of large black ocellate spots.

Burma, Straits.

D. FORSTENI, *D. and B.*

Scales 25-27. Ventrals 260-275, subc. 106-131. Teeth as in the preceding. Brownish olive, with black fasciolated cross-bands; median and lateral black head stripes.

Anamullays; very rare.

[The anterior palatine and mandibulary teeth of the following species are but little enlarged if at all.]

D. BOOPS, *Gthr.*

Scales 21. Ventrals 265, subc. 160. Eye very large. Reddish olive, spotted with black and brown in transverse and longitudinal bands; belly marbled with purple.

Bengal, Straits; rare.

D. DENDROPHILA, *Reinw.*

Scales 21. Ventrals 211-229, subc. 90-112. Black, iridescent, with numerous narrow yellow cross-bands; throat yellow; belly black, or marbled with black.

Straits.

D. BUBALINA, *Klein.*

Scales 21. Ventrals 249-252. Green above, greenish olive below; black interstitial skin.

China or Assam; rare.

D. MULTIMACULATA, *Schlegel. The Burmese brown tree-snake.*

Plate XVI, fig. 6.

Scales 19, sometimes 17. Ventrals 202-245, subc. 80-106. Dark fawn, with a numerous dorsal series of round dark spots with black and white margin; the spots often have

black pendants and alternating small dots; head with a black ≻ and post-orbital streak; or with a broad arrow enclosing a large round spot; belly white mottled with fawn. Grows to above 3 feet, tail nearly one-fifth.

Burma, Straits, China. In Burma it appears to replace *D. gokool.*

D. TRIGONATA, *Schneider.*

Scales 21. Ventrals 235-269, subc. 79-102. The preocular reaches nearly or quite to the vertical. Yellowish or greyish olive, with dark brown quincuncially sagittal cross-bars. Head mottled, with occipital spots and post-orbital streak; belly white, with lateral brown dots.

Common in India. Grows to 4 feet.

D. MULTIFASCIATA, *Blyth.*

A variety of the preceding.

A solitary museum specimen.

D. GOKOOL, *Gray. The common brown tree-snake.* Plate XVI fig. 5.

Scales 21, vertebrals enlarged. Ventrals 211-231, subc. 78-85. Preocular does not reach the crown. Yellowish or greyish brown, with a series of irregular buff vertebral dots, from the sides of each of which drops a black fasciolated Y mark; belly yellowish, with black lateral dots; the head has a large brown ⋈ mark, divided by a yellow ⋈. Grows to 3 feet, tail one-sixth.

Common in Southern India.

Much confusion has existed between *D. gokool* and *D. trigonata.* The former is distinguished by the lower preocular, peculiar and decided head-markings, fewer ventrals and the fasciolated shading forming the posterior arms of the Y dorsal marks. It is the more common of the two.

D. CEYLONENSIS, *Gthr.*

Scales 19. Ventrals 220 + 108. Grey, with black vertebral spots, each emitting a down-streak; black head blotch and post-orbital streak.

Appears to be the Ceylon variety of *D. gokool* or *trigonata.*

FAMILY XVII.—PSAMMOPHIDÆ.

Body and tail generally elongate, head very distinct, with the loreal region very concave. Eye moderate, pupil round or vertical. Head-shields normal; loreal present; posterior frontals rounded or angulated behind; supraciliaries prominent. Anterior teeth longest, the last grooved.

Ground snakes approaching the Dipsadidæ in form, with ventrals much less than 200.

PSAMMOPHIS, *Boie.*

Body and tail elongate; long and rather pointed snout. Vertical long and narrow; loreal elongate. Pupil round. Scales smooth, 15-19. Anal bifid.

P. CONDANARUS, *Merrem.*

Scales 17, lanceolate, with minute apical groove. Ventrals 176-182, subc. 80-90. Nasals generally double, sometimes single. Buff or light brown, with a dorsal and a lateral mottled black-edged stripe; belly yellowish, with a very thin lateral black stripe, sometimes a supra and an infra orbital yellow streak from nose to neck.

India, Burma; rare.

PSAMMODYNASTES, *Günther.*

Body and tail rather stout; snout short, vertical long, anterior frontals very small, nasal single, pierced by the nostril. Pupil erect. Scales 17, short, rhombic, smooth. Anal entire.

P. PULVERULENTUS, *Boie.* Plate XIII, fig. 3.

Ventrals 146-167, subc. 50-59. Head long, crown flat, snout obtuse. The second or third tooth long and enveloped in a large mucous envelope so as to simulate a poison-fang. Labials 8 (3, 4 & 5), the first 3 high. General appearance and colour not unlike a short, narrow-headed *Dipsas.* Light brown, mottled; when young a black vertebral stripe, with an edging of black and white spots; this disappears with age; belly and sides yellow with a median and two lateral rows of brown mottling or lines; throat white, mottled; ⋈ mark on head.

I caught one specimen while it was swimming across the Rangoon lake. Adult length 1 foot, tail one-fifth.

Assam, Burma, Straits.

SECOND SUB-ORDER—VENOMOUS COLUBRINE SNAKES.

FAMILY XVIII.—ELAPIDÆ.

Body moderate, tail rather short. Head-shields normal, but no loreal. Eye small or moderate, with round pupil. An erect poison-fang in front of the maxilla there being one or more simple teeth behind.

NAGA.* (NAJA, *Laurentius*).

Anterior ribs elongate, erectile, dilating the skin of the neck. Head short and rounded. One rudimentary tooth behind the poison-fang. Ventrals less than 200.† Anal entire.

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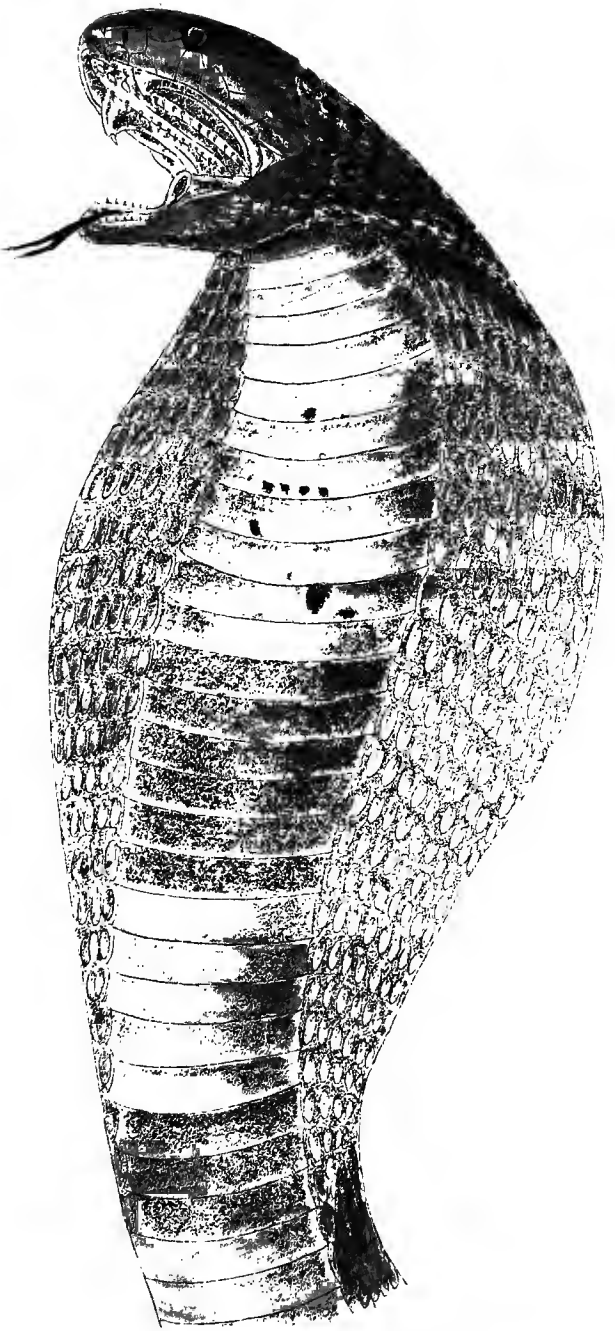
* Usually written *Naja;* as the word is probably derived from *nāgam.* I prefer to write it *Naga.*

† In a bleached specimen which I found in the Madras Museum stores, there are 209 ventrals and only 21 rows of scales both on the body and the neck. It has also a fourth postocular completing the orbital circle. I have not made a new genus for it.



Naga tripudians, the cobra.

N. TRIPUDIANS,* *Merrem. The Cobra.*

Scales 21-23 on the four-tenths of the body below the first tenth or expansive portion, but as many as 33 on the broadest portion of the cervical disk. The preocular and the anterior frontal are somewhat fan-shaped, the posterior angle of the latter resting on the broad part of the former. There are two distinct varieties of this snake, if not two species.

Variety a. The Binocellate Cobra. The Spectacled Cobra. Gokurra of Bengal. Plate XVII.

Scales 23. They are 31-33 at the ocelli, 25 at the black posterior edge of the hood. Ventrals 184-197, subc. 53-69. The neck is marked between the 10th and 17th transverse series of scales with a white, black-edged ⊂ or ≺ enclosing at either extremity a black ocellus. This pattern is entirely on the steel-brown skin, and is only seen when the cervical disk is expanded; then the scales are distant from one another like grains of linseed symmetrically arranged in rows; at other times the scales are imbricate and conceal the pattern. The general colour varies from light olive, or even buff, to dark brown; this colour is entirely on the scales, the interstitial skin being white, occasionally with dark cross-bands. A common variety has numerous narrow light cross-bars, generally in pairs. Under-parts ash or dark mottled; anteriorly a lateral black spot corresponding to the position of the ocellus on the neck; two or three series of ventrals between the 15th and 30th are very dark, nearly black. The colours are variable in shade, but they merely mark 'caste' as the Indians say, and a dozen different castes can be made out of a large 'bag' of cobras

* *Tripudiate*, v. i. to dance on the toe (Hyde Clarke's English Dictionary.) Ex. "tripudiant matrons"—*(Saturday Review.)* French zoologists, who translate literally the Latin names of animals, call this snake *Naje baladine.*

brought in for reward. As a rule the cobras found on the coast are much lighter than those of inland districts.

This binocellate variety is found in the South of India and on the coast generally. I found two specimens in Burma; but, from their fangs being absent and the fang matrices cicatrized, they had evidently been imported by jugglers and had escaped. My largest specimen is 5 feet 8 inches long. There are few English residents in India who cannot vouch to having seen specimens of 6 feet and upwards; but the application of a foot-rule has a very dwarfing effect on snakes of great apparent length.*

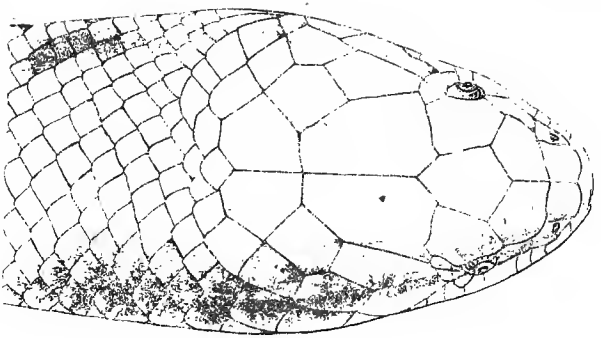
Variety b. (*θ* of Günther). *Naga monocellata? The Monocellate Cobra. Kiotia* of Bengal. Plate XVIII, fig. 2.

Scales 21; they are 25-27 at the ocellus. Ventrals 185-191, subc. 53-59. Instead of spectacles, this variety bears a plain white ocellus, with black centre and margin. The colours are very much the same as in the other variety, but generally darker. This one does not grow to so large a size; I have only once seen a specimen above 4 feet 6 inches; and the tail is rather shorter, one-seventh instead of one-sixth. It is the cobra of Burma, but is found also in Bengal and the Central Provinces.

OPHIOPHAGUS, *Günther.*

The neck is dilatable, but to a less extent than in *Naga*. Occipitals surrounded posteriorly by three pairs of large

* Out of 1,200 cobras brought to me at Bangalore for the Government reward, there were only four which exceeded 5 feet 6 inches in length. These were respectively—a male 5 feet 6½ inches—a male 5 feet 7½ inches—a female 5 feet 8 inches (tail 12 inches), weighing 2¼ lbs.—a male 5 feet 6⅞ inches, weighing 3¼ lbs. The first three were perfect, the last had a rather stumpy tail; reconstructing it, from the number of subcaudals, I found that had not the cobra met with some accident he might have been 2 inches longer, which would have brought his length up to 5 feet 8⅞ inches.



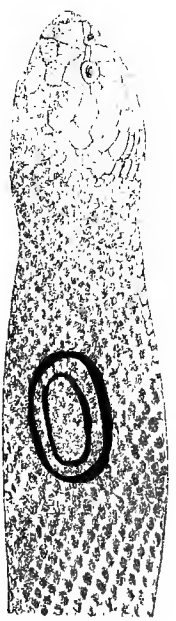


Fig. 1. *Ophiophagus elaps.*
Fig. 2. *Naga tripudians* var. *monocellata.*

shields, the two anterior being temporals. Scales smooth, large, 15 rows. Ventrals above 200.

O. ELAPS, *Schlegel. The Hamadryad.* Plate XVIII.

Scales 15; on the hood there are about 19. Ventrals 215-262, subc. 80-100; about the first ten subcaudals are entire, and sometimes the last few ventrals are two-rowed. There are two varieties distinguished by the Burmans, the dusky *gnān bok* and the banded *gnān hwa.* The former is of general brownish olive colour. The latter is yellow, with about 50 bands formed by black interstitial skin and black margins to the scales, the latter increasing until towards the tail the colour becomes black, with yellow bands, lower parts yellow, posteriorly black. The young snake is jet black, with bright yellow bands; in addition there are three yellow bands on the head, one through the occipitals, one through the vertical behind the eyes, and one through the anterior frontals; the two posterior of these consisting of a large yellow spot on each shield.

This snake grows to 12 feet in length; when at bay its head stands about two feet off the ground. From its large size it is much less manageable than the cobra, but Burman jugglers make it go through much the same performance. It will eat other snakes, and there appears to be enmity between it and the cobra, the latter (I am credibly informed) attacking it with fatal effect. When watching its eggs it is very savage, and will drive away by hostile demonstration, or even pursuit, any passers-by; at other times it is peaceable enough. It is found in the jungles of Cuttack and Burma, and in the Anamullays.

BUNGARUS, *Daudin.*

Tail short, head small, hardly distinct from the neck, the skin of which is not dilatable. Eye small. Scales 15, smooth, *the vertebrals large and hexagonal.* Ventrals above 200

Anal and *subcaudals entire*. One or two teeth behind the poison-fang.

B. CÆRULEUS, *Schneider*. B. ARCUATUS, *D. and B. The Indian Bungarus*. Plate XIX, fig. 1.

Ventrals 201-221, subc. 38-56. Upper parts jet black; lower parts white, throwing white arches over the back. (Hence *B. arcuatus* is a far preferable name, as there is not the slightest cærulean colour about the snake). The first arch is generally an incomplete collar, the next three are single; then they divide into pairs, of which there are about 30. This normal pattern is subject to variation; sometimes the arches remain single, and in one variety are incomplete. This snake grows to about 4 feet long, but is rarely found above 2 feet, tail one-eighth; young specimens are very handsome. It is found in most parts of India, but is rare in Burma, where it is replaced by the following:—

B. FASCIATUS, *Schneider. The Malayan Bungarus*. Plate XIX, figs. 2 & 2*a*.

Ventrals 200-233, subc. 23-37. Tail very short and stumpy, even swollen at the tip. Body of triangular section; spinous processes of vertebræ very prominent. Black, with about 20 yellow cross-bands completely encircling the body and tail. Head black, with a yellow > converging upwards from the throat. Grows to above 6 feet long. Common in Burma; specimens are found along the coast of Chittagong and Orissa.*

B. CEYLONICUS, *Gthr.*

Similar to the first species, but with complete black rings and narrow white intervals.

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* The Malayan fauna creeps up the Chittagong coast and down the Coromandel coast. Thus specimens of *Ophiophagus* and *Bungarus fasciatus* are found as far south as Ganjam and the *Naga monocellata* has spread into Bengal and the Central Provinces. The converse invasion is rare.

B. SEMIFASCIATUS, *Kuhl.*

Also similar to *B. cæruleus,* but the tail has complete black rings round it.

China.

XENURELAPS, *Gthr.*

Similar to *Bungarus,* but with double subcaudals.

X. BUNGAROIDES, *Cantor.*

Scales 15. Ventrals 224-237, subc. 44-46. Black, with narrow white cross-bands directed forward; white bands on the head; belly white, with irregular cross-bands, or red, with black spots.

Assam and Khasi Hills.

MEGÆROPHIS, *Gray.*

Form similar to *Bungarus,* but with 13 rows of scales, the vertebrals large, hexagonal. Anal and anterior subcaudals entire.

M. FLAVICEPS, *Reinhardt.*

Ventrals 209-226, subc. 38-52. Black, with a vertebral line and zigzag lateral stripe, white anteriorly, red posteriorly; head and neck red; belly red, sometimes black anteriorly.

Straits.

CALLOPHIS,* *Gray.*

Body very long and slender; head short, obtuse, not distinct from the neck; tail short. Scales 13, *vertebrals not enlarged;* anal generally bifid; *subcaudals bifid.*

C. BIVIRGATUS, *Boie.*

Ventrals 248-284, subc. 38-50. Head, belly and tail, red; body black, with a lateral zigzag white blue-margined stripe. Upwards of 4 feet in length.

Straits.

* Formerly ELAPS but this name is now restricted to the American section of the genus.

C. INTESTINALIS, *Laur.*

Ventrals 223-271, subc. 24-26. A red black-edged vertebral stripe; a buff, black-edged lateral stripe. Belly alternate pale yellow and black.

India, Straits.

C. GRACILIS, *Gray.*

Ventrals 238-311, subc. 21-28. Grey, a brown vertebral line, with small button-like swellings; a white, black-centred, and black-margined lateral stripe; between these stripes is a series of black, white-edged spots; belly pale yellow, with black cross-bands; tail red below, with an anterior and posterior black, white-edged ring.

Straits.

C. PENTALINEATUS, *Beddome.*

Cherry red, with 5 black stripes; neck black; head with black markings, belly red. Very thin, 3 feet long.

Travancore hills.

C. MACCLELLANDII, *Reinh.*

Ventrals 196-224, subc. 25-34. Head black, with a yellow fillet; body reddish brown, with black vertebral line; belly yellow, with variable black pattern.

Assam.

C. ANNULARIS, *Gthr.* Plate XIX, fig. 3.

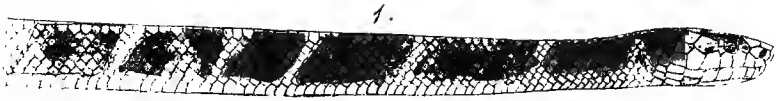
Ventrals 208-234, subc. 27-33. Head black, with a yellow fillet; body reddish brown, surrounded by about 40 narrow black rings, often interrupted; on the belly these are doubled by alternate ventral cross-bars.

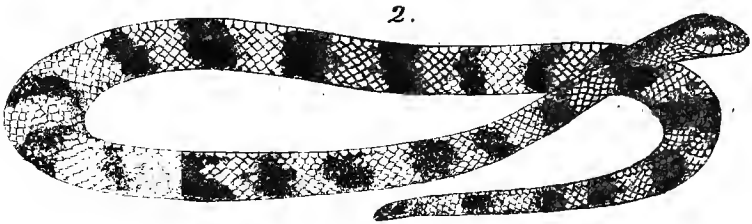
Malabar ?

C. TRIMACULATUS, *Daudin.*

Ventrals 245-274, subc. 30-35. Brown; head and neck black, with yellow spots; belly red; an anterior and posterior caudal ring, the two connected below by black spots.

Tenasserim (and Malabar ?)





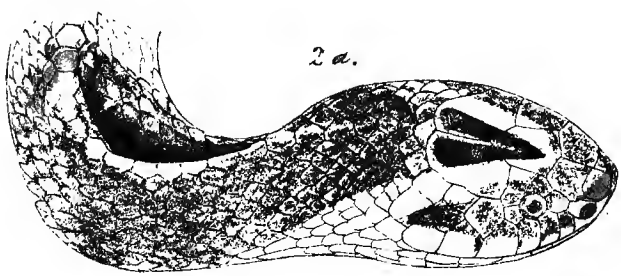


Fig. 1. *Bungarus arcuatus, (cæruleus).*
Fig. 2. *B. fasciatus,* one-sixth natural size; 2*a*, natural size.
Fig. 3. *Callophis annularis.*

C. MACULICEPS, *Gthr.*

Ventrals 205-247, subc. 24-32. Brown; 3 black lines run from the snout to join a broad black collar; belly red; tail black-ringed.

Straits.

C. NIGRESCENS, *Gthr.*

Ventrals 232-247, subc. 33-45; anal generally entire. Upper parts blackish, lower parts red; head marbled with black; a black ⊂ collar; a black, yellow-edged dorsal line.

Anamullays.

FAMILY XIX.—HYDROPHIDÆ.

Body cylindrical, compressed posteriorly; tail strongly compressed, forming a vertical fin. Head-shields pretty regular, but no loreal, and usually only a single pair of frontals; nasals generally contiguous. In most genera there are no ventrals. Scales generally tubercular and dull. All provided with a poison-fang, followed by 3 or 4 ordinary teeth. Eye very small.

PLATURUS, *Latreille.*

Head-shields normal; 2 *pairs of frontals*, nostrils lateral, nasals not contiguous. Scales smooth, *ventrals well developed*, anal bifid; subcaudals present.

P. SCUTATUS, *Laur.*

Scales 21-23. Ventrals 213-241. Generally an azygos shield between the posterior frontals. Black rings, head yellow, with black postocular stripe and median stripe.

P. FISCHERI, *Jan.*

Scales 19. Ventrals 232-241. No azygos shield. About 30 black rings, and median head stripe.

AIPYSURUS, *Lacépède.*

Body not much compressed; the ventrals are well developed, and have a *sharp median keel.* Head-shields generally divided; one pair of frontals; nasals contiguous. Scales smooth, subcaudals broad, entire.

Belongs to the Polynesian fauna.

A. ANGUILLÆFORMIS, *Schmidt.*

Scales 17. Ventrals 142. Brown, with yellow cross-bands.

A. LÆVIS, *Lacép.*

Scales 21. Ventrals 151-154.

A. FUSCUS, *Tschudi.*

Scales 19. Ventrals 157-166. Brown.

DISTEIRA, *Lacépède.*

A pair of anterior frontals between the nasals. Scales imbricate; ventrals very small, with *double keel.*

D. DOLIATA, *Lacép.*

Scales 39-41. Ventrals 234. Brown cross-bands.

A solitary museum specimen.

ACALYPTUS, *D. and B.*

Crown scaled; a pair of frontals, nasals contiguous; no ventrals.

A. SUPERCILIOSUS, *D. and B.*

Rare; found in the Pacific.

HYDROPHIS, *Daudin (sp.)*

Head short, shielded. One pair of frontals, *nasals contiguous.* Scales generally tubercular. Ventrals rudimentary or absent. (They are said to be 'broad,' purely in a comparative sense.)

This extensive genus comprises by far the greater number of the sea-snakes met with. The range of these animals being unlimited by the circumstances which confine land-snakes to particular localities, it may fairly be said that every sea-snake of the Indian and Pacific oceans may be found on the East Indian coasts; therefore these individuals not actually found on these coasts are still included in the East Indian fauna. I may here mention that 6 to 7 feet is the adult size of the largest of the species at present known. Their colour is generally buff or dirty white, with black or dull sea-blue cross-bands. One species is represented in Plate X.

Their classification is by no means complete and any description of them can hardly be satisfactory. I recommend persons desiring to study them (and they offer a fine field for study) to refer to the detailed description in Günther's Reptiles of India; here I shall content myself with quoting his synopsis of the species:

1. Scales more or less distinctly imbricate.

A *Scales large, in not more than* 17 *longitudinal series round the neck:* Kerilia, *Gray.*

Head short ... ... *H. jerdonii.*

B *Scales much imbricate, rather small, in* 43 *to* 47 *series round the neck; ventral shields split into two:* Hydrus, (*Shaw*), *Gray.*

Body stout ... ... *H. stokesii.*

C *Scales in* 23 *to* 38 *series round the neck; head not very small; anterior part of the body (neck) not, or moderately slender:* Hydrophis, (*Daud.*), *Gthr.*

Head rather short and broad, neck and body of moderate length One postocular. Belly with only a few ventral shields. *H. major.*

Head of moderate size and width; neck and body not elongate. One postocular. Ventrals broad, 310. *H. robusta.*

Head of moderate size and width; neck and body of moderate length. Two postoculars. Ventrals broad, 317; scales with a short keel; terminal scale of the tail very large. „ *belcheri.*

Head rather small; neck and body somewhat elongate. One postocular; scales strongly keeled. Ventrals not much larger than the adjoining scales. „ *cærulescens.*

Head of moderate size and width; neck and body somewhat elongate. Two postoculars; scales strongly keeled, the keel of each scale with two tubercular prominences. „ *aspera.*

Head of moderate size and width; neck and body somewhat elongate. One postocular. Back with a series of round black spots, alternating with black cross-bands. „ *spiralis.*

Head of moderate size and width; neck and body rather elongate. Two postoculars; scales faintly keeled. Ventrals broad, 320-426; terminal scale of the tail small or of moderate size. „ *cyanocincta.*

Head rather small and short, neck and body elongate. One postocular; 27 series of scales round the neck. Ventrals twice as large as the adjoining scales. Trunk with 60 broad black rings, nearly suppressing the ground-colour. „ *melanosoma.*

Head rather small and narrow; neck slender. Two postoculars; 23 series of scales round the neck. Ventrals not twice as large as the adjoining scales. Trunk with 41 cross-bands. „ *subcincta.*

Head small; neck slender. Two postoculars; 27 to 29 series of scales round the neck. Ventrals not twice as broad as the adjoining scales. Trunk with from 43 to 61 black-rings, not tapering on the sides. *H. nigrocincta.*

Head rather small; neck slender. Two postoculars; 28 series of scales round the neck, ventrals more than twice as broad as the adjoining series. Trunk with from 42 to 48 cross-bands. ,, *elegans.*

Head rather small; neck slender. One postocular; 33 to 35 series of scales round the neck; vertical short. ,, *torquata.*

D *Head very small; neck exceedingly slender*:

Liopala, (*Gray*), *Gthr.*

The length of the thin part of the body is more than one-third of the total. One postocular; 31 to 33 series of scales round the neck. Trunk encircled by from 59 to 67 blackish rings. ,, *chloris.*

The length of the thin part of the body is one-third of the total. One postocular; 31 to 33 series of scales round the neck. Trunk with from 48 to 58 blackish cross-bands extending to the middle of the side. ,, *lindsayi.*

Two postoculars; 26 to 28 series of scales round the neck. Ventrals 376. Trunk with from 60 to 64 rhombic blackish cross-bars; sides and belly not banded. ,, *atriceps.*

One postocular; 23 series of scales round the neck. Trunk with 38 broad black cross-bands, confluent on the back and belly. *H. latifasciata.*

One postocular; 19 to 23 series of scales round the neck. Trunk with from 53 to 59 complete blackish rings. „ *coronata.*

Two postoculars; 33 series of scales round the neck. Trunk with 62 blackish rings. „ *diadema.*

2. Scales not imbricate, placed side by side.

A *Head very small; neck exceedingly slender:* Microcephalophis, (*Less.*), *Gray.*

One postocular. Ventral shields 228-249, those on the hinder half of the body split into two. „ *gracilis.*

Two postoculars. Ventral shields 316, all undivided. „ *fasciata.*

One postocular. Ventral shields 412-440, those on the hinder half of the body split into two. „ *cantoris.*

B *Head of moderate size; anterior part of the body not, or moderately, elongate:* Thalassophis, (*Schmidt*), *Gthr.*

Head narrow, elongate; body rather slender. Two postoculars. Ventral shields twice as broad as the adjoining scales, 350 in number. „ *lapemoides.*

Head narrow, elongate; body rather slender. Two postoculars. Ventral shields twice as broad as the adjoining scales, 271 in number. Scales keeled. „ *longiceps.*

Head narrow, elongate; body rather slender. One postocular. Ventral shields distinct, only the interior being twice as broad as the adjoining series, 398 in number. *H. stricticollis.*

Head rather narrow and produced; body somewhat elongate. Two postoculars. Ventral shields twice as broad as the adjoining scales, 252-260 in number, scales with a central tubercle. The first upper temporal shield much longer than high. „ *ornata.*

Head rather thick and short, body of moderate length. Two postoculars. Ventral shields nearly twice as broad as the adjoining scales, 253-258 in number. The first upper temporal shield is not much longer than high; 35 or 37 series of scales round the neck. „ *elliotti.*

Head and body of moderate width and length. Two postoculars; nasal shields longer than broad. Ventrals more than twice as broad as the scales, 258 in number. The first upper temporal shield longer than high; 28 series of scales round the neck. „ *pachycercus.*

Head of moderate size and width; body of moderate length. Two postoculars; nasal shields as broad posteriorly as they are long; anterior ventral shields broad. „ *viperina.*

Head rather short; body moderately stout. Two postoculars. Ventrals distinct, but not twice as broad as the adjoining series. Back and sides with large round spots, each with a lighter centre. „ *ocellata.*

Head short and thick; body rather stout; shields of the snout irregular. Two postoculars; scales with a strong white keel. Ventrals bicarinate, not larger than the adjoining scales. *H. anomala.*

Head short and thick; body stout. One postocular. Ventral shields nearly twice as broad as the scales of the adjoining series. „ *curta.*

Head short and thick; body stout. One postocular. No distinct ventral shields. Trunk with from 41 to 43 blackish cross-bands, not exceeding downwards to the belly. „ *hardwickii.*

Head short and thick; body stout. One postocular. No distinct ventral shields. Trunk encircled by from 29 to 34 (37) black rings. „ *loreata.*

The following species have lately been added to the genus:—

H. fayreriana.
H. tuberculata.
H. crassicollis.
H. stewartii.
H. nigra.

ENHYDRINA, *Gray.*

Differs from *Hydrophis* in having a deep notch in the lower jaw.

E. BENGALENSIS or VALAKADYEN, *Gray.* Plate X, fig. 6.

The rostral is lobulated and fits into the deep mental notch. Scales 48-50.

Common on the Burman coast.

E. SCHISTOSA (?)

Wider gape, longer head, shields less granular. Scales 58-60.

PELAMIS, *Daudin (sp.)*

Head flat, with *long spatulate snout*, a pair of frontals, nasals contiguous; no ventrals.

P. BICOLOR, *Schneider.*

Black above, light brown below, with a yellow lateral band. Each scale sometimes impressed in the middle.

THIRD SUB-ORDER.—VIPERINE SNAKES.

FAMILY XX.—CROTALIDÆ.

Body stout, tail moderate or short. Head broad, subtriangular, generally scaly or imperfectly shielded. A deep pit on the side of the snout corresponding to the cavity of the maxilla. Eye moderate, with erect pupil. Poison-fang long, no simple teeth behind it.

TRIMESURUS, *Gray.* (TRIMERESURUS, *Günther.*)

Head shielded only in the supraciliary and rostral regions. *Body and head covered with more or less keeled scales;* 17-27 rows. Anal entire, subcaudals double.

T. GRAMINEUS, *Shaw.* Plate XX, fig. 3.

In this and the following five species the second labial forms the front of the facial pit. The small supranasals are separated by a small azygos shield. Scales 19-21. Ventrals 158-170, subc. 58-71. Grass green, belly paler, yellow lateral stripe.

Burma, Straits, China, Assam.

T. ERYTHRURUS, *Cantor.*

Scales 21. Ventrals 150-164, subc. 54-70. Supranasals contiguous. Same colour as the preceding, tail red or ruddy, lips often white.

Bengal, Burma, China.

T. CARINATUS, *Gray.*

Scales 23-25. Ventrals 161-167, subc. 45-68. Head scales small, strongly keeled; supranasals not contiguous. Grass-green, paler below, with or without a white lateral stripe, tail often reddish, belly often white. Grows to about 3 feet long, tail one-fifth or less.

Burma, Assam.

I consider that the above three species are merely varieties of a species. *T. viridis*, the green tree-viper. Their colour is delicate and variable; the keeled scales, the reddish tail, and the side stripe may be present or absent in either of these varieties.

T. MUTABILIS, *Stolicska.*

Scales 21. Ventrals 156-167, subc. 48-62. Reddish brown, with numerous greenish white cross-bands and two longitudinal lateral stripes of the same colour.

Andamans, Nicobars.

T. CANTORIS, *Blyth.*

Scales 29. Ventrals 174-184, subc. 55-76. Green, with alternating (quincuncial) series of dark spots; often a lateral white line, greenish or white below; tail prehensile, compressed.

Andamans, Nicobars.

T. PURPUREUS, *Gray.*

Scales 25-27. Ventrals 162-171, subc. 65-70. Dull reddish brown, pale green on the sides, yellow lateral stripe, ventrals and subcaudals marked with brown.

Straits.

T. ANAMALLENSIS, *Gthr.*

Scales 21, more or less keeled. Ventrals 148-158, subc. 49-55. Supranasals generally separated. Yellowish green, with vertebral series of rhombic black spots variegated with yellow. Head marbled with black, post-orbital streak.

Anamullays, Wynaad.

T. MONTICOLA, *Gthr.*

Scales 23, slightly keeled. Ventrals 137-141, subc. 41. Dark ash or brown, alternating dorsal series of black spots; sides black-spotted, yellow post-orbital streak; yellow ⋋ mark on the neck, belly mottled brown.

Himalayas.

T. CONVICTUS, *Stolicska.*

Scales 21, keeled. Ventrals 132, subc. 29. Hardly different from *T. monticola;* ⊂ mark on the neck.

Straits.

T. STRIGATUS, *Gray. The brown tree-viper.*

Scales 21, keeled. Ventrals 136-142. The second labial does not form the front of the facial pit. No supranasals. Brown, with large irregular mottled dark spots and white angular ⊐ mark on the neck.

Nilgiris, Coimbatore. Formerly *Trigonocephalus nilgiriensis.*

T. WAGLERI, *Schlegel.*

Scales 23-25. Ventrals 139-150, subc. 42-53. The second labial does not form the front of the facial pit. Head scales keeled. Variable in colour; when young, green with short, reddish buff cross-bars; the adult is black, with about 35 yellow cross-bands; yellow post-orbital streak.

Straits. Formerly *Trigonocephalus sumatranus.*

T. TRIGONOCEPHALUS, *Merrem.*

Scales 17-19. Ventrals 147-152, subc. 57-63. The anteanal is notched or divided. Green, with black vertebral stripe emitting alternate cross-bars; black post-orbital and head streaks; pale green below.

Ceylon.

T. MUCROSQUAMATUS, *Cantor.*

Ventrals 219, subc. 91. Brownish grey, with black ring-spots.

Assam. A solitary museum specimen.

T. ANDERSONI and T. OBSCURUS are noted by Mr. Theobald, but they would appear to be varieties of *T. purpureus* and of *T. wagleri*, respectively.

PELTOPELOR, *Günther.*

Head covered with large shield-like imbricate scales. Body scales 12, large, keeled.

P. MACROLEPIS, *Beddome.* Plate XX, fig. 4.

Ventrals 134-138, subc. 53-56. The large head scales are arranged very much like shields, there being a vertical and frontals. Uniform green, paler below, with yellow side streak.

Anamullays, Nilgiris.

CALLOSELASMA, *Cope.*

Head normally shielded. Scales 21, *smooth.* Tail ends in a long spine.

C. RHODOSTOMA, *Reinw.*

Ventrals 138-156, subc. 36-54. A subocular present. Reddish olive, dotted with brown; black vertebral line; dorsal series of erect triangular black spots; flesh-coloured streak from the snout above the eye; lips reddish olive. Grows to 3 feet.

Siam, Java.

HALYS, *Gray.*

Head normally shielded. Scales 21-27 *keeled.* Tail ends in a long spine.

H. BLOMHOFFII, *Boie.*

Scales 21. Ventrals 136-150, subc. 43-56. Three large temporals separated from the occipitals by scales, and contiguous to last 3 labials. Brown, with a dorsal series of large, round dark spots; belly marbled brown.

Japan.

H. HIMALAYANUS, *Gthr.*

Scales 23. Ventrals 162-166, subc. 43-51. Temporals separated from occipitals by scales, and confluent with the last 3 labials. Sometimes an azygos shield before or behind the vertical. Dark brown, with band-like spots; black post-orbital streak; belly black, marbled with yellow.

H. ELLIOTII, *Jerdon.*

Scales 23. Ventrals 151-43. Green, white below.

Nilgiris.

HYPNALE, *Fitzinger.*

Snout covered with numerous small shields; crown with the normal shields but triangular and scale-like. Scales 17, keeled. Tail ends in a small conical scale.

H. NEPA, *Laur.*

Ventrals 140-152, subc. 31-45. Brown, grey, or olive, with a dorsal series of dark sagittal spots. Sides and belly mottled with brown; brown post-orbital streak, with whitish upper margin.

Ceylon, Malabar, Anamullays.

FAMILY XXI.—VIPERIDÆ.

Body stout; tail short; head broad, scaled or imperfectly shielded. *No facial pit.* Eye moderate with erect pupil. Poison-fang very long, no simple teeth behind it.

DABOIA, *Gray.*

Nostril large, *between* 3 *shields;* head completely scaled. Body scales 29-31, much imbricate, strongly keeled.

D. ELEGANS, (RUSSELLII), *Gray. The Chain-viper.** Plate XX.

Ventrals 163-170, subc. 45-60. Grey, with 3 series of large black white-edged ring-spots, the vertebral series often irregular and confluent. In young specimens the spots have a beautiful velvety lustre. A yellow > converges towards the snout. Belly spotted with brown. Grows to 5 feet long, tail one-sixth.

South of India and Burma. The Indian *Daboia* is of more brilliant coloration than the Burmese variety. More common on the coasts than inland or above the ghāts.

ECHIS, *Merrem.*

Head scaled; *a pair of very small frontals;* nostril small in a *single shield.* Scales 25-29, strongly keeled, much imbricate. The lateral rows of scales, except the outermost two, point downwards and the keel on them consists of a line of dots. Subcaudals single.

E. CARINATA, *Schneider.*

Ventrals 149-154, subc. 21-26. Grey to light brown, with a vertebral series of white, brown-edged spots, below each of which is a semi-circular white streak enclosing a brown spot. The pattern is often less marked, consisting of a chain of light arches on each side, connected in the median line by a light spot. Broad brown > head-mark; belly white, spotted. 1-1½ foot, tail one-twelfth.

Not common, but widely spread.

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* For Indian synonyms, see Part III.

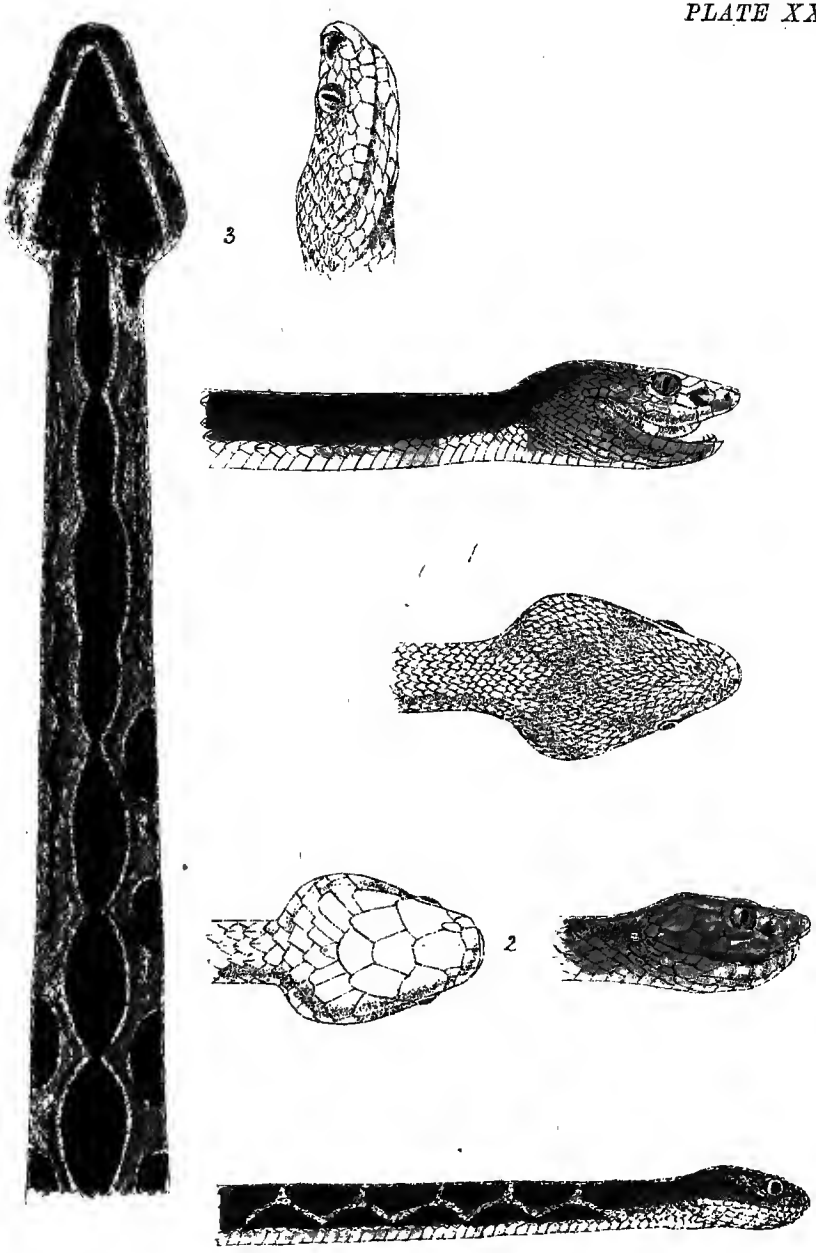

Fig. 1. *Trimesurus gramineus.*
Fig. 2. *Peltopelor macrolepis.*
Fig. 3. *Daboia elegans.*
Fig. 4. *Echis carinata.*

PART III.—NATURAL HISTORY.

CHAPTER I.—The Snake at liberty.

We have but little knowledge of the habits of snakes when at liberty, owing to the difficulties attending the observation of such animals in tropical climates;* vigilant and patient, they mostly remain during the day in a state of repose, seeking their prey at those hours when most animals have relaxed from their usual watchfulness and are at rest for the night. Whether ground or tree-snakes, they remain patiently in the same attitude until their prey approach, then, gently gliding over the short distance which intervenes, they pounce on the unsuspecting victim. The approach is so imperceptible that doubtless a certain amount of curiosity must often fix the attention of animals on perceiving the snake for two or three seconds before they become aware of their danger; but of fascination as it is called, there appears to be none.

The habits of snakes are so retiring and so little apt to attract attention, that they rarely obtrude themselves on our notice. The only occasions on which we observe them are when they imprudently venture near our habitations, or when the eye of the sportsman is quartering the ground anxiously for the first movement of game. At other times

* From the eagerness of people to look for the marvellous in all that concerns snakes, the observations of non-scientific enquirers are always open to suspicion. On this subject, the safest plan is to believe nothing that you hear, and only half what you see yourself, guarding carefully against the liability of your visual impressions being influenced by your expectations and pre-conceived ideas.

they generally elude notice; unless a European has sharp sight and habits of unconscious observation of what is going on around him as he walks, he may live for ten years in Indian stations without seeing ten live snakes otherwise than in the hands of the juggler. My own experience is hardly a fair criterion as I am very short-sighted; I cannot, therefore, attach much importance to the fact that I do not once a year come across a snake accidentally; although, if I go out snake-hunting, keeping a sharp look-out, I rarely fail to bag a specimen of some sort. But cross-examination of persons long resident in India leads me to conclude that one snake per annum is a fair average estimate of the number seen accidentally by Europeans living habitually in stations; sportmen, of course, have a much larger field of observation.

The rainy season is the time when snakes are most lively; in the hot and dry weather they retire to cool and moist places. Season does not, as far as I have observed, affect the casting of the skin in Indian snakes; with regard to the laying of eggs, its effect is variable. Young are produced once a year; the period between the impregnation of the female and the birth of her young is uncertain, but it would appear to be from four to five months. In the majority of snakes the eggs are extruded after about three months gestation, the development of the embryo taking place, as in birds, in the period between laying and hatching. But while most snakes are consequently oviparous, certain of them do not extrude the eggs with the embryo undeveloped, but retain them until maturity more or less perfect. Between the strictly oviparous snakes and the ovoviviparous snakes which extrude the fœtus perfectly developed, there are various gradations. The name 'viper' was applied originally to all venomous snakes under the idea that this class was distinguished by its viviparous habit; this has been, however, proved to be quite erroneous, for though most of the viperine snakes are viviparous so are many

harmless snakes, whilst the venomous colubrine snakes, such as the cobra and the hamadryad, are perfectly oviparous. Amongst viviparous snakes may be mentioned the sea and fresh-water snakes (at least most of the latter); the new English snake *Coronella lævis* and some tree-snakes are also ovoviviparous. Mr. Theobald records a specimen of *Tragops fronticinctus* containing "seven fœtuses" each one-sixth of its length.

The time of laying varies in different snakes, as will be seen by the following examples:—*

The cobra, at Bangalore, is impregnated about January; the eggs are hatched in May and up to the beginning of June. As many as 19 young will be found in a brood.

A *Python molurus* in the Paris Zoological Gardens, was impregnated in January and February, laid 15 eggs on May 6th, of which eight were hatched on July 3rd.—*(Günther.)*

Ptyas mucosus found containing 13 eggs, May, Bangalore.
Do. do. 9 do. do.
Do. 12 eggs hatched Sept. do.
Tropidonotus quincunciatus lays Jany. & Feby., Rangoon.
Tropidonotus stolatus found containing eggs, May do.
Do. do August, Bangalore.
Tropidonotus subminiatus do. Nov., Rangoon, (*Theobald*).
Tragops prasinus do. March, do. (*Theobald*).
Dipsas multimaculata do. July, do.
Hypsirhina enhydris do. March, do. (*Theobald*).
Trimesurus carinatus do. Dec., do. (*Theobald*).

The eggs are of the regular ellipsoid form of a silk cocoon, the shell being of a tough parchment-like material. In a large *Ptyas mucosus* they were two inches long and $1\frac{1}{4}$ inch in the short diameter. The eggs are usually laid in a hidden spot, such as a hollow tree, where some decomposing

* I regret that the loss of a note-book containing the observations made during my stay in Burma prevents my giving more complete information on this point.

vegetable substances will afford equable warmth with sufficient moisture to prevent the egg drying up through its thin covering. The eggs are frequently watched by the mother; some snakes (Pythonidæ) incubate their eggs, while the hamadryad *Ophiophagus*, as I am informed on good authority, makes a nest of 'wild plantain' shrubs which by their rotting give off heat and moisture. With regard to the incubation observed in the case of the python, I do not think that much stress can be placed on this point, the heat shown to be imparted to the eggs, though of some use in temperate climates would be scarcely needful in the natural climate of the snake. I have frequently observed *Tropidonotus quincunciatus*, when it has laid eggs in captivity, to lie on them apparently incubating them; but I should not infer that it would do so when at liberty, and moreover the eggs so incubated were all shrivelled up. The same fate awaited all eggs which I have kept in sand or sawdust, whether dry or moist; to hatch the eggs artificially they should be placed in dung heap compost.

When the young snake is mature it makes its escape from the shell by means worthy of attention. A tooth is developed on the premaxillary for the purpose;* it is flat and horizontal, being used like a leather-knife; with it the snake makes several cuts in the end of the parchment shell until, two cuts meeting, a valvular opening is formed; by this the young snake escapes. In many cases the young snake retains for some time the remains of the navel string (the vitelline duct), and the navel after closing is long visible as a slit in three or four ventral shields at about the thirtieth ventral from the vent; *e. g.*, the young cobra. But *Ptyas mucosus* emerges from the egg with the navel closed and no trace of vitelline duct.

* This tooth falls off soon after the birth of the snake. It must be remembered that in the lower types of snakes the *Pythonidæ* bear teeth on the premaxillary.

It may be taken as a rule that at birth the young snake is about one-sixth of the adult length; the cobra, adult length 66 inches, is 11 inches at birth; the Ptyas, adult length about 8 feet, is 15½ inches long at birth. Young snakes grow rapidly during their first year, more than doubling in length. Out of 1,000 cobras brought to me at Bangalore between May and August, there were 230 young of the season, from 12 to 16 inches long; above this length there were one of 29 inches long and six between 30 and 36 inches; all the remainder were above three feet long, mostly from four to five feet. This great gap in the lengths found at the same season shows 1° that the cobra produces young only once a year and at about the same month, 2° that the young measuring less than one foot at birth attain for the most part a length of three feet by the next hatching season.

After the first year growth is slower; Lenz, from observations on the indigenous snakes of Europe, concluded that maturity is attained at the fourth year, (*i. e.*, three years of age), when the snake begins to breed. Of the age to which snakes attain, we know little; as they grow older they increase, but slightly in length, but wax fat and heavy.*

Snakes feed upon small animals of any description as long as they are of proportionate size. Frogs are the principal food of the large and middle-sized ground-snakes, toads do not come amiss to them; rats, birds' eggs, and mice are also

* "A *Python reticulatus* lived in the menagerie of the Zoological Society of London for fifteen years; when brought to England it was 11 feet long, and in ten years it had attained to a length of 21 feet, after which no further growth could be observed. According to observations made by Bibron on young rock-snakes born in the Garden of Plants in Paris, this specimen would have been about four years old at the time when it was 11 feet long."—*Günther.* It is unfortunate that in the Zoological collections of our Indian cities there is no serpentarium in which the snakes of India can be systematically observed.

favourite articles of food, whilst young birds, lizards, tree-frogs and grasshoppers are the food of the tree-snakes. The water-snakes live on fish, and the amphibious land-snakes, such as *Tropidonotus quincunciatus*, catch the fish which inhabit the mud of marshes and irrigated fields.* A large python might possibly manage a kid, or a fawn of the smaller species of deer, but the stories of their swallowing goats, stags, men, and oxen are pure travellers' tales. A full grown cobra is very much distended when it has managed to swallow a rat of half a pound weight, that is, about one-fourth of its own weight. Many of the burrowing snakes live on worms and insects, and some snakes actually live on their brethren, at least on other snakes; they are probably hard up for food at the time. There is no reason why a snake should not swallow another snake nearly as big as himself if he gets the chance; I have seen two snakes who had caught the same frog between them manœuvre very cleverly when their noses met; the one who got his head within the other's jaw would certainly have gone down along with the frog if he had not freed himself from the frog and the snake too by a sudden effort. When young, snakes live on larvæ, flies, young geckoes and other lizards until they are big enough to manage the usual prey of their species.

Snakes drink water freely; I have frequently counted above a hundred gulps of water go down before the drinker was satisfied. I have never succeeded in inducing a snake to drink milk, though, when water was afterwards offered, it drank eagerly. The stories, ancient and modern, of snakes' sucking cows' teats and robbing dairies appear to be doubtful.

I am not altogether satisfied with the common account of the manner in which some snakes (the Pythons) are said to kill their prey, viz., by crushing it in their folds. The pressure which the largest snake can exercise is very mild indeed,

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* Piscibus atram
Improbus ingluviem ranisque loquacibus implet.—*Virgil.*

just sufficient to hold their prey if necessary and prevent it escaping; the only inconvenience of having a nine-foot python or hamadryas coiled round one is that he is apt to make a mess on one's clothes. Neither do snakes lick their crushed prey ('slaver it over' is the term used in story and simile) before swallowing it; if the prey is active, after catching it with their teeth they throw a few folds round it simply to prevent it from struggling, and then bolt it head foremost just as they would a frog.

Chapter II.—The Serpentarium.

The collector of snakes must study their habits if he wishes to be successful in his search for specimens; and I can only give a few indications as to the likely places for them. Dry nullahs leading down to tanks are a good find for amphibious snakes such as the *Tropidonoti;* tussocks of grass in wet paddy-fields often afford shelter to the ground vipers; the neighbourhood of houses is affected by Lycodon; the old galleries of white ants' nests are the refuge of various kinds of snakes, cobras included; the earth-snakes are to be found under large stones, and the hollows of old trees containing decaying vegetable matter are often chosen by snakes as a nest for their eggs. The squeals of a frog caught by a snake can never be forgotten if once heard, and they often enable the collector to surprise a snake at his meal. Snakes may often be captured while swimming, as they are readily detected in the water.*

But the European in India can do little himself beyond keeping a sharp look-out whilst walking for exercise or after game; by far the greater part of collections are made by employing the patience and acuteness of Indians in this

* Most snakes take to the water readily, either to capture frogs, or to cross over to some other spot. I captured a snake which rejoices in the highly terrestial name of *Psammodynastes pulverulentus*, the dusty king of the desert, while it was swimming across the Rangoon lake.

laborious pursuit. In stations where a reward is given by the authorities for every cobra that is killed, other snakes will often be brought in, and an arrangement with the police will bring these to any one willing to give a small reward. Where public money is not devoted to this philanthropic object the best way is to make generally known amongst toddy-drawers, fishermen, grass-cutters and Indian camp-followers in general, that a reward will be given for every snake that is brought in, varying in amount according to the rarity of the snake, whether it be in good condition, and alive or dead. By giving an extra reward for live specimens, all unnecessary destruction of the harmless common snakes will be avoided; and the attention of the snake-catchers can be diverted from these kinds by having some specimens kept for their inspection in the verandah; live snakes or skins in the case of the larger kinds, preserved specimens of the smaller. Notice can thus be given that these kinds will not obtain any reward.

I may here observe that Indians, those of the South at least, to my certain knowledge know very little about any snake but the cobra, have no names for any but three or four, and can give nothing but erroneous information.

The Moors know nothing about snakes, not troubling themselves about any branch of zoology unconnected with sport; while the veneration of the Hindus being concentrated in the typical *nāgam* they know little about any other snake. Snake-charmers and jugglers tell a lot of nonsense; and low Indians wishing to show off their intelligence before master, find little trouble in evolving from their inner consciousness a name for any snake pointed out to them. They have perceived that it is a point of honour with most Englishmen to have a name ready for every strange beast, and they humour this weakness by having a name ready for every snake, and also a wonderful account of the deadly effects produced by its bite or by a blow of its tail.

List of the names by which Indian (or Burmese) snakes are generally known.

	Indian-English.	Hindustani.	Tamil.	Burmese.
Naga tripudians, the cobra. ..	Cobra, Cobra di capello.*	Nāg sāmp.	Nāgam, Sārppam. Nalla pāmbu (the good snake).	Mwé howk.
Bungarus arcuatus, the Indian bungarus.	Carpet snake, Krait. Chetty (Bengal).	Karāit.	Ānali.	....
Bungarus fasciatus, the Malayan bungarus.	....	Sankni (Eastern Bengal).	....	Gnān dawja.
Ophiophagus elaps, the Hamadryad. ..	Hamadryas.	Sunkerchor (Eastern Bengal).	....	Gnān bōk, Gnān hwa.
Daboia elegans, the Chain-viper, the Daboia viper.	Carpet snake, Chain-viper, Cobra monila, Tic polonga, (Ceylon).	....	Mandali.	Mwé bwé.
Trimesurus viridis, the Green-tree viper.	....	....	Patcha mandali (green mandali).	Mwé zen kown gee.
Ptyas mucosus, the Dhāman. ..	Rat snake, Whip snake, Rock snake, Male cobra.	Dhāman.	Sara pāmbu. Chéra (Malayālim).	....
Ptyas korros, the Slender dhāman. ..	....	....	....	Lé mwé.
Python molurus, the Indian python. ..	Python, Rock snake, Boa constrictor.	Ājgar.	Perumpāmbu. (Malayālim), (the great snake).	....
Python reticulatus, the Malayan python.	....	....	....	Sava gee.

* Cobra di capello and Cobra monila are Portuguese words, the former meaning 'the snake with a small cape or hood,' the latter the 'beaded snake.' Chetty or chitti is a name applicable to any animal of variegated colour such as a leopard, a spotted deer, &c.; to show what confusion may be caused by the use of such a name I may mention that Russell in his *Indian Serpents* calls 'ohittee' the snake now known as *Atretium schistosum*.

The terms *viriyan, mandali, ānali,* are used indistinctly in Tamil and the kindred languages for any snake supposed to be venomous; the etymology of the first term is obscure, the others signify either a ringed or decorated pattern.

Water-snakes receive the prefix *nīr* or *jla* to the above names; a tree-snake may perhaps be distinguished as *marum pāmbu.* Burmans are often very intelligent in ophiology; the cobra, the hamadryad, the dhāman, the chain-viper, the black-striped red dhāman *Compsosoma,* have all names in the Burmese and Karen languages, and the people are well acquainted with their habits.

Some snakes allow themselves to be caught without the slightest attempt at resistance. The gentle *Tropidonotus stolatus, subminiatus,* and *plumbicolor* allow themselves to be taken up, and in dry weather the offer of a drink of water will at once gain their hearts. But most snakes are strongly opposed to being captured, and some show their independence by snapping viciously. *Tropidonotus quincunciatus* and *Ptyas* both fight for their freedom even at the earliest age, and, though they resign themselves philosophically to a domestic life, are always a little uncertain to handle; their bite is, however, quite harmless, and not very painful.

The collector need provide himself with no implements beyond a bag and his walking-stick, which, if placed on the neck of any snake, will permit of its being grasped without trouble. If the specimen has to be carried any distance and is too large to be stowed into a pocket, no bag being at hand, a piece of string to bind him to the stick will be found useful, as holding a large snake by the tail is inconvenient, and holding him by the neck becomes irksome, especially in the case of a venomous kind. It must be remembered that the great mobility of the maxillaries will often enable a snake to turn round on your fingers when

you think he is quite secure; therefore, take care to place your finger and thumb on either side of the neck, never above and below it.

A cobra standing at bay can be readily captured; put the end of a stick gently across his head and bear it down to the ground by a firm and gradual pressure; he will not resist; then place the stick horizontally across his neck and take him up. You must not dawdle about this; sharp is the word in dealing with snakes, and they have as much respect for firm and kind treatment as contempt for timidity and irresolution. When, however, an active snake carries on a running fight, the only way to capture him is to give him a tap across the back sufficiently hard to take the go out of him without injuring him. If you wish to capture your specimen alive, err rather on the side of mercy and see how gentle a blow will suffice to put him *hors de combat.* Even if you want the snake for the museum and not for the menagerie, it is still important to secure him with as little injury as possible.

The juggler or snake-exhibitor keeps his snakes in flat baskets of just sufficient size to hold a cobra when coiled up. However convenient this basket may be for portability and exhibition purposes, it is not suitable for other snakes than the cobra, and it is only admissible as a temporary lodging. The best habitation for snakes would doubtless be a verandah fenced to a sufficient height with wire gauze; it might be divided into compartments in order to separate snakes of ophiophagous habits from the rest of the community, and be provided with water and shrubs sufficiently to gratify the desire for coolness and shade. Such a serpentarium would enable interesting observations to be made on the habits of snakes.* The floor should be strewn with sand; it would

* Observations regarding the casting of skin and teeth, the laying, incubation and hatching of eggs, the oviparous or ovoviviparous nature of various snakes are very much needed.

not often require renewal owing to the inoffensive nature of the uric acid excreta of snakes.*

Next to the above arrangement, the best serpentarium consists of wooden boxes, old wine cases, in which the wood is replaced as much as possible by glass and wire gauze or perforated zinc. A flat-bottomed pan of water should always be kept in the box, for not only do snakes drink freely, but they also like the cool shade to be enjoyed by coiling themselves close round the pan. If a small pot of water be also given them, some snakes will proceed to inhabit it. It will not be uncommon to see half a dozen *Tropidonotus quinconciatus* coiled down comfortably in the pot of water and staying there for days together; a head coming up occasionally to breathe, and sinking down again directly.

A few pieces of brick must also be provided in order to facilitate the periodical casting of the skin; failing these convenient points of attachment, the skin will come off in fragments instead of being cast in its integrity.

To take a snake out of the box, when he is not sufficiently domesticated to be taken up with the hand, lift his body with a hooked stick, and, as his tail glides over take hold of it and deposit him on the floor or in a spare box. If you wish to tame the snake, he must be taken out daily and gradually accustomed to being handled; if you could persuade him to drink milk, the offer of it would become a great inducement to good behaviour. A cobra must always be taken out daily and gradually tired out of his wildness, but in the intervals of his performances he should be left alone and not worried. There is very little danger about handling this snake, nerve is all that is required. I have

* Snake's dung was, some years ago, of value; about three shillings per lb. was the price, if I remember right; it was used as a source of uric acid for the manufacture of *murexide*, a brilliant purple dye. This was shortly before the discovery of the aniline dyes.

very little of it myself, and can never handle venomous snakes with confidence; I have often envied the nerve of a friend in Rangoon, who, emboldened by the possession of a fancied antidote in case of accident, handles cobras with perfect freedom; he puts his hand into a narrow-mouthed basket containing several cobras, and picks out the one he wants without the slightest objection on the part of the snake beyond the usual hard swearing.

When the cobra is on the floor, squat down before him and bring him to attention, if he is making tracks, by a smart smack on the back; then, by a side-to-side movement of the knees or gently moving in front of him a piece of chalk or a rolled up handkerchief held in the left hand, he can be kept steady for a long time, following your movements. If your attention relaxes, he calms down and backs away; catch hold of him by the tail or smack him on the back, and he will come to attention again. Keep him occupied with an object in front of him, and you may do anything to him; place your right hand above his head, and you can bring him flat to the ground, but without any attempt at resistance. After he has stood up for some time, it is easy to provoke a strike; this, however, is rarely done viciously, and the injury inflicted is generally confined to his own nose; most captive cobras have their noses barked raw from frequent hits against hard substances.

The country music played by snakes-charmers during the cobra's performance is, I need hardly say, quite superfluous, and, from the very imperfect condition of the auditory apparatus, it is highly probable that, far from enjoying music, he has very little appreciation of sound. The Burmese put him through the same performance without the aid of music, and also without extracting the snake's fangs, a precaution generally taken by the Indian jugglers. These men not only take out the fangs, but, aware of their repro-

duction, often cauterize the fang-matrix; in some evidently escaped cobras which I have in my collection, there is not a trace of fang or matrix.

A feast and a fast is more the custom of snakes than frequent feeding; their prey is generally sufficiently large to afford their digestive organs exercise for several days, and during this time they take their ease lying in wait for another meal. The possibility of keeping snakes in captivity entirely depends on their temper; some snakes feed readily, others are sulky and obstinately refuse food. Amongst the latter are cobras; I do not know how they manage with them in Zoological Gardens, but I have never seen a cobra feed, and I think that, unless fed by force, he will starve himself to death. The chain-viper *Daboia* is very sulky; if caught when in good case it will live for six months or more without food or drink; but the cobra does not survive its voluntary starvation for more than a month or six weeks. Jugglers either feed their cobras by cramming them with milk or curds, or else let them loose when the lives of their captives are endangered; probably their experience in snake-catching enables them to re-capture their prisoners at a future time.

If a snake will not feed himself after being two or three weeks in captivity, he must be fed. The most convenient food for the purpose is fish; catch the snake by the neck, the finger on one side, the thumb on the other; present the head of a convenient-sized fish to him, he will easily be induced to make a bite at it, then force it down his throat, guiding the tail with a forceps when it comes within range of the teeth. I need hardly say that the fish should not be cooked, and need not be alive. If the snake, on being released, throw up the fish,* you must begin again, and give

* A snake on being captured generally throws up any recently indigested food, and some timid snakes must not be disturbed after their meals lest their digestion be deranged in a similar way.

him two fish (on the chance of his retaining at least one) and coax them gently down his gullet. Leaving the back-fin untrimmed may also mechanically prevent the rejection of the fish.

Most of the ground colubrine snakes feed freely in captivity; *Ptyas mucosus* especially is very eager at his food,* and will bolt frogs of very large size. I feed these kinds of snakes once a week; I put two frogs per snake into the boxes, and let them divide the total number amongst themselves. Pythons need only be fed about once a month; big frogs, chickens, or bandicoots are the best food for them.

CHAPTER III.—The Museum.

The collector will rarely be obliged to kill a snake for the purpose of examination. He will generally have quite enough snakes brought to him dead, and most snakes can with very little trouble be identified while alive; he will only have to kill snakes when they are quite new to him or are rare specimens worthy of preservation. The best way to kill a snake is to poison it or to asphyxiate it by a narcotic vapour; interesting experiments may be made by causing it to be bitten by venomous snakes, and an easy and painless way of killing a small snake is to put it in a sufficiently large bottle and pour in a few drops of chloroform.

* My attention was once drawn by the cries of four weaver-birds (*Ploceus baya*) who were in a cage in my verandah. On going out I found that a large Dhāman had lifted the lid of his box, carelessly left unfastened, and had got out; but instead of making instant use of his liberty, he could not resist the temptation offered by this cage of birds; he insinuated himself between the bars, and was bolting the second bird when I came to the rescue; he caught hold of the third before I could secure him again.

If taken out directly insensibility is complete, the anæsthesia will remain for an hour or more, and then pass away without injury to the snake; but this temporary anæsthesia should, of course, be avoided. Another convenient way of killing a snake without injury is by blowing into its mouth a drop or two of the oil from a dirty tobacco pipe, or administering a few drops of strong decoction of tobacco. But the systematic collector will find that carbolic acid affords the readiest mode of killing specimens for the museum. The liquid should be passed down the throat of the snake by means of a glass pipette about nine inches long. Twenty drops thus administered will destroy a large cobra in a couple of minutes. The snake is put to no apparent pain; it soon shivers, becomes insensible and dies with paralytic symptoms.

When you have your dead specimen before you, you can take down its description, diagnose it, draw or paint its portrait (a plan strongly recommended to officers who are disinclined to trail large bottles of specimens about the country) or even photograph it; but photography is not, I find, a very successful delineator of snakes, and it does not give the slightest clue to the pattern of their coloration. The only snakes which can be photographed successfully are those with lustreless scales, such as the *Hydrophidæ*, some *Homalopsidæ*, and the *Viperina*.

Either the whole snake, or merely its skin, may be preserved; of stuffing I do not speak; perhaps, on their arrival in England some cunning taxidermist may be able to make something better than a hideous sausage of your snake skins,* but that is beyond the limits of my subject.

Snakes may be preserved entire by substituting glycerine mixed with carbolic acid for the natural fluids of the body.

* Some sad examples of taxidermy applied to snake-skins may be seen in the Madras Museum.

This process is, however, very troublesome, and I only use it for small specimens and dissections; these keep perfectly moist and fresh. One-eighth of carbolic acid added to the glycerine is sufficient.

The other methods of preserving specimens are, either by putting them bodily into spirit or other antiseptic fluid or by preserving the skin only.

If spirit be used, it should be strong, about 40 degrees over proof (sp. gr. 870). Brandy and arrack are not nearly strong enough for the purpose. But considering that strong spirit is by no means easy to procure in India, that it corrugates the tissues so as to render them difficult to dissect, and that it weakens by evaporation thereby spoiling the specimens, I prefer in all cases to use the following antiseptic fluid, namely, rum or arrack of the strength it is usually made in India (20 to 30 under proof) to which I add either 4 per cent. of carbolic acid or 2 per cent. of carbolic acid and 1 per cent. of arsenic. The latter is the best addition, but specimens preserved in this arsenical spirit should be dipped in water before being handled or dissected, as the solution may blister the skin of the hand.

If the snake is known by experience to be perishable in spirit, it should be slit up and the whole of the interior removed, otherwise a few incisions into the abdomen for the purpose of removing any half-digested food and to let the spirit penetrate everywhere will be sufficient, especially in the case of small specimens. It should be removed to a permanent location in fresh spirit after a week's soaking in the first or depôt bottle. Tree-snakes are particularly difficult of preservation, and, however great care be taken, their beautiful colours generally fade, and their epidermis peels off in a very annoying manner. Bright light is fatal to the colours; the bottles should be kept covered up from the light or a uniform dirty white will soon be the general

colour of the collection. Unless the stoppers of the bottles fit very accurately, it is well to prevent weakening of the spirit by sealing the stoppers with soft wax.

If you wish to show the teeth or poison apparatus of a specimen, its mouth must be kept open with a gag before putting it into spirit, as otherwise you will find it a matter of no small difficulty to open the mouth after the muscles have become rigidly fixed.

I think that the best collection is that where there are two specimens of each snake, one in spirit, the other consisting of the skin only; it is well to avail oneself of a leisure day to dissect and skin a duplicate specimen instead of simply popping it into a bottle.

Begin by dissecting the skin from off the head, taking care not to cut further down than the subcutaneous tissue if you want the head for subsequent dissection. Slit the snake down from chin to tip with a pair of sharp scissors, keeping carefully in the median line of the ventral shields; separate the skin carefully as far back as possible on each side, and then take off the skin from the head downwards, relieving the tension by frequent strokes of the knife on the subcutaneous tissue. When you have skinned as far as the vent, the skin must be carefully separated from its anal attachments; and if it does not peel readily off the tail, dissect it off rather than run the risk of breaking it.*

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* The only snake whose body-skin comes off with difficulty is *Bungarus fasciatus;* the neural spines are so long and so firmly attached to the vertebral row of scales, that each has to be separately dissected out, no slight matter when two hundred have to be so treated; even then, button-holes will occasionally be made. In the dhāman there is a most intimate union betwixt the tail and its skin; on coming to the tail, the skin must be dissected off, do not attempt traction.

When the skin is removed, it must be pinned out with the inner surface upwards on a board with a pin at every 3 or 4 ventrals, taking care to stretch the skin as evenly as possible; the subcutaneous and fatty tissue must then be removed if the snake be at all of large size. The best way to do this is to scrape from the cut edges of the ventral shield towards the median line. When this is done, the whole surface must be brushed over with a preservative solution made by dissolving about half an ounce of corrosive sublimate in a reputed pint bottle of spirit.*

This will coagulate any remaining subcutaneous tissues, and will effectually preserve the skin against the attacks of rats or insects. Do not get any on your nails, as it dyes them a brown colour. Then complete the pinning out of the skin with a pin to every one or two ventrals, according to size, and let it dry in-doors until next day; it may then be taken off the board and transferred to the collection. Small thin skins may be gummed on to large sheets of paper, the others are best kept between two boards, as they otherwise curl up in the hot weather.

If it be desired to preserve the skeleton of a snake there is no alternative between laboriously dissecting away all the soft parts and obtaining the bones clean, but separate, by means of maceration. After the skin, inside, and greater part of the muscle has been removed, the snake should

* Corrosive sublimate (bichloride of mercury) being often required for these purposes, I may mention that it is procurable in the drug bazaars under the name (Tamil) of *Shavirum*. In Hindustani, the name is stated to be *Raskapūr* (meaning mercurial camphor); but this name is frequently and more properly applied to a sulphate of mercury. This substance is insoluble in spirit, and water changes it into the insoluble yellow subsulphate (*turpethum minerale*); this *raskapūr* would have to be sublimed with common salt to change it into bichloride of mercury. I have known many persons disappointed at getting this substance when they wanted corrosive sublimate.

be placed in a pan of water kept, covered, in some place where bad smells are of no consequence. The water should be changed occasionally, and after about a month's maceration the bones will be obtained perfectly clean but entirely separated; it is difficult even to save the skull from separation into its component bones. It is said that placing a dead snake in an ants' nest will produce a perfectly clean articulated skeleton, but this is hardly possible unless you can ensure that ants and ants alone shall have access to the specimen. I find that while ants are free enough with things not intended for them, their predatory instincts are hardly amenable to useful application.

CHAPTER IV.—Snake-poison and antidotes.

In a preceding Chapter we have seen the structure of the poison apparatus possessed by certain snakes and the mechanism of its employment. A sketch of its effects is required in order to complete the present brief account of the subject.

When we take into consideration the entire series of poisonous snakes, it will be seen that the toxic effect produced by their bite varies considerably in degree and in quality. For example, in the Australian genus *Hoplocephalus* the bite of one species, *H. curtus*, is fatal to human life, whilst another species, *H. variegatus*, can hardly kill the smallest quadruped, and on man its bite only produces a violent headache which may be averted by simply sucking the wound.* Amongst Indian venomous snakes the *Trimesuri*, a genus akin to the rattle-snakes of America are harmless against any but the smallest animals, though possessing a poison apparatus more highly developed than that of the deadly *Naga*; the effect too is different great swelling and some pain are the only

* Gerard Krefft, *the Snakes of Australia*, page 57.

sensations produced without any toxic symptoms, this being just the contrary of the effect produced by the bite of the latter snake. Nevertheless, if the bite be inflicted by any snake of highly venomous character, the constitutional effects appear to be much the same, that is to say, intense depression of the vital powers followed by loss of consciousness, convulsions and probably death. Bleeding from the mucous membranes of the mouth and alimentary canal is a frequent pathological feature. Experiments have always been made on animals, and cases of snake bite from well identified species come so very rarely under medical observation that our information is very incomplete.

The following is a sketch of it such as it is :—

Naga tripudians, the cobra, possesses a poison fatal to all vertebrate animals with the exception of a few other venomous snakes; the harmless snakes mostly succumb to its effect. It is hardly necessary to remark that a mongoos, if fairly bitten by a cobra, most certainly dies. A fair bite kills a dog in 5 to 60 minutes.* A man survives from two to twelve or even twenty-four hours. If the bite is a fair one, that is, made willingly and viciously by a vigorous snake on a part uncovered by clothing, the quantity of poison injected will almost certainly be sufficient to produce fatal results unless active local measures are at once adopted. Beyond a slight burning pain in the bitten part the patient usually suffers but little.

It would appear from the following case, one of the few extant in the records of white troops, that death may occur in a healthy European after as little as two hours :—

" The death from a snake-bite occurred when the regiment

* One of Dr. Shortt's experiments would seem to show that $\frac{1}{8}$ grain dry poison, equal to $\frac{1}{2}$ drop of fresh poison, has no effect on a large full grown dog, and that about $\frac{1}{2}$ grain, equal to $1\frac{1}{2}$ drop of fresh poison, is required.

was in camp for cholera. All the information I can elicit is that the patient reported himself at 10 P. M., an hour after the occurrence, and when the usual symptoms were rapidly advancing, and died at 11 P. M. The blood on examination was found to be dark and fluid; the wound was under the right nipple; and the snake was reputed to have been a cobra."—*Annual Report of the* 104*th Regiment for* 1862.*

Daboia elegans. Bites from this snake often occur in Burma where it is rather common; I am informed that in the Tharawadi district the Burmans when working in the rice fields, wear stout boots in order to avoid unpleasant consequences should they accidentally tread on one. It is a sluggish snake, not easily provoked to bite. A case of death from its bite occurred while I was in Burma in the person of a strong gunner of the battery stationed at Thyetmyo. The account which I received of the accident states that "Soon after day break as he was entering the fowl-house,† which is in close proximity to the barracks, he observed a dark thick-set snake of about two and a half feet in length [afterwards identified as a *daboia*] and that he took up a piece of bamboo and began teasing it, whereupon the reptile turned and bit him on the finger. The snake held on for a

* This case was the only one of the three Bengal deaths from snake-bite amongst white troops during the period 1861-72 which I was able to obtain. I succeeded in obtaining it through the kind assistance of Surgeon-Major Gibbon, officiating Secretary to the Inspector General B. M. S., Madras. The case is recorded in the A. M. D. Bluebook for 1862 but with the remark "no particulars are given." The two other cases are not mentioned in the Bluebook for the year. The only other case in India during the same period is the Thyetmyo case recorded above.

† Eggs are so dear in Burma that many soldiers keep fowls to supply themselves and the officers with new laid eggs. The fowl-house is a small hut made of planks put roughly together, and a good deal of rank vegetation usually springs up round it.

short time and it was with some little difficulty the man shook it off.*** The man came at once to hospital, being advised by one of his comrades to do so, when on the way he became very weak. The apothecary saw the patient on his arrival at hospital. It is supposed that a lapse of 20 minutes must have occurred from the time he received the bite until he reached the hospital and nothing had been done meanwhile in the way of remedies. The Apothecary immediately scarified the wounded finger freely, made the patient suck the wound and administered ammonia." For twelve hours no prominent symptoms appeared beyond swelling of the arm, restlessness and slight feverishness. Next morning he was found in a state of collapse, soon became unconscious and died 27 hours after the bite.

Bungarus arcuatus. Little is known about the effect of the poison of this snake on man, for the snake is very inoffensive and large specimens of it are rare; out of 10,810 deaths by snake-bite registered in 1869 in Bengal and the Provinces under the Supreme Government, 359 were ascribed to the 'krait.' From experiments on animals it appears to be as deadly as the cobra. A case of snake-bite admitted into the Madras hospital in May 16th, 1871, the man having been "bitten by a snake the character of which he could not recognize, on the dorsum of his left foot at 7 P. M. last night"* is attributed by Dr. Shortt to this snake. The man was admitted 9 hours after the accident, put on Dr. Shortt's potash treatment 17 hours after (when we may say that immediate danger had passed) and recovered slowly from the secondary consequences in four days. In the words of Dr. Shortt, "This is the 3rd case of snake-bite cured by the potash treatment, the two first were occasioned by cobras and the present one by a Bungarus."—(*Madras Medical Journal*, May 1872.) The ground for the presumption that

* Dr. Paul's Report, *Madras Medical Journal*, August 1871.

the snake was a *Bungarus* is that hæmorrhage from the mucous membranes was a prominent feature in the case.

Bungarus fasciatus is said by Dr. Fayrer to be somewhat less venomous than *B. arcuatus*. It is a much larger snake; nothing is known about the effects of its bite on man, as it belongs to the Malayan fauna and is very rare out of Burma and Chittagong.

Ophiophagus elaps is so rare, even in Burma, that accidents from it are not often recorded. According to the available accounts it is as venomous as a cobra; it is said that an elephant bitten by it died in about three hours. I have seen a Burman snake-catcher get bitten when playing with one (fighting is the more correct expression as this splendid snake was above 10 feet long and reared its head at least a yard off the ground). He used his ordinary remedy, chewing a dried vegetable pulp and applying the quid to the wound and was none the worse for the bite.* I may observe that this class of Burmans are little affected by these accidents, and I believe they have a remedy against them. The nature of this I could not find out; it is ascribed to the drug chewed, but I believe that gradual inoculation of cobra-poison is the secret.† This man, though quite careless about the bite of the cobra

* The snake was in perfect condition. I kept it for some time but had to kill it on my departure from Burma; its head is now in my collection.

† In the *Madras Medical Journal* for November 1870, I pointed out the possibility of careful inoculation with the poison of a snake being an antidote against the effects of a bite from a snake of the same family. Since then, March to July 1871, Dr. Shortt appears to have made an experiment on this point. A dog was inoculated—on 18th March with one-sixth grain dry cobra-poison—on 13th May with one-twelfth grains—on 18th May with one-seventh grain. No ill effect was produced. On 4th July half grain was inoculated, and the

or the hamadryad, was very cautious in handling the *Daboia;* he considered that he was not proof against the poison of that snake and said that a finger, the absence of which I had observed, had been chopped off to save him from the effects of a bite he had received in handling it.

The *Callophides.* Of the effects produced by the bite of these snakes we know little or nothing. They are very small and have such short fangs that fatal results are not much to be feared. They are by no means common in India.

Sea-snakes. The *Hydrophidæ* are, as far as we know, all venomous. A case is on record, where a sailor of a man-of-war anchored at Madras, was bitten by a sea-snake 7½ feet long while handling it. Two and a half hours afterwards he was seized with black vomit and spasms of the throat; and he was dead in four hours after the bite.

These snakes are usually very inoffensive; though the Indian coasts swarm with them it is extremely rare that any accidents happen to the fishermen. Out of the water they are blind and sluggish. In the following case, recorded by Dr. Fayrer, the person was bitten while bathing, and curiously enough had not the slightest idea of how his illness occurred until a Burman remarked that his symptoms were those of the bite of a sea-snake. The case is that of a ship Captain at Moulmain, who while bathing at 8 P. M. felt a bite which he thought was that of a crab.

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dog died in 18½ hours, the symptoms coming on slowly. But, as Dr. Shortt observes, the experiment was irregularly carried out.

It may be asked why I do not make these experiments myself. The reasons are 1° that I have a great dislike to anything like cruelty to animals. 2° That in experiments on snake poison the slightest approach to the discovery of an antidote appears to affect that part of the brain in which phrenologists locate the faculty of judgment. I do not wish to expose myself to the risk of this mental aberrance.

Up to 10 P. M. he was quite well; in the night rigidity of the muscles came on and at 4 A. M. vomiting. In the morning at 8 o'clock, the bite, on the foot, was discovered; he had rigidity and spasms of the muscles all day. On the next day he remained in the same state, at 6 P. M. spasms set in and at 7 P. M. he died—49 hours after the bite.*

The treatment of the bite inflicted by the highly venomous snakes is an unsatisfactory and a very unpleasant subject to deal with. Amongst the medical men of India and Australia who have made a speciality of snake-bite and its treatment, several antidotes have been found and used with great success by their respective inventors. From the days of the Tanjore pill to the year 1873 the story to be recorded is much the same. Numerous Medical men have found the external and internal administration of ammonia to be a specific; but experience on man and experiment on animals have shown it to have little if any effect. Dr. Halford, of Melbourne, proposed to inject ammonia into the veins, and his treatment has been adopted with great success by some Australian Medical practitioners; moribund persons rise at once, walk and eat. Unfortunately there is another side to the question; not in a single case was there evidence that the snake was of a deadly character, and it is well known that Australian venomous snakes have such short fangs that bush boots or even ordinary cloth trousers are an efficient protection against accident from them. Moreover the experiments of Drs. Fayrer (Calcutta), Hilson (Bijnour) and Richards (Balasore) on animals bitten by cobras show that the remedy has not the slightest effect.

The treatment used by Dr. Shortt and which he claims has cured the three men on whom it was used is the ad-

* Not 71 hours as stated by Dr. Fayrer, unless there be a mistake in the dates.

ministration of potash internally and externally, by draughts, enemata, fomentations, baths, &c. Suffice it to say, that of the three cases thus treated, one was Dr. Shortt's own snake-catcher, the second was a pariah coachman bitten in the evening by a snake which the man said was a cobra, the third was the case attributed to the bite of a *Bungarus* and to which I have already alluded. In the first case the local treatment (incision and suction) at once adopted appears to deserve more credit than the antidotal treatment afterwards employed; in the last two cases the evidence is very unsatisfactory. Dr. Shortt considers that potash neutralizes snake poison; brandy administered along with it "roused the nervous system, excited the circulation, and thus carried the potash into it as rapidly as possible and enabled it to overtake the poison in the blood." —(*Madras Medical Journal*, May 1872). Unfortunately for the theory as well as for the practice of the treatment it does not succeed even in the hands of its inventor, for the cobra-bitten dogs into the blood of which Dr. Shortt injected potash died as surely as those into which he injected ammonia or those he left alone. The only dog which survived (and it had a narrow escape) was injected with somewhat less than a grain of dry poison dissolved in two drachms of water and then mixed with half a drachm of solution of caustic potash.* Now we know that caustic potash in tolerably concentrated solution destroys many organic principles (such as that of hyoscyamus), so this solitary exception is easily accounted for. A drachm of Liquor potassæ added to a draught containing hyoscyamus would by destroying the narcotic prevent it from taking effect, but there would be little chance indeed of draughts containing Liquor potassæ having any beneficial effect on a patient who had taken an over-dose of hyoscyamus. It is

* Reports of Dr. Shortt's public experiments, *Madras Medical Journal*, March, April, May, 1870.

evident that *neutralization* of the faintly acid cobra-poison is quite ineffectual, for it is as readily neutralized by ammonia as by potash; but as the former alkali has no tendency to destroy it, cobra-poison mixed with Liquor ammoniæ shows no diminution of activity whilst that mixed with Liquor potassæ may show an appreciable diminution. If further proof were needful, I might mention that the blood is sufficiently alkaline of itself to neuturalize the acidity of any amount of cobra-poison.*

The last antidote proposed is to the effect that artificial respiration and galvanism has been tried with success in dogs affected by cobra-poison. This is evidently on the theory that cobra-poison acts by paralyzing the respiratory muscles and that artificial respiration will enable the patient to tide over the crisis until the poison becomes naturally eliminated. This idea, borrowed from Mr. Waterton's experiments with the

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* It may appear singular that a medical man should fall into the error of supposing that the secretion of a salivary gland could consist principally of an acid capable of being rendered inert by neutralization with an alkali. But really what can we expect when we find that Dr. Shortt's notions on the gland and its secretion are so vague that he imagines the former to be a little bag situated at the base of the fang, capable of being removed not only without injury to the snake but without any trace of the operation being visible except on the closest scrutiny, and also capable of reproduction so perfectly that the operation can be repeated once a month. (M. M. J., Nov. 1871, pages 346 and 347.) That this gentleman should have neglected to prepare himself for his experiments by some study of ophiology is so little credible that I quote the passages :—"Some [snake charmers] go further and cut out that portion of the jaws which contains the poison gland."—"My curiosity being excited, I examined the mouth of the snake again more carefully, and found a small cicatrix at the base and a little beyond the fang, and a more scrutinizing examination discovered to me that the entire poison gland had been removed, although the fangs were left unmolested : and I also learned that this operation of removing the poison gland is resorted to once a month and that it was effected by an iron style."

wourali poison, does not promise much; indeed it has before been tried without success. The wourali owes its toxic effects to an alkaloid *curarine* producing muscular paralysis by a specific action on the motor-nerves, whilst snake-poison appears rather to act as an animal ferment exciting diseased action in the blood; the affection of the lungs is quite secondary to that of the blood. The action of snake-poison appears to be not dissimilar in kind from that of mad-dog poison; both are toxic principles residing in a natural salivary secretion; and the analogy will be more apparent if it be remembered that hydrophobia has been produced in man by the bite of a dog not apparently affected with rabies.*

My own opinion regarding the nature of snake-poison may be thus stated:—In certain of the salivary glands of snakes there is secreted a ferment analogous to the *ptyaline* of the salivary glands of mammals. This ferment belongs to the class of albuminoid substances in which several other ferments are comprised, ptyaline, pancreatine, pepsine, diastase, emulsine, &c., and like them its power is limited (that is, it becomes exhausted when it has produced an effect proportionate to the dose used, not being renewed at the expense of the substance acted on as in the case of most vegetable ferments). There are several kinds of it which

* Such cases are rare, but there is not the slightest doubt that they occur. Since writing the above lines, I saw in the *Lancet* of 29th March 1873, an account of a death from hydrophobia, in the person of a medical practitioner in Jamaica; he had been bitten a few months before by a pet dog, which was in perfect health at the time of his death. Another case is recorded in the *Madras Medical Journal* for March 1872. There is ample evidence that a dog free from any symptom of rabies may secrete saliva producing hydrophobia when inoculated in man; but there is no evidence to show whether the secretion of the toxic saliva was spontaneous or consequent on the bite of a dog either rabid or similarly affected. If it arose spontaneously, might not the property become hereditary?

may be called *elapine, viperine, crotaline,* &c., according to the snake by which it is produced. Its toxic effect varies in each of these kinds and at present we have little knowledge as to its mode of action. I am inclined to think that, in the cobra-poison at least, the effect of the ferment is to set up a diseased action in the blood rendering it incapable of circulating through the lungs. Hence the symptoms of death from asphyxia.

Considering that snake-poison can be obtained in considerable quantity and that it preserves its properties when dried, one may reasonably be surprised that it has not been better studied. Unfortunately sensationalism has invaded this branch of medical inquiry and the prominence of the antidote question has prevented the systematic examination of the poison which would prepare the way for the discovery of the antidote. There is no excuse for the neglect of systematic examination of the subject in the course of empirical research after a remedy, for this object, if attained, is by no means so practically useful as would at first sight appear. One might almost count on the ten fingers all the authentic cases of venomous snake-bite which have occurred amongst Europeans in India during the last half-century; and on the five fingers all those attributable to accident only. With the exception of the Army cases of which I shall presently speak, I only know of one case where a European has been bitten otherwise than through his own imprudence; he recovered and the snake is said to have been a cobra. Apart from the interest of the subject, when studied in a scientific manner, I think that snake-poison experiments do harm by keeping up a sensational excitement and by diverting medical energies which would be far better employed in seeking a remedy for diseases more obnoxious to Europeans in a week than all the snake-bites of a century. Europeans do not need antidotes, and the black population of India are out of their reach. If all the *real* cases of deadly snake-bite which come

under medical observation in India were cured, the mortality from this cause would not be reduced by one per cent.

The annual Indian mortality from snake-bite is stated to be not far from 20,000.* This sounds alarming, but it must be remembered that it occurs in a population of 251 millions, nearly one-quarter that of the whole world. Reduced to sober death-rates it signifies a mortality of 80 per million. This number corresponds very fairly with the mortality from the same cause in the Madras Presidency in which the reported deaths from snake-bite are about 2,000 annually.

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* In 1869 the deaths from snake-bite in Bengal and the Provinces under the Supreme Government were reported to be as follows :—

	Deaths.	Population.	Mortality per million.
Bengal	6,219		
Orissa	350	60,000,000	111
Assam	76		
North-West Provinces...	1,995	28,350,000	70
Punjâb	755	17,100,000	44
Oude	1,205	10,800,000	111
Central Provinces ...	606	8,325,000	73
Burma	120	2,250,000	53
	11,326	126,825,000	Average 88

The population of the several provinces I have calculated by deducting 10 per cent. from the numbers obtained in the census of 1872, as I find that the population of the Madras Presidency has increased at the rate of about 3¾ per cent. annually since the last census. In the document from which the number of deaths above given is extracted, the total population is taken at 121 millions which gives 93 per million as the average death-rate from snake-bite. It will be observed that the death-rate is least in Burma and in the Punjâb; may this be from the manlier character of the people of these countries and from the absence of the domestic reasons for murder which exist amongst the Hindoos? It is certain that Burma is more infested with venomous snakes than any part of India, but a Burman would not lie down and die as a soft-fibred Hindu might were he bitten by a snake of slightly venomous character.

In 1869 they were 2,192 which, on a population of 26,600,000, gives 82 per million.

Taking this rate for granted (although snake-bite covers a multitude of suspicious deaths in the mofussil,) we must still compare it with other causes of mortality; we thus have for the Madras Presidency—

82	deaths	by snake-bite, per million,
23	do.	by wild beasts,
176	do.	by drowning,
70	do.	by other accidents,
17,400	do.	from all diseases in a healthy year,
(besides 300 to 8,500	do.	from Cholera).

To give an instance of the purely sensational character of the outcry for the necessity of reducing the mortality by snake-bite, I will quote the records of the British army in India during the years 1860-71. In these twelve years there were only four deaths by snake-bite *but thirty-eight from dog-bite.* Taking the total strength for the twelve years as a population of 717,592 Europeans for one year, we find that the annual mortality amongst them from snake-bite was at the rate of only 5·5 per million.* It is curious that whilst sensation has fixed on the mortality from snake-bite, amounting to 82 per million in Indians, and 5½ per million in Europeans, nothing is said about the 53 deaths per million caused amongst Europeans by dog-bite.†

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* One of the four cases I have shown was from imprudence. (See Appendix).

† The perfect inefficacy of the war waged annually against the dog population affords evidence of the hopelessness of attempting the extermination of venomous snakes. Every town and village in India is invested with dogs which are utterly useless, a great nuisance and danger, and dependent entirely on man. Nothing

Though we are exposed to a horrible death, causing a mortality amongst us ten times greater than that caused by snake-bite, and perhaps twenty times greater if we exclude accidents from imprudence, yet we take no heed of the obvious and preventible danger, reserving all our zeal for the comparatively insignificant and perfectly unpreventible danger caused by the presence of snakes in the land.

The time, thought, and money wasted on the chimerical endeavour to reduce the mortality from snake-bite would be better employed in diminishing the deaths from preventible disease. While it is authoritatively owned that a million of lives could be annually saved by placing quinine within reach of the whole Indian population, I am at a loss to imagine how any one can obtain the ear of Government to such a trifle as the mortality from snake-bite. But the subject is a sensational one and there is more rejoicing over a dubious case of cobra-bite recovered than over a diminution of death-rate signifying a hundred thousand lives saved. As long as Englishmen in India wear their feet shod and their legs clothed the risk of death from snake-bite is small indeed. I may thus exemplify it:—An Insurance Company could afford to pay £1,000 in case of accidental death from snake-bite, for an annual premium of one penny from each English person

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would be easier than to exterminate the breed were the measure vigorously carried out directly by destruction and indirectly by a license-tax, yet any one can see that the rewards paid for dog-killing are perfectly wasted and that the system is too often one of time honoured peculation. If there is practically such difficulty in keeping down the number of these animals, every one of which is bred amongst the habitations of men, how much more difficult must it be to effect any appreciable diminution in the case of animals which swarm in the country without attracting observation and are entirely independent of man.

in India. As regards the Indian population, our philanthropy might, as I have before said, find better objects than the mortality from a cause of which the sufferers do not complain and which is practically unpreventible.

It may be asked, however, what is to be done in case a servant is bitten by a venomous snake. Well, supposing this very rare accident to occur (for the bitten man's own statement is not often worth much) the circulation of the part bitten should be isolated as much as possible by a string or twisted handkerchief tightly tied round it, the wound laid open and vigorously sucked ; if it can be cauterized *at once* either by a hot iron, the explosion of gunpowder, a strong acid or alkali, this may be done—but it is no use inflicting this painful treatment unless it can be done immediately—which is practically all but impossible. After this, let the patient take his chance, as it is quite possible that the snake was not a venomous one or that the patient did not receive a fatal dose of poison. He may be perfectly certain that it was a cobra, or a *kati viriyan* or a *mandali*, &c., &c., &c., and yet it may have been only a dhāman or the harmless little *Lycodon aulicus*. I never met an Indian who didn't declare the latter snake to be very deadly ; besides it is often very like *Bungarus arcuatus* in coloration, and the length of its anterior maxillary teeth might easily lead Europeans examining it to believe that it possessed poison-fangs. From its habit of lurking about dark places, it is often disturbed by servants entering godowns and bath-rooms ; the man treads on it, feels that he is bitten, sees this snake scuttling away, and then rushes out half-dead with fright, crying out that he was bitten by a venomous snake. Every symptom of really venomous snake-bite may come on ; and in weak or nervous subjects death might possibly occur. But in the large majority of such cases remedies are applied, the patient recovers, and the antidote used is in high repute.

In an average case of snake-bite the following points are in favour of recovery :—

1° The person may have been bitten through clothing. The penetration of a cobra's fangs is hardly more than one-eighth of an inch, never a quarter of an inch, so that a very thin cloth will reduce the depth considerably, perhaps sufficiently for the apical orifice of the fang (which is nearly $\frac{1}{16}$ inch above the point) to be scarcely beneath the surface of the skin.*

2° The bite may have been a scratch rather than the strong and vicious bite necessary for the injection of poison.

3° The snake may not have been of a venomous kind. Unless the snake is produced and recognized as a fairly grown specimen belonging to the kinds fatal to human life, there is no certainty. The statement of Indians is rarely worth anything.†

Of land-snakes, the cobra, the *daboia* and large specimens of *Bungarus arcuatus* are practically the only Indian snakes dangerous to human life. In Burma the last mentioned snake is replaced by *B. fasciatus*.

In an undoubted case of deadly-snake bite, I do not consider that any good is done by other measures than the immediate local treatment. There appears to be not the slightest use in

* Here is one fallacy of the Australian cures. The longest fanged Australian snake has fangs about half the length of a cobra's, so that the penetration could never exceed one-eighth inch, and would generally be about one-sixteenth ; the most flimsy cloth would in the majority of cases prevent the bite taking effect.

† I have seen an intelligent Englishman, considered rather an authority on snakes, declare that a *Ptyas mucosus* just brought to me was a cobra ; he even pointed out the poison-fangs.

the administration of stimulants; it is best to let the patient lie quiet, giving him plenty of cooling drink such as lemonade, soda water or effervescent draughts.

To illustrate how may chances there are in favour of the bitten person, even when the snake is certainly venomous, I may quote the following cases which occurred within the last three months:

A kuruven who was in the habit of bringing cobras for the Government reward, was bitten in the ball of the thumb by a cobra whilst in the act of handing it to me. One fang penetrated and the wound bled freely. By the time I could dispose of the snake and get my instruments, at least three minutes had elapsed. I tied a string round the base of the thumb and with a sharp-pointed knife followed the track of the fang down the wound, which had penetrated to its full depth below the skin. I told him to suck the wound, which he did in a very nonchalant manner. Not the slightest symptoms appeared. In the meantime I took up the cobra, which was in perfect condition, squeezed out the poison from the glands and despatched it as usual. By the time half an hour had elapsed, the man got tired of sitting sucking his thumb and went off. He has been perfectly well ever since.

Two pariahs, who used to bring snakes, got drunk one Sunday and were bitten whilst playing with the snakes they were keeping to bring me on the morrow. They came to me in great fright. One had two lacerated fang marks on a finger, his hand being also swollen; the other was slightly scratched on the leg. The former had fastened a string round the finger above the wound; the latter had done nothing, the scratch being trifling. The seriously wounded man wanted medicine; as the wounds were inflicted about a quarter of an hour before, I did not see much use in inter-

ference, and as the man had a good quantity of arrack inside of him I contented him by means of a draught of water coloured pink with dentifrice lotion, and they soon took their departure without any constitutional symptoms appearing. The man's hand was swollen when I saw him next day. The cobra by which these men had been bitten, and which they brought with them, was in perfect condition.

In these cases the cobras had evidently bitten without injecting poison; I have no doubt that this happens frequently and that many of the authentic recoveries ascribed to antidotes are really due to the want of malice on the part of the snake. Had I been an antidote enthusiast I might have made some nice cases of cure out of these accidents.

CHAPTER V.—Schemes of extermination.

At a time when Government is continually been urged to undertake the extermination of the venomous snakes in India, a few words on the subject may not be out of place.

The idea is, I consider, theoretically preposterous and practically impossible of execution; moreover, attempts to carry it out result in the waste of public money sadly needed for much more important sanitary objects.

The idea that Government is to spend large sums on protecting people from animals which a child can destroy by a blow with a stick is preposterous. Rewards for the destruction of wild beasts one can understand, as the service demands both courage and skill, but one cannot seriously listen to a proposal the effect of which would be to turn half the labourers of the country into snake-hunting loafers, and to spend money which could be much more advantageously employed.

The outcry against venomous snakes I have shewn to be purely sensational, and the persons who raise it have not the faintest idea of the waste of public money they are urging on Government. A medical man who should know better, writes, "is there no benevolent individual in this Presidency who would give a few rupees to rescue the lives of so many of our fellow-creatures so suddenly and rapidly put out of existence?"* and proposes to raise a subscription fund, the interest of which should be expended for the purpose of destroying noxious snakes (*M. M. J.*, Feby. 1871). One cannot but give credit to Dr. Shortt for wishing to effect the destruction by voluntary subscription, however much the proposal to wage warfare with Rs. 250 per annum may remind one of the energetic old lady's assault on the Atlantic Ocean with her mop. The outcry for the extermination of venomous snakes is rarely so modest and, if the system urged on Government were ever carried into effect, the funds required would amount to many thousand times as much as the above moderate estimate. But Indian estimates are always small at first.

I will now give a few facts to show the utter absurdity of these schemes and the waste of public money caused by the sensational outcry against the ravages of venomous snakes.

In Bancoora, a small district of Lower Bengal, no less

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* Dr. Shortt, who writes to the above effect, and says that a snake which has bitten one person "is permitted to use its deadly fangs on many more" (as if there were man-eating cobras going about) has the sense to own that "even if an antidote sure and certain in its effects as a remedy, be discovered, it would not save the lives of the hundredth part of the people who are now killed by snake-poison;" that is to say, that not one Indian in a million would be on the average benefited by the discovery (the mortality from reputed snake-bite being, as we have seen, considerably under 100 per million annually).

than 44,450 venomous (?) snakes were brought in for reward between May 29th and December 7th, 1869. As the reward was for the greater part of the time at the rate of 4 annas a head, not less than Rupees 10,000 must have been spent in this attempt at extermination. Let us now make a little calculation; the district swept of snakes being that immediately round the kucherry, could hardly have been more than 100 square miles in extent but let us say 150 square miles; now supposing that this extermination were carried out all over India, an extent of about 1,500,000 square miles, we should have 10,000 such areas each costing at the rate of Rupees 17,000 per annum for snake extermination, thus making a total item of 1,700 lacs of rupees in the annual budget. I have estimated the snake-yielding area of Bancoora very liberally; supposing it to be only 15 miles, a more probable extent, there would be 100,000 such areas.

It may be objected that the Bancoora snakes could not all have been venomous. Granted; they were probably not so, but we cannot make a department of ophiologists to superintend the disbursement of rewards, and must needs confide it to the civil authorities. Supposing the rewards were in every case to be disbursed by an officer versed in ophiology and devoting his whole time gratuitously to the extermination—then really venomous snakes would alone be paid for; but the rates must, of course, be higher than when any snake is accepted as venomous on the *dictum* of a kucherry peon,* and from my experience in Bangalore I may say that it could not be fixed at less than four annas. Now, in

* I found that in the Bangalore municipal snake extermination of 1871 about 5 per cent. of the snakes paid for were really venomous. In the present year, the destruction was transferred to me by the Mysore Government for experiment and report. Every snake recorded in Appendix B was examined and registered by me.

Bangalore, a station where Rupees 550 were spent in 1870 and Rupees 500 in 1871 on this very object, no less than 1,400 venomous snakes were brought in for reward (1,225 to myself) between 1st May and 30th September 1873. In August they were brought in at an average of 32 daily, and the expenditure became so great that the reward was reduced from 8 annas to 3 annas. Notwithstanding this reduction, the venomous snakes still come in (at the present date) though at a slower rate, and I have not the slightest doubt that for years to come 2,000 cobras annually could be produced by the 20 square miles comprising Bangalore and the immediate neighbourhood. From observations on the numbers of cobras produced at each breeding season and the small extent of the ground actually hunted over in the destruction of the 1,400 cobras, I estimate the cobra population of this station at 1,000 to each square mile; Bangalore is, however, no worse off than the average of other parts of India the only difference is that the cobra is nearly the only venomous snake found in Bangalore (See Appendix) while in coast stations venomous snakes are generally more numerous and in greater variety. Now with a venomous snake population which I may fairly estimate at an average of 1,000 per square mile, four times the human population, the cost of exterminating the breed can be readily calculated. In these hard times a lac of rupees cannot be thrown away; hundred of lacs would have to be spent before any diminution in the venomous snake population could be appreciable. One slight compensation might be found; a good deal of the money spent in rewards would return to Government in the shape of duty on spirituous liquors.

CHAPTER VI.—Snake mythology.

In nearly every part of the world there exist legends showing the wonder, fear, and veneration inspired by snakes. In many instances the ophidian nature of the legend is hidden by changes and overgrowths, but it can generally be traced to the form it possessed in other times or countries. Most of these legends are of distinctly Asiatic origin, evidently carried by Aryan or Turanian emigrants to the countries they peopled; and nowhere can they be better studied than in India where the habits of these races have changed comparatively but little. The Amravati sculptures show Turanian (Dravidian) people worshipping the many-headed *naga*, and Mr. Ferguson in his work on *Tree and Serpent-worship* considers that this form of religion is essentially Turanian and was abhorrent to the Aryan race. This, however, is more than doubtful. All that can be said with certainty is that whilst the aboriginal and the Dravidian races of India are strongly disposed to serpent-worship pure and simple, the veneration of the Aryan races for the serpent is largely caused by its having become a phallic symbol with them. In the early ages of man, serpents naturally became endowed with supernatural attributes and shared with the heavens and meteorological phenomena the awe of the superstitious. The mysterious death caused by the venomous kinds, their silent gliding motion, and the curious periodical casting of the skin inspired probably the first feelings of idolatrous worship and, exploited as these have been by the priest-craft of all ages, uncivilized man still looks on snakes with awe whilst civilized man, often not less ignorant, regards them with fear and hatred.

Whether in consequence of occurrences similar to that recorded in the story of Tiresias or simply from priestly

devices, the serpent early became connected with phallus-worship and thus acquired still greater religious significance. In the Mexican tradition of the serpent-mother of mankind, in the Hebrew legend of the temptation of the first woman, in the Karen story of her cohabiting with the python, in the Sanskrit account of the churning of the ocean by means of the eternal *naga* Ananden, we find the serpent occupying a similar place in cosmogony and the origin of the human race. This phallic symbolism of the serpent took considerable development and was adopted in nearly every religion of antiquity. It was introduced, with many other heathen symbols into christian rites, its phallic source being masked by its significance of eternity, of the resurrection, &c.*

When by the 'decentralization' of the attributes originally belonging to the Hindu *Trimūrti*, each member of it, or two of them at least, became invested with the powers of creation, preservation and destruction formerly allotted separately to the three members, we find the symbolical serpent sharing in the multifariousness of functions and appearing as a symbol of the three supreme attributes; he is a creator, a preserver, a destroyer. In the phallic form of serpent-worship the creating and preserving attributes are adored, and this worship widely spread in India is found in other countries, even in Germany. Considered as a destroyer, the serpent-demon inspires no less awe than the serpent-creator and guardian obtains reverence. The monster emerges from the waters to devour women, the night-dragon tyrannizes over the earth and is slain by solar heroes. The christian devil, bearing an Aryan name and an adaptation of Sīven's trisūl, ends in a serpent's tail. In modern times, especially in Europe, where snakes are less common than in Asia, the phallic form of serpent-worship is often dis-

* See the curious notes on this point in de Gubernatis' *Zoological Mythology*.

guised by its transference to fishes; the snake (*anguis*) is replaced by the eel (*anguilla*), the twin-serpents of Mercury* by the twin-fishes sacred to Venus.

Hindoo mythology constantly refers to the *Nagas*, a race of beings intermediate between snakes and men and corresponding to the fallen angels of Semite mythology; they have a king, the eternal serpent Ananden or Vāsuki, also called Nagendren, Sarpendren,† &c., &c.; they live in a world or Lokum of their own, the capital of which is Bhogavati. The affinity of these Nagas to snakes, especially to *naga* the cobra, is one practical reason of the respect paid to snakes by Hindoos; for the *Nagas*, like fairies and demons, are very malicious, though beneficient to those who pay them proper respect. An injury done to *naga* the cobra would, in the mind of a good Hindoo, certainly bring down on him the vengeance of the *Nagas*.

The apparent contradictions constantly met with in Hindoo mythology owing to the decentralization of the Trimūrtic attributes extend also to the mythical snakes. Thus Sīven, in his destroying personation, wears a necklace of *nagas* emblems of death; but as destruction is only apparent and results in the re-appearance of force and matter in new shapes, he is also a creative power and is adored as such under the symbol of the lingam, with which the snake in its phallic aspect is closely connected. Again, Vishnu is called by many names significative of his reposing on the great snake Ananden, whilst his *vahum* (carrier) Garuden, king of the birds, is known by names derived from his enmity to snakes. The great snake Ananden or

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* "Preller and Kuhn have already proved the phallical signification of the *caduceus* (tripetêlon) of Hermês, represented now with two wings, now with two serpents," (de Gubernatis, vol. ii, page 399).

† With Sarpendren, King of serpents, compare Sapengro in the Gipsy language.

Vasuki, sometimes represented as the supporter of the world is said to have accompanied Vishnu in his avatars. According to this view, Lakshmanen, Ramen's brother, and Balarāmen, Krishnen's brother, were both avatars of the snake Ananden.

Krishnen when bathing in the Kavery river, was attacked by a great snake named Kāliyen, but he vanquished it and, on its submitting, condemned it to exile.*

In Mysore there is everywhere to be found most distinct evidence of serpent-worship being of a phallic nature. Nearly every tope of trees about Bangalore contains a group of stones with figures of snakes sculptured on them; most people observing these would imagine them to be 'sāmy-stones,' mere peace-offerings to demons. They are in reality votive offerings set up under the following circumstances:—

A barren woman desirous of offspring has three stones carved and deposited with certain votive ceremonies in the well of the house. Should her barrenness cease the stones are taken up and placed with much ceremony (including presents to priests) on a mound made between a peepul (*Ficus religiosa*) and a neem tree (*Azadirachta indica*); for this purpose a young neem tree is generally planted near a full grown peepul tree. The middle stone bears the image of the goddess Balyama or Mināchi (the fish-goddess) a personification of Pārwadi, wife of Sīven;† the lower half of her body is scaled and ends in a fish's or serpents'

* This episode is often seen in temple sculptures. Krishnen stands on the serpent's head holding its tail in his uplifted hand. In correct pictures Kāliyen is represented as a spotted water-snake. But there is a story that the spectacles on the cobra's neck are the marks of Krishnen's feet, and Hindu artists who accept this account often make Krishnen stand on the cobra's head as a pedestal.

† According to some accounts Mināchi was an avatar of Ananden who accompanied Vishnu in his fish-avatar as in the Ramen and Krishnen avatars.

tail. One of the side stones is sculptured with the figure of the *sesha*, a five or seven-headed cobra (a representative of Ananden) the other bears the twin-serpents of Mercury's caduceus. On one of these figures, generally in the uppermost of the rings formed by the entwined pair of snakes, is the *lingayoni*, the combined generative emblem of both sexes; and in another ring is a radiated circle which, I imagine, represents a cluster of snake's eggs.*

The legends on the subject of snakes, especially the *naga*, are endless; the following basilisk-myth which I gathered in Malabar, is an example out of a number.

When a cobra finds a pot of gold (the *naga* demons are guardians of under ground treasures) he lies down on it and guards it; the gold shrinks, and after many years concentrates itself into dust and a single luminous gem of immense value called the *mānikkum*. By this time the cobra has also shrunk to a small size, he takes the *mānikkum* in his mouth and flies away to bathe, his track being shown by the radiance of the gem. Shooting stars are thus accounted for. He goes to bathe in the north-sea. It is considered unlucky to see him flying North, but lucky to see him returning from that direction.

Sometimes this cobra is killed for the sake of the *mānikkum*. To ascertain the value of the gem, gold is poured over it; it floats on the surface of the gold until its full value has been poured; it then sinks.

Some of the stories told about the sand-snakes *Gongylophis conicus* and *Eryx johnii* appear to be connected with a solar myth. These stories originate in the old idea of

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* Compare de Gubernatis on the reverence in which snakes are still held in some parts of Germany as domestic guardian genii, bestowing welfare and fruitfulness on the family, especially its female members.

the *Amphisbœna*, a snake supposed to walk forwards and backwards with equal facility; its extremities were also supposed to exchange functions every year, and it died on producing its young. The 'double-headed' snake is manufactured by snake-jugglers and exhibited to the credulous, European or Indian.

The fiction of the 'male cobra' (*Ptyas mucosus*) and the many marvels told about venomous, or supposed venomous, snakes do not demand any notice; as far as I have seen their absurdity is not redeemed by any interesting circumstance of origin.

The reverence paid to the *nāgam* is dying out in India with the decay of the Hindu religion, but it is still widespread. It is considered a lucky thing if a cobra takes up its abode in or near the house and the snake is propitiated by offerings of eggs and milk; if it does not consume these, it yet appears to appreciate the feelings which prompted their offer and to refrain from any injury to the occupants of the house. It certainly does good by keeping down the rats. Accidents sometimes happen from a person treading in the dark on one of these half-tame cobras, but they are by no means frequent, and the Indians who do not regard the cobra with feelings of love at least have sufficient respect for it not to wantonly incur the vengeance of the serpent-demons by doing it harm.*

In Malabar the legend of Parasurāmen teaches forbearance towards the naga. According to the Kēralōlpatti, Parasurāmen (an incarnation of Vishnu) standing on the heights which then formed the coast of the Western sea,

* Of course I speak here of respectable Hindoos; for amongst the pariah castes and the aboriginal tribes commonly known as 'jungle people,' there is no hesitation in killing a cobra for the sake of the reward. But in the absence of this motive, even these people show towards snakes the passive humanity usual to Indians.

threw his hatchet into the sea; it flew as far as Gokarnam, and so far the sea receded, all along the coast. He then rendered the land stable by foundations of gold and brought in Brahmins from different countries; but the newly formed land was so infested with snakes that the colonists would not stay and returned to their own countries, leaving Kérala to the Nāgattānmār (nagas or naga-demons). Parasurāmen went in search of new colonists, and having brought Arya Brahmans he divided the land into 64 grāmams, (parishes) and in each allotted a part to the snakes. He ordered that the snakes should be propitiated by pūja and regarded as household divinities, and this being done the colonists were troubled by them no more.

When we find legends of this kind interwoven with the religion and history of the people it is not to be wondered at that destruction of snakes is as unpopular with them as it is popular with us. Snakes do us no appreciable harm but the majority of English people hate them for religious reasons as much as the Hindus venerate them for religious reasons; however, before we attempt to carry out our fanatical or prejudiced hatred of them, it is well to see whether such measures might not possibly be injudicious, from a moral point of view, as well as impotent and wasteful of public money. The Hindu religion is decaying from contact with western civilization, the veneration for snakes is dying out, and, before long, whenever these become a decided nuisance, people will at once proceed to thin their numbers without scruple and without the incitement of reward. In the meantime let snakes be studied by the light of science, free from the influence of legend and prejudice.

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APPENDIX A.

Table showing the mortality from Snake-bite and from Dog-bite amongst White troops in India in the 12 *years* 1860-71.

Year.	Strength.	Deaths from Snake-bite.	Deaths from Dog-bite.			Total.
			Bengal.	Madras.	Bombay.	
1860	64,455	...	4	1	2	7
1861	57,082	...	1	...	1	2
1862	63,713	1 (Bengal)	3	1	2	6
1863	67,525	1 (do.)	2	1	...	3
1864	65,102	...	3	1	1	5
1865	62,589	...	2	...	...	2
1866	58,901	...	2	...	...	2
1867	56,896	1 (do.)	1	...	...	1
1868	52,887	1 (Madras)*	1	...	...	1
1869	55,988	...	1	...	...	1
1870	55,380	...	2	1	...	3
1871	56,974	...	4	1	...	5
Total	717,592	4	26	6	6	38

* In Burma which is garrisoned from the Madras Presidency.

The total deaths from all causes (including deaths of Invalids on the voyage home) amounted to 19,182 or 26·7 per thousand (26,700 per million) annually.

The deaths from snake-bite were at the rate of 5½ per million annually.

The deaths from dog-bite were at the rate of 53 per million annually.

APPENDIX B.

Table showing the number of venomous snakes for which the Government reward was paid in BANGALORE *from May to October* 1873.

Period.	No. of days.	Cobras.			Other venomous snakes.			TOTAL.	REMARKS.
		Well-grown.	Young of the season.	In the egg.	*Bungarus arcuatus.*	*Dabcia elegans.*	*Echis carinata.*		
	Reward.	8 *annas.*	2 *annas.*	½ *anna.*	4 *annas.*	8 *annas.*	4 *annas.*		
May 22-31st ...	10	13	...	50	...	...	...	63	Of the 718 well-grown cobras, only 7 were under three feet; one half were between 4½ feet and 5 feet. They comprised 308 males & 410 females. On August 15th there were brought 55 well-grown cobras and 5 young of the season. The expenditure in August averaged Rs. 14 daily.
June	30	100	77	...	1	...	...	178	
July.....	31	201	79	...	...	...	...	280	1,000.
Aug. { 1st, 2nd, 7th-19th	15	404	74	...	1	...	...	479	
		Rewards reduced to 3 *annas.*	1 *anna.*						
Aug. 20th-31st.	12	67	25	...	...	...	1	93	
September. ...	30	116	14	...	...	2	...	132	
	Total ...	901	269	50	2	2	1	1,225	

Between May 1st and 21st, rewards were disbursed by the Sub-Magistrate to whom 135 cobras were brought.

In the present month (October) cobras are still brought at the rate of about 4 or 5 daily.

Sequel of Appendix B.

Table showing the mortality from "Snake-bite and Wild beasts" in BANGALORE *and in* MYSORE, *during the last 3¼ years.*

	Population.	1870, last half.	1871.	1872.	1873, 3 quarters.	TOTAL.	Annual average mortality per million.
Cantonment and Pettah.....	142,513	...	2	...	6	8	17
Remainder of Bangalore Taluq.	49,446	1	7	2	...	10	61
	191,959	1	9	2	6	18	29
Mysore State.....	5,055,000	144	276	229	not known.	649	51

From this table (which, as in all the recent Government Returns, unfortunately includes deaths by wild beasts) it will be seen that the mortality from snake-bite in the Mysore State is less than the average on the whole of India (80 per million) and in Bangalore and its environs smaller still. It may then be safely assumed that Bangalore is not an extraordinarily snake-infested station, and that an estimate of venomous snake-population drawn from the extermination experiment summarized in the preceding table is well within the probable average for India.

APPENDIX C.

List of common snakes found about BANGALORE *and* RANGOON.

BANGALORE, *(Mysore)*.	RANGOON, *(Pegu)*.
Atretium schistosum.	*Bungarus fasciatus.**
Bungarus arcuatus, not common.	*B. arcuatus*, occurs, but rarely.
Cyclophis calamaria.	*Compsosoma radiatum.*
Cynophis helena.	*Chrysopelea ornata.*
*Dipsas gokool.**	*Dendrophis pictus.*
Daboia elegans. } not common.	*Dipsas multimaculata.**
Echis carinata. } not common.	*Daboia elegans.**
Gongylophis conicus.	*Homalopsidæ*, various.
*Lycodon aulicus.**	*Lycodon aulicus.*
*Naga tripudians.**	*Naga monocellata.**
Oligodon subgriseus.	*Ophiophagus elaps.*
*Ptyas mucosus.**	*Python reticulatus.*
Passerita mycterizans.	*P. molurus*, occurs, but rarely.
Simotes russellii.	*Ptyas korros.**
*Tropidonotus quincunciatus.**	*P. mucosus*, occurs, but rarely.
*T. stolatus.**	*Psammodynastes pulverulentus.*
T. plumbicolor.	*Simotes bicatenatus.*
*Zamenis fasciolatus.**	*S. cruentatus.*
	*Tropidonotus quincunciatus.**
	*T. stolatus.**
	T. subminiatus.
	Tragops prasinus.
	*Trimesurus carinatus, &c.**
	Xenopeltis unicolor.

* Very common.

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CORRIGENDA.

Page 3. The *Typhlopidæ* should, strictly speaking, have been included amongst the families possessing rudimentary hind limbs; but these organs, though present, are imperceptible except by dissection, whilst in the three other families mentioned they are plainly visible.

4. The parietal and frontal bones should be included in the bones forming the walls of the cranial cavity.

8, line 15. The reference letter *k* should apply to the basi-sphenotympanic muscle.

16, line 9 from the bottom. *For* prefacing it with *read* principally from.

72 and 181. The Lycodon is represented on Plate IX and not Plate XI.

102, line 8 from the bottom. Omit the first ⋈.

133. 'Cobra monila' is perhaps a corruption of 'cobra manilha, bracelet snake, (Dr. Shortt).

138, footnote. *For* indigested *read* ingested.

156, footnote. *For* invested *read* infested.

161, line 16. *For* been *read* being.

168, last line. *For* serpents' *read* serpent's.

POSTSCRIPT.

Note A.

Page 16. The poison of *Daboia elegans* shows a tendency to crystallization during drying much more marked than in the case of cobra-poison. This snake being rare in Mysore I have had no opportunity of examining its poison while revising this manual.

Note B.

Page 29. It will be observed, by reference to the scheme of development at page 43, that I have assigned to the *Dipsadidæ* a place not far removed from the *Crotalidæ*. I have remarked that the brown tree-snake *Dipsas gokool*, when angry, vibrates its tail in the same way as the tree-vipers; I have not noticed this action in the other families of Colubrine tree-snakes.

Note C.

Page 147. *Echis carinata* is so small a snake that one might naturally suppose its bite to be of little danger to man. Along with some live specimens of this snake sent me from Arconum by Mr. H. R. P. Carter, one of the Resident Engineers of the Madras Railway, I received the following interesting note:—

"My servant was bitten by one about a week ago when catching it. He of course nearly died of fright, not of poison, but although the snake only managed to strike and draw blood and not to seize or bite, the thumb was numbed—and that the blood was affected was curiously proved. The boy had cut himself some days before on the hand which was not bitten; the cut appeared to be all right but two days after being bitten a small artery burst which kept bleeding for 12 hours before I found it out."

Note D.

Page 162. It would appear that in five districts of the Madras Presidency—Nellore, Chingleput (and Madras), North Arcot, Bellary and Tanjore—comprising about one-fifth of the area of the Presidency or about one-thirtieth that of British India, Rupees 1,57,290 were expended during the year 1872 in two-anna rewards for snakes destroyed.

Note E.

Page 173. Up to the end of February 1874, when the funds at my disposal were expended, cobras continued to be brought in for reward. From the 1st to the 26th a total of 168 were paid for. In the females eggs were well developed, being about an inch long in most of those examined. A month later, eggs were found of full size, but the fœtus hardly distinct.

Note F.

Page 171. The excuses made by Englishmen for the indiscriminate destruction of snakes may be divided into those of religion, of disgust, and of philanthropy. I am sorry to say that of these the religious excuse is not uncommonly avowed. I have known persons who took as holy a relish in beating a snake to death as their grandfathers might have taken in drowning a witch. They considered that they were fulfilling prophecy on a small scale.

The excuse that snakes are nasty, disgusting, or slimy reptiles is an example of the force of prejudice and we know that "a good sound prejudice is not to be contradicted by mere eyesight and observation."—(*Friends in Council*). Its effects are well illustrative of the following passage from Mr. Alexander Bain's work on the Emotions and the Will. "The enunciation of disgust is a favourite exercise. * * * The objects thus sought out need not offend the senses in any way; if they can only furnish a slight pretext for being nasty or unclean, it is enough for letting off the charged battery of the powerful organ of disgust. If any class of living beings should happen to provoke this out-burst, terrible is their fate. No limits are set to the promptings for evil of this sentiment."—Chap. XV.

The philanthropic excuse, if meant in regard to the Indian population, I would answer in the words of Dr. Johnson :—"My dear friend, clear your *mind* of cant. You may *talk* in this manner; it is a mode of talking in society; but don't *think* foolishly." If made in regard to the European population the excuse is a very poor one. The person who kills a snake on the chance of its being venomous, would exercise his philanthropy to more purpose by shooting every dog that comes across his path; for we have seen that amongst white people in India the chance of death by dog-bite is ten times as great as that by snake-bite.