6.

Sir Joseph Fayrer, Bart.

K.C.S.I. M.D. F.R.S.

J. Fayrer

various papers on Indian venomous snakes and their poison and its effects on life by

Sir Joseph Fayrer - K.C.S.I. M.D. F.R.S

These papers were bound together in 14 March 1887

There are several other
papers on Snake poison
by me in various journals;
"Evening Hours" edited by
Lady Barker —
Indian Medical Gazette.
Proceedings of Royal Society
(associated with Dr. T. L. Brun[ton]
)

Papers relating to Snakes and their poison, chiefly written in India previous to my return to England in 1872.

The lecture on "the Nature of Snake poison" was read at the Medical Society of London in 1884.

Most of the contents of this Vol: will be found in "the Thanatophidia of India" published by Churchill in 1872.

J. Fayrer. M.D. F.R.S

The Fayrer Gift.
June 1st 1916.

The Inspector-General has recently issued the following Circular to all Deputy Inspectors-General of Hospitals. Dated Fort William, the 22nd November, 1869.

(Extract) :—The Inspector-General of Hospitals is desirous that the observations on snake-poison, which Dr. Fayrer has hitherto been engaged in, should be extended throughout the Presidency, and he now asks Medical Officers to render any assistance in their power for the fulfilment of the object. The Inspector-General believes that very useful and practical results will accrue from the scientific investigations which Dr. Fayrer is still prosecuting; researches which may lead to a complete knowledge of the subject, and which must prove of service to the population of the country.

2. The Inspector-General therefore requests you will be so good as to supply each medical officer in your circle, of whatever grade, with a copy of this memorandum, and to enlist their exertions on the subject.

3. Medical officers are requested to submit to you, as soon as practicable after the 1st January, 1870, a return of all authenticated cases of snake-bite that occurred among the civil and military population under their cognizance, during the year 1869; (from the 1st January 1870 to the end of the year, cases, as they occur, are to be recorded monthly.)

6. Particular attention should be paid to the detail of symptoms after a bite, the duration of life, and the pathological symptoms after death; noting particularly the absence or presence of the rigor mortis, the state of the blood, microscopically if practicable, and its fluidity or coagulability; the treatment pursued, and any remarks to elucidate the recorded conditions.

7. The bodies of persons who have died from snake-bites are frequently sent by the Police, or Judicial authorities, to the civil medical officer for examination. It is particularly requested that careful accounts of all such autopsies may be sent in with the printed form; and that in making the examination, medical officers will be kind enough to note *particularly* the conditions to be attended to in paragraph 6, as well as any other pathological condition that may be observed. The local effects of the bite, the position of the fang punctures, and the state of the parts in the vicinity of the bite, as well as remote from it, should be accurately recorded.

8. Particular attention is also requested to any difference in symptoms and pathological states in the cases of bites of the Viperidæ, *i.e.*, the Russells Viper, or Daboia, and the Trimeresurus, as distinguished from those of the poisonous colubrine snakes, such as the Naja Tripudians, or Cobra, Ophiophagus

Elaps, or Sunkerchoar, and all of the less poisonous Bungarus family, as B. Cæruleus or Krait, and B. Fasciatus or Sankni.

NOTE.—A list of the poisonous snakes of Hindoostan is appended.

SNAKES MOST COMMONLY MET WITH HAVE ** PREFIXED : THOSE LESS SO* ; THE REMAINDER ARE COMPARATIVELY RARE.

SUB-ORDER, POISONOUS COLUBRINE SNAKES.

Family——————*Elapidæ.*

GENUS ** 1. NAJA : *N. Tripudians*, or Cobra : several varieties. Native names, Keautiah, Gokurrah, &c., &c., &c., &c.

" * 2. OPHIOPHAGUS : *O. Elaps. Hamadryas*, one species. From Assam to west bank of Hooghly. Native name, Sunkerchoar.

" ** 3. BUNGARUS : *B. Cæruleus*, or *Krait*. From Calcutta to Delhi.

** *B. Fasciatus*, or *Sankni* (marked with black and yellow bands. Bengal generally.)

" 4. XENURELAPS : *X. Bungaroides*, found about Cherrapoonjee.

" 5. CALLOPHIS : *C. Intestinalis.*

C. Maclellandii, found in Central India.

C. Nigrescens, found in the Neilgherries.

C. Annularis, India generally.

Family of Hydrophidæ or Sea Snakes.

1. PLATURUS : *P. Scutatus*, found on the Coast from Chittagong to Madras.

P. Fischeri, found on the Coast from Chittagong to Madras.

* 2. HYDROPHIS : Several varieties found on the Coast. *H. Cyanocincta, Hidgelli.*

* 3. ENHYDRINA : *E. Bengalensis, Hidgelli*, Botanic Garden, Dhappa Canal. *H. Robasta, Hidgelli.*

4. PELAMIS : *P. Bicolor. H. Coronata, Hidgelli.*

H. Stricticollis, Ditto.

H. Chloris, Sandheads.

H. Gracilis, found at Dhappa, Calcutta.

SUB-ORDER, VIPERINE SNAKES.

Family of pit Vipers or Crotalidæ.

1. TRIMERESURUS : * *T. Gramineus*, found in Bengal, has been found at Dhappa Canal.

* *T. Erythrurus*, found in Bengal.

T. Carinatus Ditto.

T. Anamallensis Ditto.

T. Monticola Ditto.

T. Strigatus Ditto.

T. Mucrosquamatus, Ditto, Assam.

2. Peltopelor : *P. Macrolepis*, found in the Annamallay Mountains.
3. Halys : *H. Himalayanus.*
4. Hypnale : *H. Nipa*, or *Carawala*, found in Southern India.

Family of Vipers or Viperidæ.

1. Daboia : ** *D. Russellii*, Native name, *Bora*, found all over Bengal, from Southern India to the Himalaya as high as 3,500 feet above the Sea.
2. Echis : *E. Carinata*, found in the Annamallay Mountains, Carnatic and other parts of India.

J FAYRER, M.D.

THE THANATOPHIDIA OF INDIA.

[redacted]

Dr. Murray, Inspector-General of Hospitals, having kindly sanctioned the distribution among Indian Medical Officers of a circular letter* and printed form, with the object of obtaining information on the subject of snake-poisoning in this Presidency, I think it may be well to supplement that circular with a short description of the list of poisonous snakes thereunto appended, and with a few remarks on the important anatomical and zoological peculiarities of these reptiles, as it may be useful to those who have not paid particular attention to this branch of Natural History.

the Bengal Presidency

The list, in giving merely the names of the varieties, species and genera of the Thanatophidia, or poisonous snakes, indicates generally the localities where they may be looked for, and the relative frequency or rarity in which they may be expected to occur. A more detailed account may, perhaps, aid those who are disposed to assist in collecting and recording reliable information on a subject interesting alike to science and humanity.

The order Ophidia, of the sub-class Reptilia proper, is divided into three sub-divisions :—

1. The Ophidii Colubriformes, or innocuous snakes.
2. The Ophidii Colubriformes Venenosi, or poisonous colubrine snakes.
3. The Ophidii Viperiformes, or viperine snakes—poisonous.

The two last sub-orders, under the designation of Thanatophidia, a name peculiarly applicable to them, as they occur in India and in the Bengal Presidency especially, I propose to describe.

I will premise the description of individual genera and species by a few remarks on the general characteristics of the three sub-orders, and especially on those which distinguish the innocuous from the venomous snakes ; and of the latter, the differences which mark the viperine from the colubrine forms.

The characters possessed in common by the three sub-orders are the elongate form ; the absence of any exo-skeleton, sternum, pectoral arch, sacrum or limbs, with the exception in a few of the colubrines, of rudimentary pelves, or hinder extremities. The mandibles are united by an extensible ligament, and are

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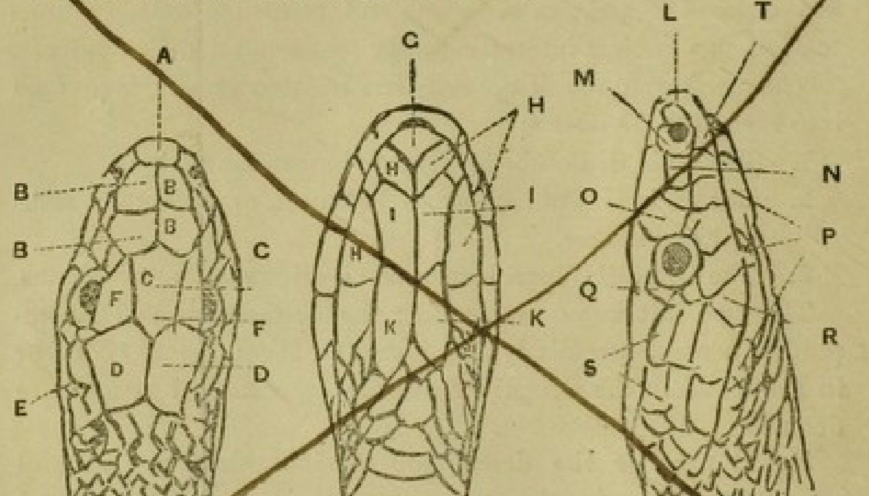
* Vide page 22, Vol. V., *I. M. G.*

articulated with tympanic bones, which allow of the extensive gape through which they swallow their prey. They have neither external ears nor eyelids, but the eye is covered by a transparent glassy capsule, which exfoliates with the epidermis, when that is shed. The body is naked, but it has this epidermis, which is frequently exfoliated, laid in scale-like folds and shields on the head and ventral surface. The number and arrangement of these non-imbricated shields on the head is of value in the classification of the genera and species. They are named as follows :—

Rostral.
Anterior frontal.
Posterior frontal.
Vertical.
Supraciliary.
Occipital.
Nasals.
Loreal.
Ocular anterior, or præ-orbital.
,, posterior, or post-orbital.
Upper labials.
Temporals.
Mental.
Lower labials.
Chin shields.

Diagrams of the Shields on the head of a Colubrine Snake.



New diagram

A. Rostral.
B. B. Anterior frontal.
C. Vertical.
D. D. Occipital.
F. F. Supraciliary.
G. Median labial or mental.
H. H. Lower labials.
I. I. Chin shields.
K. K. Chin shields.
L. M. Nasals.
N. Loreal.
O. Præ-orbital
P. Lower labials.
Q. Post-orbital.
R. T. Upper labials.
S. S. Temporals.

Snakes are provided with sharp, recurved teeth which are anchylosed to the maxillary, palatine and pterygoid bones, and it is by the form and arrangement of these teeth that the poisonous are most easily distinguished from the innocuous species. Certain Ophidia approaching nearly to the Saurian forms, such as the Typhlops, Tortrix, Uropeltidæ, have rudimentary pelves and a narrow mouth, without the enormous gape; but in these it is only a matter of less development. The lungs are unsymmetrical, one being much larger than the other. The heart has three cavities, one ventricle and two auricles; the urinary bladder is wanting.

The organs of locomotion are the ribs, which unite with a rudimentary transverse process of the vertebræ, and correspond nearly to the number of dorsal vertebræ, and the ventral plates or scales.

They are all carnivorous, existing on living animals or eggs; the prey is swallowed entire, as they have no organs of mastication. They are oviparous, ovoviviparous or viviparous. They are "hæmatocrya," or cold-blooded. Their blood is rich in solid constituents, and has red corpuscles of an eliptical shape, which are flattened and bi-confex, and smaller than in other reptilia.

These are some of the most marked characteristics of the order Ophidia, that are common to the three sub-orders into which it is sub-divided. Before describing those which differentiate one sub-order from the other, I would make a few remarks on the osteology of the cranium, the dentition, and glandular apparatus, to which they owe their deadly properties. The Ophidia are distributed generally over the surface of the globe, wherever climate and other circumstances are favorable to their existence; India has, perhaps, a larger share than any other country, and the poisonous forms constitute a considerable proportion of the whole number of families.

Of twenty-one familes well known to naturalists, in this country, four are poisonous. The most deadly of the poisonous colubrine snakes,—such as the Ophiophagus elaps, and Naja tripudians,—are Indian. Whilst of the viperine forms, the Viperidæ are represented by the formidable Daboia Russellii, than which there is probably no more deadly viper, and the Crotalidæ by the Trimeresurus. All the members of this family are much less formidable than their African and American congeners, such as the Crotalus horridus, or rattle-snake, the Jararacca, or Craspedocephalus Brazeliensis, which are much more deadly than any of the Crotalidæ of this country.

The 4 poisonous families are :—

Elapidæ. Hydrophidæ.	Colubrine.
Viperidæ. Crotalidæ.	Viperine.

The 17 innocuous families are :—

1. Typhlopidæ.
2. Tortricidæ.
3. Xenopeltidæ.
4. Uropeltidæ.
5. Calamaridæ.
6. Oligodontidæ.
7. Colubridæ.
8. Homalopsidæ.
9. Psammophidæ.
10. Dendrophidæ.
11. Dryophidæ.
12. Dipsadidæ.
13. Lycodontidæ.
14. Amblycephalidæ.
15. Pythonidæ.
16. Erycidæ.
17. Achrochordidæ.

The 4 poisonous families contain :—

	Genera.		Species.	
Elapidæ	6	5	16	14
Hydrophidæ ...	7	4	42	24
Viperidæ	2	2	2	2
Crotalidæ	6	4	15	12
	20	15	75	52

The cranium of a snake is built up of a number of bones which have their homologues in the Mammalean skull, but are more complex, and modified in accordance with the structure and habits of the reptile. It is unnecessary to describe, in detail, the bones which enter into the formation of the cranial cavity, which is very small, being in proportion to the imperfectly developed encephalon it protects. But as those which enter into the structure of the maxillary and mandibular arches are of importance in distinguishing the venomous from the non-venomous snakes, it is well that a short description of them should be given. It is the peculiar structure of the jaws, indeed, that forms one of the chief characteristics of the Ophidians. The bones which compose the upper jaw and palate, as well as the mandibles, are freely moveable, the latter being loosely hung from the tympanic bones, and are united in front by ligament. The mastoid bones with which the tympanic bones articulate are also moveable, so that the distensibility of the mouth is very great, as it often needs to be, to enable the snake to swallow prey larger in diameter than itself.

The mechanism of deglutition in the Ophidia is very remarkable; the mouth can not only be opened vertically, but transversely, and further, each lateral half has the power of separate and independent motion which is called into action when the prey is swallowed. By the continual action of the jaws and teeth, the animal brought within the grasp of the mouth, is slowly drawn in and engulfed; it is first held firmly by the sharp recurved teeth, one side of the jaw is then protruded, the teeth being withdrawn to be again implanted further on; the same process is repeated alternately on either side, until the prey is finally drawn within the grasp of the gullet. This is the mode of deglutition in the Python and other non-venomous snakes. A similar process, with certain modifications in the dental arrangement, obtains in the poisonous snakes; the chief structural distinction being found in the maxillary teeth, which in them are long, sharp, recurved, and perforated fangs, through which the secretion of the poison gland is hypodermically injected into the bitten animal. Before describing the maxillary arch, it may be well to say a few words about the dentition of serpents generally. The non-venomous forms have two rows of teeth in the upper jaw:—the outer or maxillary, the inner or palatine. In the majority, the outer row has from 20 to 25 teeth, though in some genera as Tortrix, Homolopsis, they are less numerous; in the typical venomous snakes the maxillary bone is very short, and the outer row is represented by a single long tubular fang, with loose reserve fangs in the mucous fold surrounding it, which is firmly anchylosed into the moveable maxillary bone. In other genera, Dryophis, Dipsas, the maxillary teeth increase in size towards the posterior part of the bone, and the terminal teeth are even grooved on their convex surface; these teeth may enable the snake to retain a firm hold on its prey, or they may give entry to acrid saliva, but they are not connected by a duct with any poison gland.

The grooved or perforated poison fangs are firmly fixed in the maxillary bone, and are covered by a fold of mucous membrane, in which they are ensheathed, and in which other poison teeth lie loose until one of them is called for by the loss of the actual fang. Its successor then becomes anchylosed to the maxillary bone, and communicates with the duct of the poison gland.

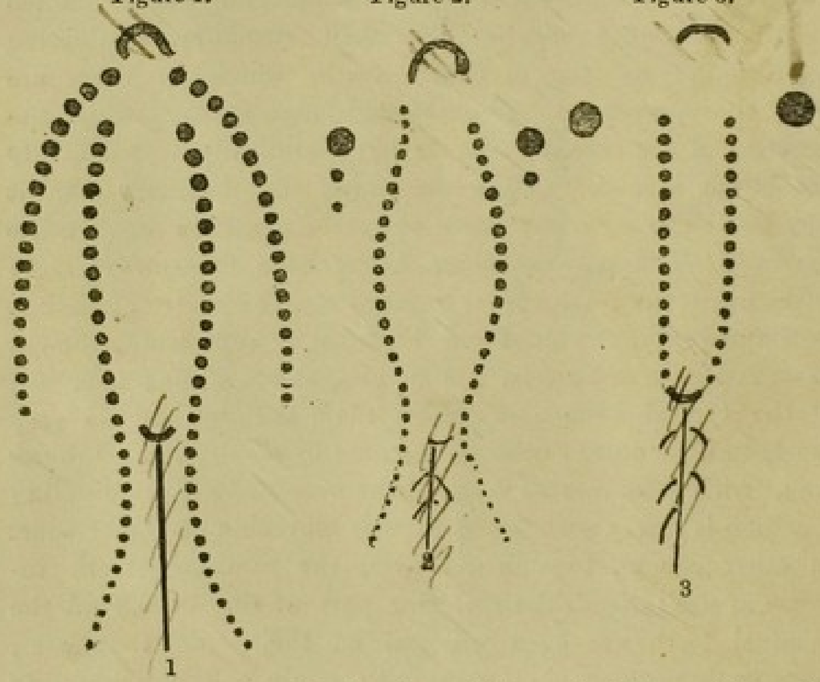
The teeth of the Ophidia generally are conical, sharp pointed, and recurved weapons, firmly fixed in the bones with which they are connected. In some snakes the præ-maxiliary, or inter-maxillary bone is without teeth; in others it is furnished with them. The maxillary bones, in the poisonous snakes, have one or two grooved fangs, one only of which on either side is effective; and in some of the poisonous colubrine snakes, as the Cobra or Bungarus, there may be one or more smaller teeth of the ordinary kind immediately behind the poison fangs. In the non-venomous colubrine snakes the maxillary bone has a whole row of equal sized recurved teeth. The palatine teeth are of about the same size as the maxillary in non-venomous snakes. The pterygoid teeth are somewhat smaller. A diagram

X:/

new Diagram

PLATE II.

Dhamin (Ptyas Mucosus.) Figure 1. | Cobra (Naja Tripudians.) Figure 2. | Daboia Russellii Viper. Figure 3.



The dotted lines show the directions of the marks that would be made by the bites of—

1. DHAMIN. 2. COBRA. 3. RUSSELLI'S VIPER.

The actual number of maxillary, palatine, and pterygoid teeth is not indicated by the marks, but merely the direction they take.

In the Viper they are not much above 8 or 10 palatine or pterygoid, only one maxillary.

In the Cobra 25 or 26 pterygoid or palatine, and one, or perhaps a second, small (though not a poison fang) maxillary.

In the Ptyas (Dhamin) or harmless snake, from 35 to 40 pterygoid or palatine teeth, and 20 to 22 maxillary teeth.

of the dentition of the Ptyas or Dhamin would be as in Figure 1; of the Cobra or Bungarus as in Figure 2; of the Daboia or Viper as in Figure 3. The examination of the wound inflicted by a snake ~~would~~ thus, to a very great extent, enable one to judge whether it were poisonous or not. The relative proportions of the maxillary bone and teeth in the three abovementioned snakes, which are typical of the sub-orders, is represented in the Plate 3. In the typical poisonous snakes,

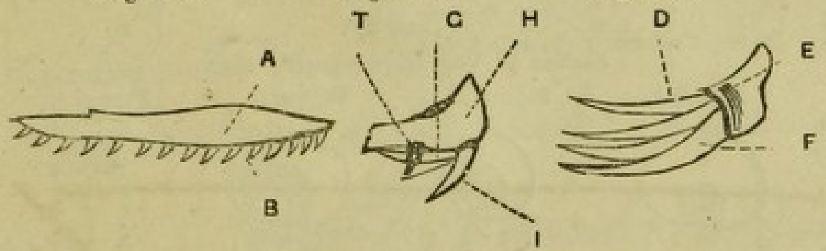
might

x 2

see Diagram

PLATE III.

Figure 1. Figure 2. Figure 3.



A· Maxillary bone.
N· Teeth.

G· Reserve poison fangs.
H· Maxillary bone.
I· Poison fang.
T· Tooth.

D. Reserve poison fang.
E· Maxillary bone.
F. Poison fang.

W

1. Maxillary bone and teeth of Ptyas Mucosus.

2. Maxillary bone poison fangs, and reserve fangs and maxillary tooth in Cobra.

3. Maxillary bone with poison fang and loose reserved fang in Daboia Russellii, about the natural size.

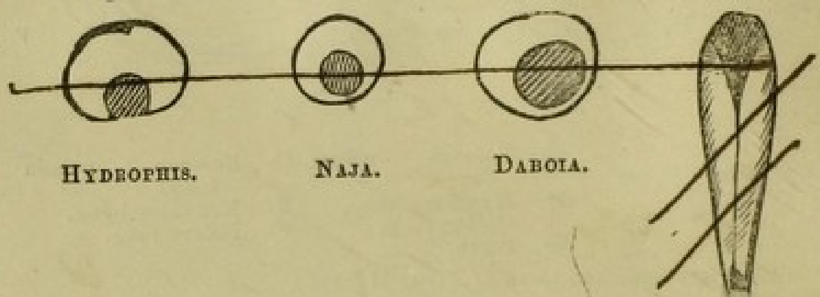
the maxillary bone is reduced to a mere wedge of bone, giving support only to the poison fangs. The ecto-pterygoid bone is elongated in proportion, and it is mainly through the medium of its articulation with this bone that its hinge-like motion enables it to depress or erect the fang at will. The tooth, it is to be observed, has no independent motion, it moves only with the bone with which it is united, that bone being moved during muscular action by the pressure on it of the ecto-pterygoid. In the viperine snakes, in which the poison fangs are very large, the degree of mobility is remarkably great, and the snake, when irritated and about to strike, gives them a peculiar and independent vibratile movement, which is very striking. In them the natural position of the fang is the recumbent one. When the snake strikes, and as it opens its mouth, the maxillary bone is pushed forward, and the fang is erected. The poison fangs are described as grooved or perforated teeth, but, strictly speaking, they are not so. Like other teeth, they are solid, composed of dentine and enamel, but they are folded over so as to form a cylinder in some cases; in others an open groove. It is as though you took a leaf and folded it longitudinally until its edges overlapped to form a tube, or approached each other so as to form a groove. The various degrees of involution are represented permanently in the fangs of different poisonous snakes. For example, in the Hydrophidæ, the fang is only so folded as to form an open groove; in the Elapidæ the canal is a complete tube; in the Viperidæ it is even more so, all appearance of this involution have disappeared.

New Diagram

PLATE IV.

Section of fangs of poisonous snakes.

Figure 1. Figure 2. Figure 3. Figure 4.



The groove or canal communicates at the base by a triangular opening with the poison duct; and the apex is open near the point (vide Figure 4.) It will be seen from this, that the groove or perforation is external to the pulp cavity. The dentine of the fangs is arranged so as to radiate vertically round the canal, and it is covered externally with a coat of cement, which gives its polish and hardness. The fangs vary much in size in different families of poisonous snakes. In the Viper they are very long and sharp pointed, and most formidable weapons from their size, having the power to inflict a deep wound. They are perforated from the base to the apex by the poison canal running along the anterior convex side of the tooth; they are firmly anchylosed to the maxillary bone, which is exceedingly mobile. Their natural position in a state of rest is the recumbent one, but they become erect when the snake strikes. In the capsule of mucous membrane which envelopes the fang, there are several reserve poison fangs, in different stages of growth; they are unattached, but are ready to replace the actual fang if lost, and to become anchylosed to the maxillary bone, and connected with the duct of the poison gland.

X 1

This rule tho' general is not absolute for some snakes have fangs altho' they are not poisonous.

Similar fangs of the Psammodynastes Pulverulentus. "This snake has a very repulsive aspect: its dark, ill-defined colours, short and thick head, and swollen lips caused by large hidden fangs, give it the appearance of a venomous snake: it remains small, the largest specimen I have seen being only 21 inches long, the tail measuring 4½ inches." It has a wide geographical range, occurring in Khasya, Sikkim, Assam, Pegu, Tenasserim, Cochinchina, Sumatra, Java, and the Philippine Islands." — There are some

good specimens in the M.
museum, lately presented by
Major Godwin Austen, from
the Khasya hills. The long
fangs are distinctly visible
and the snake looks very
like a poisonous one.

2

[illegible] it by direct observation;
tortoises & other snakes and fish
died from their bite in less than
an hour and a man succumbed
after four hours" —

It is necessary that these should
be borne in mind. The
latter reference to the land
snakes the exception to the
[illegible] zone.

1 .42

On the other hand the bite of the Hydrophidae might present much the appearance of that of the non venomous terrestrial snakes; the anterior maxillary tooth or fang is so small & little different to the other maxillary teeth that the ~~two~~ distinct marks of two fangs would probably not be ~~recognised~~ present and so the bite might be a most dangerous one. For as Gunther says "there cannot be the slightest ~~a~~ doubt that the Sea snakes belong to the most poisonous species of the whole order.

Russell & Cantor have ascertain

Note

The amount of involution I believe, varies in the Hydrophidae. For example in the fangs of a large Enhydrina Bengalensis. 4 feet long, of six inches in girth. I find the fang present the appearance depicted in figure –

The groove is partially open. but it is much closed – and except on close examination might appear nearly as much closed as the other fangs. It is after all merely a question of degree not of kind.

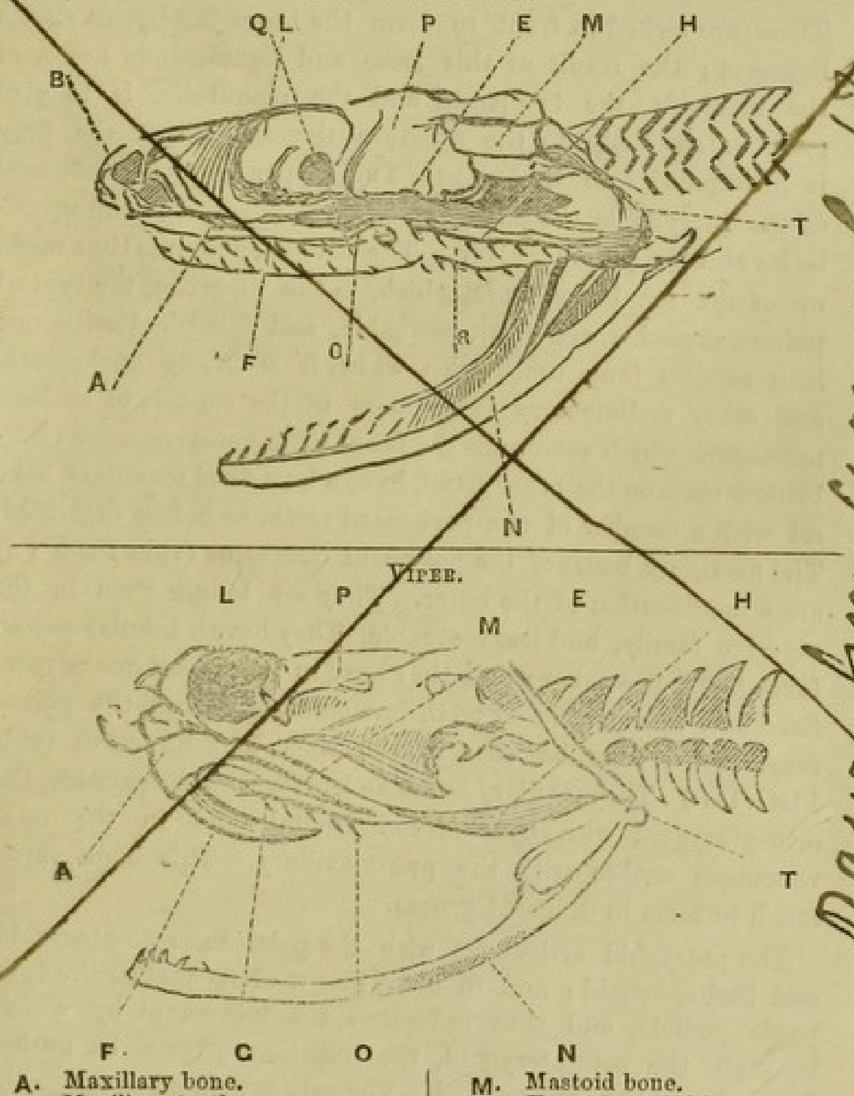
In the Elapidæ the structure of the fang is similar, but it is relatively much smaller, and there is little or no movement in the maxillary bone, which is longer than in the Viperidæ, and has sometimes one or two ordinary teeth behind the poison fang. It is also a most formidable weapon, independently of its connection with the poison gland, but only half the size of the viperine fang. In the Hydrophidæ the fang is still smaller, and it remains as an open groove along which the poison is injected into the wound it has inflicted.

The Hydrophidæ or salt-water snakes are a very poisonous family. The bite is very dangerous, notwithstanding the small size of the fang.

A few words now on the formation of the Ophidian skull.

PLATE V.

COLUBRINE SNAKE.



new Diagram

Drawn from crania by Fayrer

A.	Maxillary bone.	M.	Mastoid bone.
E.	Maxillary teeth.	E.	Ecto-pterygoid bone.
F.	Poison fang.	O.	Palatine teeth.
G.	Palatine bone.	R.	Pterygoid teeth.
H.	Pterygoid bone.	B.	Inter-maxillary bone.
N.	Mandible.	P.	Parietal bone.
T.	Tympanic bone.	L.	Frontals.

It has three pairs of frontal bones; the two anterior form the anterior part of the orbit, the two median lie between them and the two posterior, which form the posterior boundary of the orbit. The nasal bones lie immediately in front of the middle frontal, and the inter-maxillary bone between them forms the muzzle of the snake. The parietals lie behind the post frontals, and at their posterior angles are the two mastoid bones which overlap as they articulate with them. The mastoid bones, which are moveable, articulate with the long and slender tympanic or inter-articular bones; they articulate at the opposite extremity with the mandibles, each of which consists of three segments,—the articular, the coronary, and the dentary. These are united in front to form the lower jaw by an elastic ligament; the result of this loose and ligamentous union of the mastoids, the tympanic and the mandibles, is to give great extensibility to the aperture through which the prey is introduced into the gullet. The upper jaw is composed of the pterygoids, the palatines, the ecto-pterygoids, the maxillaries and the præ-maxillary. The maxillary arch is thus made up of the maxillary bones, which, in the Viperidæ, the typical poisonous snakes, are short, moveable, and furnished with one long tubular fang each, with which it is firmly anchylosed, and other rudimentary fangs loose in the capsule of mucous membrane which surrounds the fang. The non-venomous Colubrine snakes, on the other hand, have a long fixed maxillary bone set with a number of non-perforated teeth, as before described. The maxillary bones of the poisonous Colubrine (vide Plate V.,) are a modification of the latter. They are longer than in the viperine family, and less moveable. They have a tubular poison fang, but it is smaller; and they have in some cases one or more fixed and non-perforated teeth immediately behind the poison fang. Such may be seen in the Naja and Bungarus (vide Plate III.) The maxillary bones articulate with the palatine, the ecto-pterygoid with the anterior frontal, and in the non-venomous snakes with the præ-maxillary. This bone varies much in form in different genera.

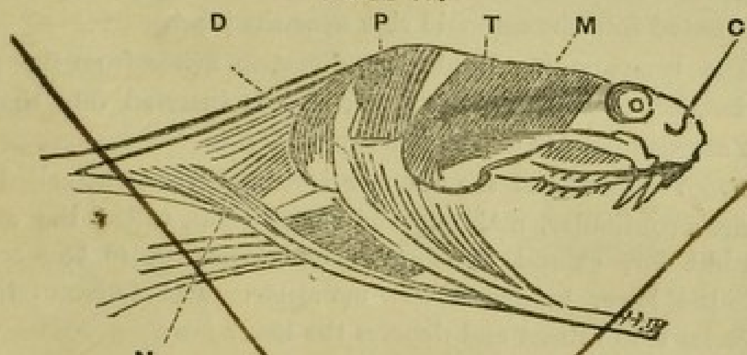
The pterygoid articulates with the palatine, ecto-pterygoid, and basi-sphenoid; and in the Viper it abuts against the tympanic pedicle, and thus influences the movement by which, through the ecto-pterygoid, the maxillary bone is pushed forward and the fang erected. The ecto-pterygoid overlaps the posterior portion of the maxillary at one end, and at the other it joins the pterygoid. The mandibular arch is composed of the tympanic bones which articulate with the mastoid at one end, and with the condyles of the lower jaw or mandibles at the other; this mandible on either side being, as I have said, composed of three segments, and the posterior part of the pterygoid, which,—in the Viper,—abuts against the end of the tympanic pedicle.

The bones which enter into the formation of the cranial cavity are,—parietals, basi-occipital, occipital, ex-occipital, sphenoid, ali-sphenoid, basi-sphenoid, pre-sphenoid and orbito-sphenoid; the lachrymal and turbinal bones, and vomer. These are connected with the maxillary arch. In the Vipers especially there is a prominent bony spine on the base of the skull, to which the longus colli muscles have a firm attachment. This gives these snakes the great power of striking that they possess.

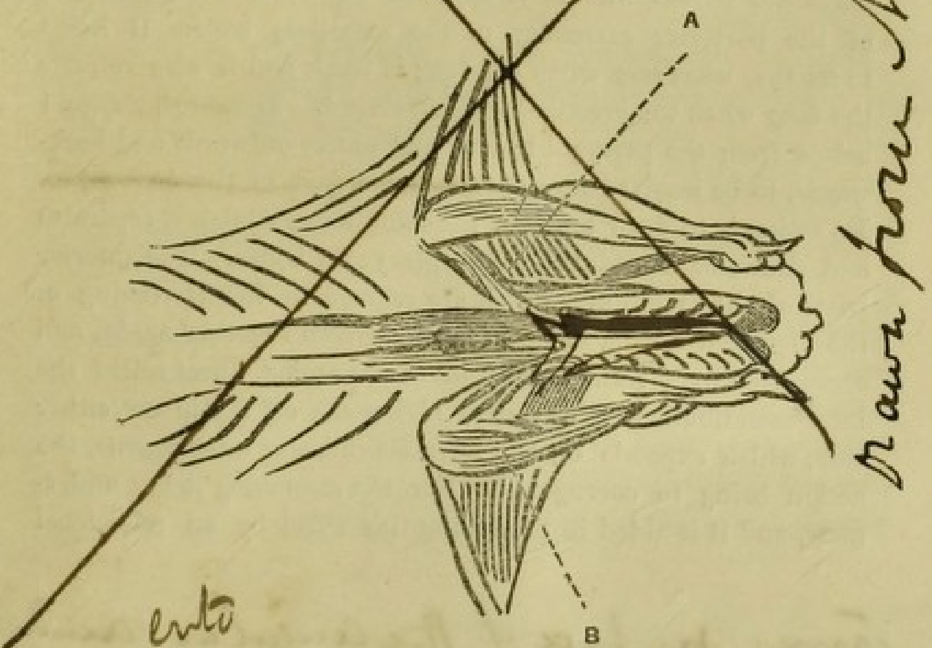
PLATE VI.

New Diagram

Drawn from Nature by Fayrer



C. Costi-mandibular.
D. Digastric.
M. Masseter.
N. Neuro-mandibular.
P. Post-temperal.
T. Temporal.



A. ento ~~Ecto~~-pterygoid. B. Ecto-pterygoid.

The muscular apparatus connected with the bones I have just briefly described, is next to be shortly considered, especially that portion of it which is concerned in the act of grasping the prey and inflicting the poisoned wound.

The following are the muscles concerned in these processes :— The masseter, which arises from the ecto-pterygoid, and passes backwards, winding round the tympano-mandibular joint, to be inserted into the mandible as far forward as the dentary. The membranous origin of this muscle extends over the poison gland.

The temporal muscle arises from the parietal bone, and is inserted into the coronary process of the mandible. It is partly covered by the masseter. The posterior temporal takes its origin from the anterior part of the mastoid and parietal, and is inserted into the coronoid side near the joint.

The tympano-mandibular, or digastric, arises from the posterior part of the tympanic bone, and is inserted into that of the angular process of the mandible.

From the fascia of the anterior vertebræ, a muscle, called the neuro-mandibular, and another smaller slip, called the costo-mandibular, extend downwards and forwards, to be inserted into the lower border of the mandible. The action of these muscles is to retract and depress the lower jaw.

The ecto-pterygoid passes forwards and expands into a fascia, which, in the poisonous snakes, covers the sac in which the fangs are enveloped. It is inserted also into the lower part of the posterior extremity of the maxillary bone. It helps to fix the maxillary when the fang is used, and it also retracts the fang when the erectile force is relaxed. The ~~ecto-~~pterygoid ento arises from the pterygoid bone, and passes outwards and backwards, to be inserted into the ~~posterior part of the lower jaw.~~ Its action is to draw together the mandibles; whilst it separates and draws backwards the palato-pterygoid bones. The anterior parts of the mandibles, which are relaxed in the stretching of the ligament during deglutition, are drawn together again, and corrugated by a transverse band of muscular fibres called the inter-mandibular. This muscle also sends off a slip on either side, which expands on the inter-mandibular integuments, the action being to corrugate it after the stretching it has undergone, and it is aided in producing this effect by an additional

inner surface of the angular and surangular elements covered by the ecto pterygoideus.

thin layer of muscle. T~~he pre-spheno-pterygoid extends~~ forwards to ~~the pre-sphenoid, and is attached to the pterygoid and ecto-pterygoid, where they unite. In pushing~~ forward the pte~~rygoid it also pushes forward~~ the maxillary bone, through the ecto-pterygoid, ~~and rotates it~~, so as to make the poison fang erect ~~itself. The~~

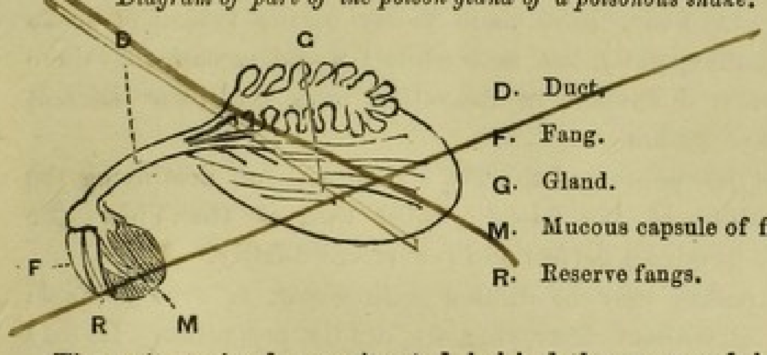
The pre-spheno-palatine takes its origin from the side of the fore-part of the pre-sphenoid, and passes outwards to its insertion along the inner surface of the palatine. From the side of the pre-sphenoid the pre-spheno-vomerine muscle arises; it sends a slender tendon to the vomer, the action of which is to depress and retract the præ-maxillary, restoring it to its natural position after it, with other bones which have been displaced in swallowing the prey.

Such are the muscular arrangements by which the mouth is opened vertically, and laterally; the poison gland compressed and the venom injected through the poison fang, which, by a simultaneous combined action of muscle and bone, has become erect, and is fixed in that position during the infliction of the deadly blow by which the fangs are inbedded in the flesh of the snake's prey.

A few words now on the poison gland, and its ducts.

New Diagram

Diagram of part of the poison gland of a poisonous snake.



D. Duct.
F. Fang.
G. Gland.
M. Mucous capsule of fangs.
R. Reserve fangs.

The poison glands are situated behind the eye, and in front of the tympanic bones. They are oval bodies about the size of an almond in the cobra; the secreting structure consists of a series of elongated lobes diverging from the principal duct. The lobes are sub-divided into lobules, which are sub-divided into cœca. These, having secreted the poison, convey

The pre-spheno-pterygoid arises from the pre-sphenoid and extends backwards & outwards to the Pterygoid and Ecto-pterygoid where they unite. In contracting it draws or rather pushes forwards the pterygoid and Ecto-pterygoid & maxillary rotating the latter and erecting the fang it through the poison duct to the base of the poison fangs in the capsule of mucous membrane surrounding them. These glands are of different form and size in different families of snakes, but they are all modifications of the structure I have described. The gland is encased in a capsule, and is partially covered by fibres of muscle (the masseter), whose action in closing the jaw at the same time compresses the gland, and squeezes the poison through the duct into the perforated tooth. The secretion of the gland varies much in color and viscosity in different snakes, but its general appearance is that of a clear, lightly viscid fluid, soluble in water, and slightly acid in reaction. It manifests its deadly effects most powerfully when inoculated into the blood when the snake is fresh and vigorous in the warm weather, and when it has not bitten for some time. It seems to act through the circulation, paralysing the nerve centres, and thus destroying the vital force. But there is no doubt, I believe, that, notwithstanding all that has been said to the contrary, it is capable of absorption through the mucous membranes with which it is brought into contact, though with much less dangerous effects than when it is introduced into the blood. In certain experiments in which the cobra poison was placed on the conjunctiva of dogs, the symptoms of poisoning were rapidly and strongly, though not in all cases fatally, developed. I may have more to say on the subject of snake poison subsequently, but meanwhile I would remark that there are certain differences in its action as derived from different families of snakes.

This is the case with the lower animals apparently but not always so in man

Thus, the poison of the Naja kills without destroying the coagulability of the blood; whilst that of the Viper—the Daboia—produces perfect and permanent fluidity. ✗

The poison may be diluted with water, or even ammonia or alcohol, without destroying its deadly properties. It may be kept for months or years, dried between slips of glass, and still retain its virulence. It is capable of absorption through delicate membranes, and therefore it cannot safely be applied to any mucous surfaces, though, no doubt, its virulence is much diminished in the endosmosis. The Prince of Cannino, L. Buonaparte, gave in 1843 an analysis of the venom of the

It kills when introduced into the stomach— When put into the eye— or when applied to the Peritoneum

Viper (Pelius Berus), and he pointed out the presence of a principle representing the ptyaline of saliva. This he called viperine. He also found albumen and mucous fatty matter, substances soluble in alcohol, yellow coloring matter, and saline matters.

The elementary analysis of viperine has yet to be made; it appears to act by a catalytic force, that is, it kills by some occult influence on the nerve centres; viperine is a neutral substance, and very unstable.

The terms echidnine, crotaline, have been given to a similar principle derived from other snakes. They are, no doubt, identically the same.

The poison acts most rapidly on birds and mammals. Less so on the cold-blooded animals, but fishes, frogs, molluscs, and non-venomous snakes are destroyed by it, and often die very rapidly.

I have not been able to satisfy myself positively, after many experiments made on purpose, that the poisonous snakes are absolutely insensible to their own, or to the venom of others, but to a great extent they certainly are so.

I have repeatedly made Cobras and Daboias bite themselves, and each other, and they never seemed the worse for it. But I believe that the poison does take effect on snakes of a less deadly character; and though I have generally seen the Bungarus escape, I have seen an occasional death after being bitten by a Cobra, that, I think, might with some reason be attributed to the poison. The non-venomous snakes die rapidly,—the Ptyas, a large, vigorous and fierce snake, though non-venomous, succumbs within an hour or so to the bite of a Cobra.

The flesh of an animal dead from snake-poison does not seem to be affected; animals and men eat it with impunity.

The blood of an animal killed by snake-poison is itself poisonous; and if injected into an animal, rapidly manifests its poisonous effects. I have transmitted the venom through a series of three animals, with fatal effect. I have had little or no opportunity of studying the local effects of the poison, death has always occurred so rapidly that there has been no time for secondary or local changes.

The sweepers or Dhomes who attended during experiments always took away the fowls and ate them

Mr

~~Dr~~ Stewart of Cuttack tells me he took ~~out~~ 16 eggs with well formed embryos out of Hydrophis cyanocincta. The eggs were as large as hen's eggs and the young snakes were 6 inches long. 16

~~THE THANATOPHIDIA OF INDIA.~~

~~By J. Fayrer, M.D., C.S.I.~~

The Ophidia are oviparous and viviparous.

The colubrine snakes generally are oviparous; but there are exceptions, such as the Hydrophidæ and Homalopsidæ, which are ~~all~~ viviparous, producing from 4 to ~~9~~ 16 young ones. × perhaps more.

The viperine snakes, as their name implies, are all viviparous.

The distinction is not one of such great importance, as might at first appear. In the oviparous snakes the young are produced from eggs of an oblong obovate form with a soft leathery white shell. These, from 10 to 40 or 50 in number, are deposited in some place where the natural heat is sufficient to hatch them.

Of all the Ophidia the Python only, according to some authorities, incubates; it coils itself over the eggs, and sits on them till they are hatched.

The viviparous, or rather ovoviviparous snakes produce their young alive. The eggs are hatched in the oviduct, development having proceeded in them to the point at which the delicate covering of the egg bursts before or during parturition, and the young ones come into the world alive, and immediately show all the activity of their race. A higher temperature than that which is natural to the viper, in its ordinary condition, is necessary to effect this. The temperature of the reptile increases at these times, and the ~~parturient~~ gravid female is said to expose herself to the heat by basking in the sun's rays, at which time she is more sluggish and inert than on ordinary occasions. The female of all snakes is said to be larger than the male; there are certain differences in color also, which may distinguish the sexes. In the Hydrophidæ the male is known from the female by a distinct swelling on each side of the tail extending from the root to, or beyond, the middle of its length. But in other snakes there is no certain external anatomical character to distinguish the sex; dissection, of course, reveals it. × The tail in males is thicker than in female.

Or pressure on the ventral surface of the tail forward to the vent causes in males ~~the~~ protrusion of two vascular portions.

In cold and temperate climates, snakes hybernate or remain in a state of lethargy or torpidity. Active life is suspended until returning warmth rouses the vital energies into a state of activity. They differ much in their modes of life, habitation, food, &c. They are all carnivorous. Mollusca, insects, reptiles, birds, mamalia, eggs and milk are their food. Vegetable matters have been found in the stomach, but they are essentially carnivorous, and most, if not all, take their food only whilst it is alive.

Irrespective of the ordinary natural classification, they are arranged under the following heads :—

Tree snakes; those that live for the most part in trees or bushes, and are characterized by their brilliant colors, generally green, their slender and whip-like form, and great activity. Both the non-venomous colubrines and the viperine snakes are found among this section.

The water snakes are the salt water and the fresh water snakes;—the first are all venomous, the second are all innocent.

The salt water snakes have a peculiar form adapted to their mode of life—a compressed tail. Nostrils above the snout; they are all poisonous and viviparous.

The fresh water snakes have the nostrils like those of the salt water snakes. They live in the fresh, though they may be found like the others in brackish water; they have not the compressed tail; they are viviparous, and all belong to the sub-order of non-venomous colubrines.

Ground snakes.—Representatives are found in all the three sub-orders. They live, generally, above ground. They are more or less cylindrical in shape and very flexible in body. The greater number of snakes are found in this section.

Burrowing snakes live much under ground; have a rigid cylindrical body, short tail, narrow mouth, and small teeth. No ventral shields; they are all innocuous.

The Thanatophidia comprise the two sub-orders: Ophidii Colubriformes Venenosi, and Ophidii Viperiformes: these are represented in India, the former by the Elapidæ and Hydrophidæ; the latter by the Crotalidæ and Viperidæ. In these families the most deadly snakes are found

many, if not all, are

A few words on the characteristics of each of the sub-orders and their sub-divisions as found in Bengal.

The members of the poisonous colubrine sub-order are distinguished by their form, which is like that of the innocuous snakes. By the formation of the maxillary bone, which, though shorter than that of the harmless snakes, is much longer and less moveable than that of the vipers. The poison fang is shorter, and less moveable than that of the viper owing to the comparative immobility of the maxillary bone, with which it is anchylosed.

It is to be observed that the mobility of the poison fang in all snakes depends entirely on that of the maxillary bone, as the active tooth is firmly anchylosed to the bone. The reserve fangs lie loose in a reduplication of mucous membrane. The canal through which the poison flows is less developed in the poisonous colubrines than in the vipers, and in the Hydrophidæ it is actually an open groove. The maxillary bone also in some cases bears other teeth besides the poison fang.

The third sub-order Viperidæ.

The viperine snakes are distinguished by their form, the broad head, small, very mobile maxillary bone, to which is anchylosed a long perforated poison fang, which, on account of the mobility of the maxillary bone, is erectile.

There are other less important distinctions which will be noticed in describing genera and species. It may be briefly noticed that the general characters of a viperine or a colubrine snake are easily recognised. The formation of the maxillary bone and the dentition are certain guides in distinguishing one from the other.

[redacted]

[redacted]

THE ELAPIDÆ.

This family has several genera in British India. It is subdivided into the Najidæ, or snakes with hoods or dilatable necks, and the Elapidæ, which have no hoods.

In the first section Najidæ, there are twogenera —Naja and Ophiophagus.

In the second, Elapidæ, there are three Indian genera, *viz.*, Bungarus, Xenurelaps, Callophis.

The family of Elapidæ is characterized by a cylindrical body; a rather short and tapering tail; nostril lateral. The head has the normal number of shields above, but the loreal is always absent; eye rather small, with a round pupil. The poison fang has a mark on its convexity, indicating the groove, which is quite open in the Hydrophidæ.

Naja.

Gunther gives the following description of this genus :—

"Body and tail of moderate length; belly flat; head rather high and short, not very distinct from the neck, which is very dilatable, the anterior ribs being elongate. The shields of the head normal, but the loreal is absent; nostril wide, lateral between two shields; eye of moderate size, with round pupil; one præ, three, sometimes two or four post oculars. Six upper labials, the third and fourth entering the orbit; the third forms the lower half of the anterior margin of the orbit. Scales smooth, much imbricate in numerous series round the hood; anal entire; sub-caudals two rowed. The fang is grooved, with foramen at its extremity; one or two small ordinary teeth at a short distance behind it."

There is only one species, and that is *Naja Tripudians*, or the Cobra di Capello, or Naja.

Coluber Naja. L. Sys. Nat.
Naja Lutescens. Cantor.
„ Tripudians. Gunther. Gray.
„ Larvata. Cantor.
„ Atra. Cantor.
„ Kaowthia. Cantor.

But there are several varieties, each having a distinct name given to it by the natives. They are all most deadly, and though the snake-charmers consider some more poisonous than others, it is probable that any difference that may exist, is more due to the vigor of the individual snake, than to any thing attributable to the particular variety. They all have the hood, and they never attack without distending it. They raise the anterior third of the body from the ground, slide slowly along on the posterior two-thirds, and with the hood dilated remain on the alert, darting the head forward to the attack when anything hostile approaches. This attitude is very striking, and few objects are more calculated to inspire awe than a large cobra, when with his hood erect, hissing loudly, and his eyes glaring, he prepares to strike. Nevertheless, they are not, I believe, aggressive; and unless interfered with or irritated, they crawl along the ground with the neck undilated, looking not unlike the innocent snakes, but the moment they are disturbed, they assume the menacing attitude I have described.

The *Naja Tripudians*, or cobra, grows to the length of five feet and a half, or even more,* and is found all over Hindustan up to 8,000 feet high in the Himalaya; but Mr. Hodgson says he has never seen it in the Nepal valley.* It is equally dreaded and fatal everywhere. The varieties are numerous, and they are distinguished by the markings on the hood, and by various shades of color, from the darkest olive or black with a purple iridescence, to a pale chocolate, fawn or yellow color. They are all, notwithstanding their differences of color or markings, considered by naturalists to be but varieties of one species. They have various names in different parts of India, and are regarded by the snake-catchers as different species, and as having different powers of destruction. Such

* I believe *it is* to be found in the Nepal Valley. I have seen it in the Oude Terai.

* I have recently received a living female cobra from Nagpore C.P. sent by Dr W.B. Beaton, of the variety called Kurrees, so much of a chocolate brown color, without any mark on the hood. This 5 ft 8 in long including the tail. Tail 1 1/4 — Girth 6 3/4 inches: — [illegible]

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differences probably depend on age, vigor, or other circumstances, as naturally the intensity of the poison of the different varieties is probably almost equal.

The cobra is a nocturnal snake, that is, it is most active in the night, but it is often seen moving about in the day. It is oviparous; the eggs, from 18 to 25 in number, are obovate, and about the size of those of a pigeon, the shell is white, but tough and leathery. The cobras feed on small animals, birds' eggs, frogs, fish, or insects; they rob hen roosts and swallow the eggs, whole; they prefer taking their food at dusk or in the nights. They are said to drink a great deal of water; but it is certain that they will live weeks, even months, in captivity without touching food or water. They go into water readily, and swim well, but are essentially terrestrial snakes. They can climb and occasionally ascend trees in search of food. Cobras are not unfrequently found in the roofs of huts, holes in walls, fowl houses, old ruins, under logs of wood, cellars, old brick kilns, and old masonry of stone, brick-work or mud; such are the common dwelling place of these reptiles, and where they are frequently disturbed by men, who stepping on or inadvertently disturbing and touching them, receive their death-wound.

The cobra is most deadly, and its poison, when thoroughly inoculated by a fresh and vigorous snake, is quickly fatal. Paralysis of the nerve centres takes place, and death occurs with great rapidity, sometimes in a few minutes, especially when the fangs having penetrated a vein, inoculate the poison immediately into the venous circulation. The number of deaths caused yearly in India by these snakes is perfectly appalling. The cases in which recovery occurs are, it is to be feared, very few, treatment appears to be of little avail unless it be almost immediate, and then in the case of a genuine bite there is but little hope of saving life. As to the mode of treatment, and other matters connected with the bite of the cobra, and the great mortality caused by it in India, they will be described subsequently.

The cobras are the favourites of the snake-catchers, and it is astonishing with what ease and freedom they are seized and handled by these men even when in possession of their fangs. They render them temporarily harmless by cutting out the poison fangs, but these are quickly reproduced, unless, as most

-owerful and fierce & Dr Beaton informed me that
-killed a fowl in one minute.
This is the largest Cobra I have seen, tho'
I believe they attain even a larger size
than this

generally happens with the fang, all the reserve fangs and germs are removed, in which case the snake is harmless for life. Their graceful movements in the erect attitude they assume with the hood distended as they follow the movements of the snake-charmer's hands, make them an object of wonder as well as fear to all, and the superstitions of the natives about them are endless. The muntra or spell is far more potent in their ideas than any drug, and to such they generally trust when bitten. How frequently these fail the records of any Civil station in India will prove, and it is to be feared that the more material remedies of the physician are scarcely more potent for good.

The snake-catchers in Bengal describe a great variety of cobras. The following list was furnished by a very intelligent Mahomedan, who has had much experience, and who, though not a snake-catcher originally by profession, has been one for several years, and is exceedingly expert in catching and handling these reptiles. The first great distinction made by these people, is the cobra with spectacles on the hood, or gokurrahs, and those with one occellus or other mark on the hood, named keautiahs. They maintain that these are distinct species, and that they vary considerably not only in appearance, but in habits, and properties.

I have received a Gokurrah from Nagpore C.P. without any mark on the hood at all

The gokurrah has the following varieties :—

1 Kalla—black ; 2 Koyah—black and white ; 3 Gomunah—wheat colored ; 4 Puddah—yellow colored ; 5 Doodiah—whitish colored ; 6 Tatuliah—tamarind seed colored ; 7 Kurrees—earthy colored ; 8 Tameshur—coppery colored ; 9 Puddun nag—golden colored.

The 2nd, 3rd, and 7th being the most common varieties about Calcutta.

The keautiah has the following :—

1 Kalla—black ; 2 Tatulia—tamarind seed colored ; 3 Kurrees—earthy colored ; 4 Sonera—gold colored ; 5 Doodiah—whitish colored ; 6 Bans-buniah—mottled white and black ; 7 Giribungha—brownish colored ; 8 Koyah—black and white colored ; 9 Sankha-mookhi—like the sankni or bungarus fasciatus—black and yellow.

1st, 2nd, and 6th are most common about Calcutta, and no doubt in different parts of Bengal many other varieties are described, and different names are given to those above men-

The Cobra is called in the N.West & other parts of Hindustan

Kála Sámp.

Nág Sámp.

tioned, for the natives are fond of refining on points of this kind.

I append a note kindly furnished by Mr. Westmacott of the Civil Service, of the names of certain varieties described in Puruliah, and no doubt many others might be collected, the nomenclature being different as in different parts of the country.

"Notes on varieties of cobras, taken at Puruliah, Maunbhoom, 1866:—

Airá Gahman.—Average length $51\frac{1}{2}$ inches. Top of head, purple brown, shading into bright orange in the lower half of the hood. Back, two shades of vinaceous brown in faint stripes. Spectacles, white bordered, dark brown. Throat band and spectacles underneath ashy brown. Belly, pinky white.

Maniläg.—Average length $36\frac{1}{2}$ inches. Not very common. A remarkably slender neck and broad jaw. Top of head, light brown, shading into yellow in the hood, and back and belly yellowish white.

(Memo.—I cannot recollect whether this was a spectacled *Gahman.*)

Bichá Jarmá Gahman.—Average 47 inches. Above, ruddy brown and yellow. Hood, reddish brown. Spectacles, yellow bordered ruddy brown.

Kaliy—Average length 51 inches. The common black cobra, whole body black. Ring on hood, two throat bands, and a collar below the hood ranging in individuals from a creamy white to a dirty grey.

Kánta Káris Gahman.—Average length 48 inches, a light made snake. Above, vinaceous brown with yellow tinge in the hood. Spectacles, red. Throat bands, purple brown.

Dudhiya Gahman—Average length 44 inches. Top of head, vinaceous brown, darker on the hood, and lighter along the back. Below, ashy white. Spectacles, white, with a dark brown well defined border.

Párula.—A beautiful snake of which I never procured but one specimen, which I failed in preserving. Length 41 inches. All above a light shade of purple brown. No spectacles. Hood bright red.

Sarsa Gahman.—The common yellow cobra, largest variety of all.

Charara Gahman.—A large yellow cobra. I have not noted the differences between these two varieties.

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Basta Karicha Gahman.—Average length 50 inches. A very dark vinaceous brown, white spectacles, bordered light red."

The chief difference however insisted on, is that between the gokurrah and the keautiah, and these they regard as distinct from each other as is a sankni (bungarus fasciatus) from a krait (bungarus cœruleus.) The gokurrah, they say, is essentially a snake of the town or city. The keautiah is of the fields and jungle. The gokurrah is slower to kill, as its poison is thicker though most deadly. The keautiah poison is thinner, and takes effect sooner though it is not more fatal than that of the gokurrah.

Both, they say, incubate, and the snakeman informs me that over and over again he has dug them out of holes sitting on their eggs.

The gokurrah takes to the water reluctantly. The keauteah freely, and will remain for a considerable period under water.

The hood of the keauteah is ~~much~~ smaller relatively than that of the gokurrah, and the body is more attenuated, it is more slender, and more active than the gokurrah.

The varieties of both eat about every 6th day; they deposit their eggs once in the year, and that in the rainy season.

The keauteah is often found during the rainy season in the huts of the villages, where it has been driven to take shelter by inundation. It is as unusual to find a keauteah, though, in the ruins or débris of an old building, as it is to find the gokurrah in the open country. The snake-catchers here say that they believe that whereas the gokurrah is found all over Hindoostan, the keauteah is, if not confined to Bengal, rare in the N. W., and other parts of India. This however is by no means certain, and requires confirmation.

some of

The snake-catchers have a curious notion concerning the sex of the cobra. They say that the hooded snakes are all females, and poisonous; and that the males are all hoodless and innocent. The male, in fact, of the ophiophagus or sunkerchor, as well as of the naja, gokurrah, or keauteah, is the dhamin, or ptyas mucosus. They assert that there can be no doubt of this, and that they have irrefragable evidence of it, and that the dhamin is proof also against the cobra poison if bitten.

It is needless to say, notwithstanding all this, that the story is a fable. The ptyas is an innocent snake belonging to a different family, and succumbs rapidly to the poison when bitten

I am not aware of any external character that distinguish the male from the female. The tail in the male is perhaps rather thicker & firm pressure in the living snake behind the vent causes protrusion at either corner of it

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by a cobra, as I have proved over and over again by experiment.

The cobra is an object of superstitious veneration and awe to the Hindoos, in whose mythological histories it takes a prominent place.

In a religion that deprecates the wrath of a cruel and destructive power, by worshipping and propitiating the deity in whom that power is vested, it is natural that the type of destruction and the incarnation of evil, as represented in this reptile, should be regarded with peculiar deference.

Many Hindoos object, I am told, to destroy the cobra, and if they find it in their houses, as sometimes is the case, when one has taken up its abode in a hole or crevice in the wall for years, it is propitiated and conciliated, fed and protected, as though to injure it were to invoke misfortune on the house and family.

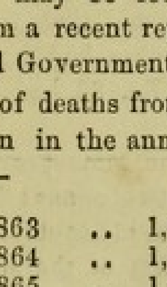
Should fear, and perhaps the death of some inmate bitten by accident, prove stronger than superstition, it may be caught, tenderly handled, and deported to some field, where it is released and allowed to depart in peace, not killed. This feeling happily is not universal, and the cobra has many enemies to limit his increase. Besides the natural enemies, such as the herpestes (ichneumon) and other creatures, numbers are destroyed by the low caste people, who follow the vocation of snake-catchers or charmers, and others also search out the snakes and kill them for the sake of reward. But still the loss of human life from their bites is very great, and seems to call loudly for some plan by which it may be mitigated. An idea of the loss of life caused throughout India yearly by the bite of the cobra and other venomous snakes, but especially the cobra, as it is by far the most common, may be formed from the following information extracted from a recent report of the Commissioner of Burdwan to the Bengal Government.

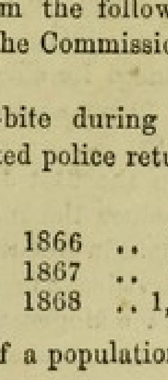
He says, "the number of deaths from snake-bite during the last nine years is shown in the annual printed police returns to have been as follows :—

1860	.. 878	1863	.. 1,048	1866	.. 929
1861	.. 989	1864	.. 1,035	1867	.. 984
1862	.. 1,041	1865	.. 1,184	1868	.. 1,144

Total 9,232 persons killed in nine years out of a population of 5,701,072.

a male organ.





"There may be a little inaccuracy in the above figures, but they have been compiled over a series of nine (9) years, and it cannot be questioned that they show that there is a mortality of above 1,000 persons every year, in a population of nearly 6,000,000 people."

In the district of Midnapore—which the commissioner considers the worst—in the year 1865, there were 530 deaths from snake-bite recorded, out of a population of 1,200,000 persons.

In the district of Beerbhoom, on the other hand, there were in one year 60 cases of death from snake-poisoning, out of a population of 743,685 persons. It appears from the report that women suffer more than men.

In 1858, a reward of four annas was given by Government for each venomous snake destroyed in the division, and the Magistrate reported in December that Rs. 1,961-8 had been paid for 1,845 snakes destroyed during the year. The reward was reduced to two annas for every poisonous snake brought in, but this was not sufficient inducement, and the numbers rapidly diminished.

	Snakes.	Rs.	As.
In 1859	957	124	4
,, 1860	217	27	0
,, 1861	8	1	0

The Magistrate remarked "that there are few persons who would risk their lives to bring in a live snake for two annas."

In Bancoorah, another district of the Burdwan division, the Magistrate proposed that the reward of two annas shall be given for all poisonous snakes brought in dead or alive. This was sanctioned with a proviso that the Magistrate himself should see the snake's head cut off. The reward was raised to four annas for each snake, in 1862. On the 14th July following, the Magistrate reported that the increased reward had produced its effect—47 snakes had been brought in on one day, and 70 on another day; Rs. 89 had been spent in less than a month.

On the 21st July of the same year, the Magistrate proposed to reduce the reward to two annas; he says, "97 snakes were brought in on Saturday, and 118 to-day." The duty of personally supervising the decapitation of the snakes became so irksome, that the Magistrate applied to higher authority for permission to depute some one to see this done: but the request was refused.

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On the 20th October, the Commissioner reported, that from the 29th May to 14th October 1862, 18,423 snakes had been killed, giving an average of 110 snakes a day; and he applied for a grant of Rs. 10,000 to provide for the rewards, at the same time proposing to reduce the reward to two annas.

On the 6th January, 1863, the Government of Bengal remarked that whereas from 29th May to 14th October, 18,423 snakes had been killed, and from 15th October to 7th December the number had increased to 26,029, giving an average of 463$\frac{4}{9}$ per diem, the Lieutenant-Governor expressed his surprise that the average number of snakes killed daily should have increased during the cold weather, and the Magistrate was requested to submit an explanation on this point. The Magistrate explained it by ascribing it to the increased expertness of the snake-catchers, and the large number of persons who had abandoned their occupation and taken to this comparatively lucrative mode of obtaining a livelihood. It was considered probable that many of these snakes might not have been poisonous, but the Magistrate rejoined that he had exercised great care in discriminating, and that 40,000 rupees would not have paid the rewards had they been given for all kinds of snakes. From this one would conclude that the advantages of Bancoorah as a residence must be doubtful. It gives a sad proof of the fatal character of the bites of the Indian Thanatophidia, and there is reason to believe that the greater share of the mortality is due to the cobra.

Ophiophagus.

There is only one species of this genus, *Ophiophagus Elaps*—Hamadryad; Native name, Sunkerchor. ai raj in Orissa

It has a variety of synonyms.

Naja Bungarus. Schlegel.
" Elaps. Schlegel.
" Vittata, Elliott, Madras.
Hamadryas Ophiophagus. Cantor.
Trimeresurus Ophiophagus. Dum: and Bib:
Hamadryas Elaps. Gunther.

This is probably the largest and most formidable venomous snake known. It grows to the length of 12 or 14 feet, and is not only very powerful, but also active and aggressive. It is hooded like the cobra, and resembles it in its general configuration and characters.

poisonous and is probably the largest poisonous snake
Eats other snakes. The coloration is [illegible] and the very beautiful

Waterton in his "Wanderings" mentions a viperine snake (Crotalidae) named the Lachesis mutus.—found in British Guiana called the Bushmaster by the Dutch, or Curucucu. It [illegible] is sometimes 14 feet in length. It is very

Gunther's definition of it is as follows :—" Body rather elongate ; tail of proportionate length ; head rather short, depressed, scarcely distinct from the neck, which is dilatable ; occipitals surrounded by three pairs of large shields : the two anterior of which are temporals ; nostrils between two nasals ; loreal none ; one or two præ, three post orbitals ; scales smooth, much imbricated in transverse rows in fifteen series round the body, but in many more round the neck ; those of the vertebral series are rather larger than the others. Ventrals more than 200, anal entire, anterior sub-caudals simple, posterior two rowed, sometimes all bifid."

Maxillary bone with a large fang in front, which is perforated at the end, showing a longitudinal groove in front, a second small simple tooth at some distance behind the fang. The color of this snake varies according to age and locality. The adult is some shade of olive green or brown. According to Gunther it is :—

1*st.*—" Olive green above ; the shields of the head, the scales of the neck, hinder part of the body and of the tail edged with black. Trunk, with numerous oblique alternate black and white bands converging towards the head, lower parts marbled with blackish or uniform pale greenish. This variety is found in Bengal, Assam, the Malayan Peninsula, and Southern India."

2*nd.*—" Brownish olive, uniform anteriorly with the scales black edged posteriorly : each scale of the tail with a very distinct white, black edged, ocellus, as in ptyas mucosus." This variety is not found in Bengal ; Gunther says it is found in the Phillipine Islands, and perhaps in Burmah.

3*rd.*—" Uniform brownish olive ; scales of the hinder part of the body and of the tail somewhat lighter in the centre ; all the lower parts black except the chin and throat, which are yellow. This variety is found in Borneo."

" The young have a much more varied coloration. They are black, with numerous white equidistant narrow cross bands : one occupies the extremity of the snout ; the second across the posterior frontals ; the third across the crown of the head, behind the orbit ; the fourth across the occiputs to the angle of the mouth, the two latter bands are composed of oval spots. In a specimen from the Anamallay Mountains the belly is black, and the white bands extend across, being wider than the black ; in a second specimen, of which the locality is unknown, the belly is white, each ventral having a blackish margin."

The young Ophiophagus might well be mistaken for another genus.

Major Beddome says the young Ophiophagus is very like the Dipsas Dendrophilla, an innocent snake. The shields surrounding the occipitals are large, and give a distinctive character to the snake. "There is one præ orbital, seven upper labials, the third and fourth entering into the orbit, the third the largest, the sixth and seventh very low, temporals large, 2+2, ventrals 215, 262, sub-caudals 80, 100 ; the number of entire anterior sub-caudals varies much."

It is probably the largest and most deadly of the thanatophidia; fortunately, though widely distributed, it is not very common. According to Gunther it is found in almost every part of the Indian continent. In the Andaman and Phillipine Islands, in Java, Sumatra, Borneo, and, according to Dumeril, in New Guinea. Major Beddome of Madras says he has killed one nearly 14 feet in length near Cuttack in Bengal, where it is common. It does not appear to be much, if at all, known in the North-West or Central India ; it is most common in the damp climates of Assam, Bengal, Orissa and Southern India. It has been caught in the Botanical Gardens, near Calcutta, and it is said by the snake-catchers to be not uncommon in the Soonderbunds.

I have heard of an officer being attacked by one in Assam, and being in considerable danger. Dr. Anderson, curator of the Indian Museum, has the dried skin of an individual sent from Assam, that measures eleven feet nine and a quarter inches in length ; a specimen in the Indian Museum, killed in the Botanical Gardens, Calcutta, measures eight feet three and three-quarters of an inch, and five and three-eighths in girth. For these measurements I am indebted to Dr. J. Anderson.

The Ophiophagus, like many other snakes, takes to the water at times. A friend informs me that he shot one in the river near Teryah Ghat, at the foot of the Khasyah Hills, in April last. He was going slowly up a narrow stream in his boat when he met it coming towards him, with its head raised several inches out of the water. A charge of shot disabled it, and it was captured near the river bank, where it sought refuge. My

I had a living specimen from Rangoon nearly 12 feet long.

informant had not the means of preserving the snake, so he cut off its head and made a drawing, which is evidently that of an Ophiophagus. It was above 9 feet in length.

The Rev. Dr. Mason, in his work on Burmah, gives the following account of the hamadryad, which is, if not identically the same, merely a variety of the Bengal species:—

"The natives describe a venomous serpent that grows ten or twelve feet long, with a short, blunt head, a dilatable neck, thick trunk, and short tail. It is of a darker color than the common cobra, nearly black.

"I have never seen it, but the description given me accords so well with the generic characters of hamadryas, that it must be a species of that genus. 'The hamadryas,' says Dr. Cantor, 'is very fierce, and is always ready not only to attack, but to pursue, when opposed;' this, too, is a conspicuous trait in our Tenasserim serpent.

"An intelligent Burman told me that a friend of his one day stumbled upon a nest of these serpents, and immediately retreated, but the old female gave chase. The man fled with all speed over hill and dale, dingle and glade, and terror seemed to add wings to his flight, till reaching a small river he plunged in, hoping he had then escaped his fiery enemy; but lo! on reaching the opposite bank, up reared the furious hamadryad, its dilated eyes glistening with rage, ready to bury its fangs in his trembling body. In utter despair he bethought himself of his turban, and in a moment dashed it upon the serpent, which darted upon it like lightning, and for some moments wreaked its vengeance in furious bites; after which it returned quietly to its former haunts. Karens from Pegu describe a species of hamadryad (the belted hamadryad) with black and whitish transverse bands. It is often seen twelve feet long, by a foot in circumference; and one of my informants tells me he has seen them nearly three fathoms long, and proportionately large. It does not appear to be known in these Provinces, but the Burmese and Karens have well established names for the species; and it must be, I think, Cantor's."

Hamadryas Ophiophagus. Cantor.
Naja Elaps. Schlegel.
„ Bungarus. Schlegel.
„ Vittata. Elliot.

The Bengali name is sunkerchor, breaker of shells. It is found in the forest and grass jungle ; it is said to live in hollow trees, and to climb them readily, being frequently found resting on the branches.

As its name implies, it feeds upon other snakes, though probably when its usual food is not forthcoming, it is contented with birds, mammals, fish, frogs, &c.

It resembles the cobra, except that it is longer in proportion to its size, and its hood is relatively smaller ; it is, however, more graceful in its movements, and turns more rapidly. It is occasionally seen with the snake-charmers, who prize it highly as a show ; but they say it is exceedingly dangerous to catch, and difficult to handle before its fangs are removed.

In September, 1868, one of about 8 or 9 feet long was brought to me by some snake-men, but its fangs had long been extracted, ciatrices indicating their former presence. It was of a light olive green, with arrowhead shaped transverse bars. It was very much under the control of the snake-man, who exhibited it, and sat up, erecting its hood and following the motions of his hand exactly like a cobra. On two different occasions it ate snakes in my presence, two specimens of Passerita mycterizans, that had been killed by a cobra. The snake-man put the head of the passerita into the hamadryad's mouth, and in about a quarter of an hour it gradually swallowed it; during the process it moved slowly about with the head, neck and hood dilated, and it looked very odd with the smaller snake hanging out of its mouth. The fangs had been, as I have said, extracted, but on pressing the poison gland a deep yellow coloured viscid fluid exuded. I collected a few drops of this and inoculated a drop of it into the thigh of fowl. The bird sickened and died in about three hours; with much the same symptoms as in cobra poisoning, the blood of the fowl coagulated firmly after death. It would appear from this, that although the snake be deprived of its fangs, the glands still retain the power of secreting poison, but that it was altered in appearance and properties I think very probable.

I have just received a living specimen from Rangoon, nine feet six inches in length. It is of a light olive color in front, but dark towards the tail, with the bands as above described. It seems sluggish and indisposed to attack; when roused it hisses, and slightly expands the hood, raising its head some inches from the ground. A living passerita mycterizans was

I subsequently received another of the dusky variety nearly 12 feet long.

put in the cage, but it has not touched it; a dog was also placed in the cage with it, but it could not be made to strike. In short, it seemed disinclined to be troubled, and as though it wished to be let alone. It is very powerful, and the snake-man seemed disinclined to handle it without other professional aid, as he was alone.*

The dilatable neck is not altogether peculiar to the Najidæ, but it is better marked in them than in any other snake. The Tropidonotus Macropthalmus, an innocuous colubrine snake, which attains a length of 39 inches according to Gunther, and is found in Khasya and Sikkim up to 4,000 feet, has this anatomical peculiarity. It is known by its large eye and dilatable neck; the scales, Gunther says, "show an arrangement very similar to that of the cobra, for which it is frequently taken; all the specimens I have seen show unmistakeable signs that their captors considered it best to kill them from a distance, and to inflict a death-wound as near to the head as possible."

It is of "brown, or blackish brown above, uniform or with a dorsal series of reddish brown spots; neck with an indistinct arrow-shaped mark; anterior part of the belly with large quadrangular blackish brown spots; posterior part and lower side of the tail more or less clouded with brown."

"Young specimens have indistinct square dark spots on the back arranged in quincunx, and a bright yellow collar broadly edged with black."

The natives say almost every snake is poisonous, and they give this character to the lizards as well.

The fabulous Biscopra, Varanus is believed to be as deadly as Cleopatra's asp; whilst the Touktai, Platidactylus, Gecko, of Burmah has got an equally evil repute among the Burmese, and with as little reason. The fact is, that though some of the Sauria may be able to bite hard, they are all perfectly innocent as to venom. There is no such thing as a lizard of any kind with a poison gland connected with a fang, and, however positively it may be affirmed, it may be as positively denied that any lizard is venomous.

BUNGARUS.

In this genus there are only two Indian species to be described. They are both common, and one of them, the Bungarus

* He did so subsequently without difficulty, making a man hold the tail, whilst he managed the head.

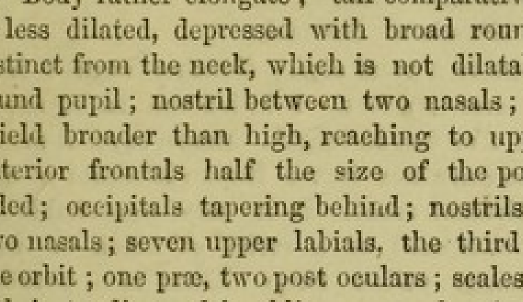
Cœruleus or Krait, is probably next to the cobra, the most destructive snake to human life in India, though not actually so venomous as some others. The name is of vernacular origin, Bungarum Pamah being the native term for the typical species, B. Fasciatus on the Coromandel Coast.

Gunther say of this genus, that "all the species occur on the continent of India; they are extremely closely allied to one another, so that it is sometimes difficult to distinguish species from varieties." I only know of two species that occur in the Peninsula of Hindostan, the B. Fasciatus and B. Cœruleus, and these are so extremely unlike, that it is impossible to conceive how they could ever be mistaken for each other.

Gunther certainly describes two other species: B. Ceylonicus, which somewhat resembles B. Fasciatus, and B. Semifasciatus, which somewhat resembles B. Cœruleus; but as they are not found in India, the first being Cingalese and the second Chinese, I do not include them in my description. The large black or deep blue and yellow-banded bungarus or sankni, is, to an ordinary observer, totally different to the smaller and dark-colored one, or krait, however much they may be alike in more essential characters. Another species of some naturalists, "Bungarus Flaviceps," is placed by Gunther in another genus, of which it is the only representative, Megœrophis. This is placed by some authorities among the Bungarums, and is very nearly allied to them. It is not found in India, but in Borneo, Java, Sumatra and Penang, where it attains the length of six feet or more.

Gunther gives the following general description of the genus :—

"Body rather elongate ; tail comparatively short ; head more or less dilated, depressed with broad rounded muzzle scarcely distinct from the neck, which is not dilatable ; eye small, with round pupil ; nostril between two nasals ; loreal none ; rostral shield broader than high, reaching to upper surface of snout ; anterior frontals half the size of the posterior, vertical five-sided ; occipitals tapering behind ; nostrils rather wide between two nasals ; seven upper labials, the third and fourth entering the orbit ; one præ, two post oculars ; scales smooth, moderately imbricate, disposed in oblique rows forming fifteen longitudinal series round the body : those of the vertebral series are very broad, hexagonal ; ventrals between 200 and 300 ; anal and sub-caudals entire ; scales without apical groove ; maxillary bone



with a fang in front, a second small simple tooth at some distance behind the fang."

The Bungarums are diurnal terrestrial snakes, but like others, they generally prefer the shade to the sunshine. They are found in the open country, grass and low jungle and fields. They live in holes in the ground, sometimes down among the roots of trees extending to a considerable depth. They are not frequently seen in inhabited places, though they do at times find their way into native huts and houses. I killed a very large one in Rangoon many years ago, that got into a hut full of dhoolie-bearers at the field hospital during the last Burmese war. They feed on small animals, snakes, frogs, toads, lizards, and they are very poisonous; but owing to the shortness of the fang, which is much smaller than that of the cobra, their bite is less dangerous, and excision being more practicable, treatment may be useful and recoveries more numerous. Bites from the B. Fasciatus are comparatively rare; those of the krait, B. Cœruleus, are very common, and the police returns show a large mortality among the rural population therefrom.

The Bungarus is not particularly aggressive, and tries to escape when discovered, but if attacked it retaliates fiercely, and its bite is very dangerous. The B. Fasciatus lies coiled in curves, and when disturbed jerks itself out like a spring, but without extending its whole length of body.

The first species to be described is the Bungarus Fasciatus, or Sankni, Bungarum Pamah according to Russel of the Cormandel Coast, Rajsamp of some natives.

Bungarus Annularis. Schleg. Daud:
,, Fasciatus. Cantor.
Pseudo Boa Fasciata. Schneid:

This Bungarus grows to a great size. Gunther says 4 feet, but it has been found over six feet. I killed one in Rangoon many years ago over five feet in length. Mason says it grows to 6 or 8 feet. A specimen now in the Indian Museum is 58¾ inches long, 4¾ in circumference. It is very remarkable in its coloration, being composed of a series of black or steel blue and bright gamboge yellow rings. There is a peculiar metallic lustre on the skin which is very beautiful. Its tongue is flesh colored; lips and throat gamboge colored. It is tolerably common in Bengal and in Southern India, as well as Burmah, and it is also known in the North-West, where it is

Note by Major MacMahon ~~of Delhi~~

Dy: Commr of Delhi — of the origin of the name "Karait"

"Kâlgundait is the proper Urdu name for the Bungarus. Karait is I presume merely an English corruption of the Urdu word Kâlgundait: if not it must be a Bengallie corruption of it as no native of Delhi would understand you if you spoke of the "Karait" –

I presume "Kâl" means death, or perhaps Kala black.

however it is the common word used

sometimes called "koclia krait." Its bite is very dangerous, but the police returns do not show that it causes many deaths; probably because it is not so much in the way of being met with as the cobra or krait. Its fangs are relatively to those of the cobra, very small, and its bite in dogs causes death much slower than the cobra's bite. It is much less valued by the snake-men than the cobra, as it does not erect its head, nor is it amenable to their tuition. Dogs bitten by B. Fasciatus died at various periods from 4 hours 28 minutes to 10 days.

Dr. P. Russell has figured it in his great work on Indian serpents, and in describing it he notices what is very striking, the trigonal shape of its body, the sharp dorsal ridge and declining sides. Gunther's definition of it is as follows:—"The first temporal shield is scarcely longer than high; ventral 200 to 233; sub-caudals 32 to 36. Body with alternate broad black and yellowish rings extending across the belly. There are from twenty-five (25) to thirty-three (33) of these black rings round the trunk; the first is the broadest, and produced into a triangular process, the point of which rests on the vertical shield. Head black anteriorly, and on the sides separated from the triangular process by a yellow V. like mark; lower parts and throat uniform yellow. The hexagonal vertebral shields and the hard blunt and almost bony end of the tail, with which some natives think the snake can sting, are very characteristic."

Bungarus Cœruleus.

This is the krait of India, and next to the cobra is the most destructive to human life. It is figured by Russell in his great work, and is called by him *Gedi Paragoodoo.* It has a variety of synonyms:—

Pseudo Boa Cœrulea. Schneider.
Boa Krait. Williams.
Boa Lineata. Shaw.
Bungarus Cœruleus. Daud:
" Lividus. Cantor.
" Candidus. "
" Arcuatus. Dum. and Bib:
" Lineatus. Gunther.

This snake is described by Gunther as follows:—"The post temporal shield is considerably longer than high. Ventrals 201-221. Sub-caudals 38-56. Lower parts uniform white. Upper parts bluish or brownish black, uniform, or with more

~~in Bengal~~ It is called Dhamin Chiti in some parts of Bengal.

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or less numerous, very narrow white cross streaks, not quite as broad as a scale, and generally radiating from a white vertebral spot, no collar." I would add that the lower part, the ventral and surface, is sometimes, as in a specimen from the Indian Museum, Calcutta, now before me, of a dark livid color, or of a yellow tinge, and that the light-colored bands are broader than a scale uniting with the general light color of the ventral surface.

Gunther describes three varieties :—

1. "Upper parts uniform blackish brown. B. Lividus from Assam—Cantor. In young specimens the head is white, with a a black line between the occipitals."

2. "A vertebral series of equidistant small white spots, from which narrow transverse streaks proceed."

3. Upper parts with narrow white streaks arranged in pairs. B. Arcuatus.—Dum : and Bib : The coloration of the dark parts varies from a deep, almost steel blue black, to a chocolate brown. Tongue white, iris black. This species of Bungarus is common all over India ; it seems to be more destructive to life in the Upper Provinces than in Lower Bengal. The fangs are much smaller than those of the cobra, and its poison is not so rapid in its action, which, with the comparative smallness of the wound, gives greater hope of cure, but it is, as I have said, very dangerous and destructive, as shown by the police returns.

It grows to a considerable size : the one before me from the Indian Museum measures $47\frac{3}{8}$ inches in length, and $2\frac{5}{8}$ in circumference. Dr. P. Russell gives 29 inches as the length, but it certainly attains a much larger size than this. Gunther says 54 inches. The trunk is of nearly equal thickness from the neck to within 4 or 5 inches of the tail. The scales in the dorsal ridge are large and hexagonal. Dr. Russell says that this snake was sent to him from Masulipatam, under the name of Cobra Monil. Gunther says that Europeans in the peninsula of India give the same name Cobra Monil to the Daboia Russelii or Tic-polonga.

It seems to be common all over India. I am not aware if it be found in the Himalaya. It is found in the fields, grassy plains, rice khets, low scrubby jungle, and among débris of wood or buildings. It sometimes insinuates itself into houses in the verandah, bath-rooms, on the ledges of doors or jhilmils, book cases, cupboards, &c., and in such situation it is not unfrequently the cause of fatal accident. I know of an instance

I have since received a living specimen 49 inches in length from Delhi

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where, after a night's dâk in a palanqueen, a lady, in taking out her things on arriving at her destination, found a krait coiled up under her pillow: it had been her travelling companion all night.

The krait may be mistaken for Lycodon Aulicus, an innocent snake, the coloring and general appearance being in many cases very similar. The least examination of the mouth would detect the difference, but at first sight they are much alike, and are often mistaken, the Lycodon suffering for its resemblance to its poisonous fac-simile.

Xenurelaps.

There is only one species as yet known of this genus, and Gunther says there is only one specimen of it preserved, and that is in the Museum of the University of Oxford. It is 15 5/8 of an inch long, the tail measuring 1 5/8 of an inch. This specimen came from Cherra Poonjee in the Khasyah Hills: the only habitat given by Gunther. -*-

It is very closely allied to, and resembles a Bungarus. Gunther gives the following definitions of the genus:—

"Body sub-cyliadrical, long and slender; belly rounded; head short, sub-trigonal, with rounded snout, not distinct from the neck, which is not dilatable; tail short. The shields of the head normal, but the loreal is absent; nostrils lateral, between two shields; eye small, with round pupil; one præ, two post oculars; scales smooth, not much imbricate, in fifteen rows, those of the vertebral series enlarged, hexagonal anal entire; sub-caudals bifid; maxillary with a grooved fang in front, and with a small smooth tooth behind."

The single known species is—

Xenurelaps Bungaroides. Gunther.
Elaps Bungaroides. Cantor.

Gunther's definition of the species is "very similar in general habits to a Bungarus. Shields of the upper surface of the head normal, the occipitals somewhat tapering behind; rostral as broad as high; nostril open, round; loreal none, the præ orbital being in immediate contact with the post nasal; two post oculars; seven upper labials, the third and fourth entering the orbit; temporals 1 + 2 + 3, the anterior in contact with both post oculars. Six lower labials; two pairs of short chin shields, the anterior in contact with three lower labials. Scales in fifteen series, those of the vertebral series enlarged hexagonal;

The Lycodon Aulicus is not so dark colored as the Krait—

*"In the proceedings of the Asiatic Society of Bengal (No III March 1870— P. 82.. Mr Jerdon says he has obtained a single example of the very rare Xenurelaps Bungaroides — of which only one specimen is known, the type specimen in the Museum at Oxford"—

Jerdon describes his specimen thus. "It is 15 inches long of which the tail is 2 4/8 — It has 224 ventral scutae and 44 sub caudals and 13 to 15 rows of scales on the body. It only differs from Gunther's description by having one white interrupted line commencing on the vertical and extending to the throat on each side. The color of the body was a deep rich madder brown, and the bands were yellow, paling posteriorly. The chin and throat are whitish, which passes into red gradually deepening on the posterior part of the body and tail and there are numerous oblong black marks on the

~~There are only two species~~

abdominal and sub caudal circles 68

ventrals 237; anal entire; sub-caudals 46; upper parts black, with narrow white angular, transverse lines, the angle of which is pointed forward: these lines are more distinct in front than behind; there are about 48 on the trunk. The lower part of the rostral shield white; a white line across the snout, before the eyes; two interrupted divergent white lines commence on the vertical shield, each descending to the side of the neck; another band descends from behind the eye to the fifth and sixth labial, lower parts whitish, with irregular blackish cross bands."

I have been unable to collect any information about this snake, it is not in the Indian Museum.

Dr. Cantor describes it as "black blue above, with white arrow-shaped stripes; beneath alternately white and black blue."

It is called Elaps Bungaroides from its resemblance to B. Cœruleus or the Krait.

In habits and properties, as in appearance, it most probably resembles the B. Cœruleus. Information being much needed about the snake, it is to be hoped that naturalists on the frontiers will endeavour to procure specimens and such information as to its habits, as will throw light on the subject.

Callophis.

This genus has several species in India; they are all venomous, though from the shortness of the fangs, and as they are generally of small size, it is probable that a fatal result would not be produced by their bite in man. The poison is virulent, nevertheless, and fowls bitten by some of the species succumbed in from one to three hours. The known Indian species are:—

Callophis Intestinalis.
" Macclellandii.
" Anularis.
" Trimaculatus.
" Nigrescens.
" Cerasinus.

They are all more or less distinguished by the presence of a bright color, on the more sombre hue of the general surface of the body.

They are sluggish, apparently defective both in sight and hearing, for they allow themselves to be approached with little sign of fear. They are not aggressive, and bite reluctantly, but if irritated, they can be made to bite, and the poison proves fatal to fowls.

They are ground snakes, and are slow and sluggish in their movements. They seem to prefer hilly to level country, and they live chiefly on snakes. Gunther says, the Calamariæ, an innocent family, that they much resemble in appearance, are their principal food.

Gunther's description of them is as follows:—"Body subcylindrical, very long and slender; belly rounded; head short, obtuse, with broad snout, not distinct from the neck, which is not dilatable; tail short. The shields of the head normal, but the loreal is absent. Nostril wide, lateral between two shields; eye small, with round pupil; one præ, two post oculars. Temporals in a single longitudinal series; six, seven or eight upper labials, the third and fourth entering the orbit. Scales smooth, not much imbricate, in thirteen rows; those of the vertebral series not enlarged. Sub-caudals bifid; maxillary with a grooved fang in front, without other teeth behind."

"The Callophides are very similar to one another: their body is cylindrical, of nearly the same width throughout, and much elongate; the number of ventral shields is almost always exceeding 200. The head is of moderate length, slightly depressed, not distinct from the neck, with broad rounded snout. The nostril is lateral, rather narrow, situated between two shields; eye small, with round pupil; cleft of the mouth of moderate width, not much extensible. The shields on the upper side of the head normal; the occipitals somewhat elongate; loreal absent. The single præ-ocular forms a suture with the hinder nasal, and extends to the upper surface of the head, but does not reach the vertical, which is comparatively narrow. Two post oculars in contact with the single anterior temporal. The number of upper labials does not exceed eight, generally, there are less than eight, the third and fourth entering the orbit. Scales invariably in thirteen rows, smooth, polished, not much imbricate. Tail short, and tapering, with bifid subcaudals."

Callophis Intestinalis.

This species is found in Central India (Malwah) according to Gunther. The only specimen in the Indian Museum in Calcutta is one marked from Singapore, under the synonym of Elaps Fasciata, Cantor. The proceedings of the Zoological

Society, part 7, 1839, p. 34, gives the following description of it:—"Pale reddish brown above, with a bright yellow dorsal line, with black serrated margins; in the tail three black bands; the abdominal surface whitish yellow, enclosed on each side by a black line." Habitat, Singapore. Its synonyms are:—

Elaps Furcatus. Schlegel. Schneider.
Aspis Intestinalis. Laur: Syn. Amphib.
Maticora Lineata. Gray.
Elaps Intestinalis. Cantor.
Callophis Intestinalis. Gunther.

Gunther describes the Malwah variety as follows, which somewhat differs from Cantor:—

"Head light brown above, yellowish below, spotted with black on the sides; a vermilion black-edged band runs from the occiput to the top of the tail; a buff-coloured band, with an upper and lower border, runs along the joining edges of the two outer series of scales: the upper black border is as broad as the shape of reddish grey ground colour, as the side of the back. Belly with alternate pale citrine and black cross bands, the latter colour occupying three or four ventral shields together, whilst the former rarely occupies more than two; tail with three black rings, which, however, are sometimes absent."

"Upper labials six; ventral shields 223-271; sub-caudals 24-26. It attains to a length of 2 feet, the tail measuring 1½ inch.

At a meeting of the Asiatic Society on the 6th April, 1870, Dr. Stoliczka exhibited a specimen of the rare Callophis Intestinalis obtained from Upper Burmah. The species has the poison glands extending from the head to about ⅓rd of the total length of the body, lying free in the cavity of the anterior part, and causing the heart to be much further removed backward than is generally the case in other species of snakes."—Pro., Asiatic Soc., April 1870.

CALLOPHIS MACCLELLANDII.

Synonyms:

Elaps Macclellandii. Reints. Cal. Journal, Nat. Hist.
„ Personatus. Blyth. Journal, Asiatic Society.
„ Univirgatus. Gunther's colubrine snakes.
Callophis Univirgata. Smith. Proc. Zool. Soc.
„ Macclellandii. Ditto ditto.

Gunther describes three varieties of this snake:—

1. "Belly with uninterrupted black cross bands, alternately limited to the belly, or extending up the sides of the body, so as to cover scales of the four outer rows, and give the appearance of a lateral series of large black spots. The three last cross bands of the trunk form complete rings, crossing the vertebral line; tail with three other black rings. This specimen is 26½ inches long; tail 2⅓ inches; ventral 196-218; sub-caudals 27-34."

2. "Belly with quadrangular black spots rather irregularly disposed, and not extending up the sides; tail without black rings. This specimen is 18 inches long; tail 1⅓ inch; ventrals 224; sub-caudals 25."

3. "The cross bands reach entirely across the back, forming rings, from 22 to 28 in number; on black vertebral line, which, however, is indicated by isolated small spots. Ventrals 196-218; sub-caudals 27-34." Varieties 1 and 2 are from Nepal and Darjeeling; 3 from Assam.

There is a good specimen of this snake in the Indian Museum, but it has been bleached by the action of the spirit; it is from Assam. Museum No. 123.

Gunther's description of the species generally, is as follows:—

"Head and neck black above, with a yellow cross band behind the eyes. Body and tail reddish brown, generally with a black vertebral hue from the nape to the top of the tail. Belly yellowish, with black cross bands or quadrangular black spots."

"Upper labials seven, temporal small, 1 + 1 + 12, anal bifid."

CALLOPHIS ANULARIS.

"Gunther says of it:—"Head and neck black above, with a broad yellow cross band behind the eyes. Body and tail reddish brown, without longitudinal band, but with 40 narrow, equidistant, black, white-edged rings; each of them is about as broad as a scale in the back (those round the tail being broader), and occupies one ventral shield on the belly. Belly yellowish, with a black cross band in the middle between the rings; each of these cross bands occupies a ventral shield, so that about every third ventral is black. Upper labials six, temporals small, 1 + 1 + 1, the first very narrow, the third the largest; ventrals 208; anal bifid; sub-caudals 33."

Gunther says:—"I have examined only one specimen of this species, remarkable on account of its singular coloration. It is marked "India," and is 19 inches long, the tail measuring 2 inches."

Callophis Trimaculatus.

Synonyms :

Vipera Trimaculat. Daud: Rept.
Elaps Trimaculatus. Merr: Tent.
Coluber Melanurus. Shaw, Zool.
Callophis Trimaculatus. Gunther. Proc. Zool Soc.

"Light bay above; an indistinct line formed by minute brown dots, along each series of scales. The upper side of the head, the neck, and a spot below the eye, black; snout with some irregular small yellow spots; a yellow spot in each temporal shield; a sub-triangular yellow spot on the middle of the neck; the back of the neck edged with yellow behind. Tail marked with black below, and with two black rings, each of which is variegated with yellow. Belly uniform white (red during life); upper labials six; temporals elongated 1 + 1 equal in size; ventrals 258-274; anal bifid; sub-caudals 35."

Russell has figured this snake in his Indian serpents, figure viii, Vol. 1. Gunther says he has received one from Bengal, agreeing with Russell's typical specimen. The snake is very small, being only 12 inches long, tail measuring $\frac{7}{8}$ of an inch.

Museum No. 124. There are specimens in the Indian Museum described as Elaps Melanurus, Cantor, from Rangoon. These were presented by Dr. Fayrer in the year 1853. They are bleached and altered in color by the action of the spirit.

Callophis Nigrescens.

Callophis Nigrescens. Gunther.
" Concinnus. Beddome.
" Malabaricus. Jerdon. Beddome.

Gunther's description is as follows:—

"Upper parts dark blackish ash or black, the lower uniform red; upper part of the head symmetrically marbled with black; a black spot below the eye; another descends from the occipital to the angle of the mouth; a black horse-shoe like collar, with the convexity directed forwards; a narrow black vertebral line, and slightly edged with yellowish, runs from the collar to the tip of the tail; a series of small ovate black spots indistinctly edged with whitish coloring on each side of the trunk disappearing posteriorly; tail colored like body, without black rings.

In old examples, the black dorsal stripe and the black lateral spots disappear, and only the whitish edge of the latter remain, forming indistinct longitudinal lines.

"Vertical shields elongate; upper labials seven; temporal 1 + 1; the anterior twice the size of the posterior; ventrals 232-247; anal entire, in one specimen bifid; sub-caudals 33-42."

"I have examined three specimens of this species, one of which was sent by Captain R. H. Beddome from the Neilgherries. The largest is 4 feet long, the tail measuring 5 inches."

Callophis Cerasinus.

Major Beddome describes a species from the Wynaad, Malabar forests, to 3,000 feet high.

"Rostral slightly produced back between the anterior frontals; anterior frontals only half the size of the posterior, the latter touch the orbit; no loreal and no anti-ocular; nostril between two nasals; seven upper labials, third, fourth and fifth very high: third and fourth enter the orbit; one small post ocular; vertical six-sided elongated, pointed behind; superciliary small; occipitals large, elongated, pointed behind, with a pair of large temporals on each side; anal entire; back purplish brown, with a shining nacreous lustre, with transverse broad irregular shaped black bands extending to the top of the tail (about 40) at nearly equal distances, and which are continued (though not broad) underneath the belly and tail, but do not quite meet; sides (2 or 2½ of lowest row of scales) and belly of a bright cherry color; head black in front, neck with the fifth, sixth and seventh labials, and a portion of the occipitals cherry colored; length 21½ inches, of which the tail is 2 inches; circumference 1⅛ of an inch; sub-caudals 13; abdominals 228."

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T[redacted]

[redacted]

[redacted]c.

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ii

OPHIDIA VIPERIFORMES.

This sub-order has two families: the Viperidæ or Vipers, the Crotalidæ or Pit Vipers.

I shall pass on to the description of the Indian forms of this sub-order, to complete that of the terrestrial poison snakes, leaving the Hydrophidæ or pelagic Thanatophidia, for subsequent consideration. The Ophidia Viperiformes or viperine, differ essentially from the colubrine snakes. The maxillary bone is very short, and bears only one tooth, the long scimitar-like poison fang. A description of it has already been given.

The head is generally broad, triangular, and covered with small scales instead of shields (there are exceptions, Peltopelor Macrolepis.) The body is short and robust, and the tail is sharp. The scales are frequently carinated. The Indian forms are arboreal as well as terrestrial and are all venomous. The broad triangular head generally without shields, the long moveable fang, and the comparatively short and robust body, distinguish the viperine from the colubrine snakes. A deep pit in the loreal region between the eye and the nostril is characteristic of the Crotalidæ.

The family of Viperidæ is represented in India by one of its most formidable genera, Daboia.

The family of Crotalidæ is represented by the Trimeresurus, Hypnale, and others; but they fall far short of their congeners in the New World, where the Crotalus Horridus and

Brazilense
Craspedocephalus are almost, if not quite, as deadly as the Ophiophagus, Naja, and Daboia of India.

The Calloselasma, the single species of a genus of the Crotalidæ of the same name, is represented as attaining to the length of three feet, and being very deadly. Gunther says, "Kuhl was eye-witness of a case where two men bitten by one and the same snake expired five minutes after." But this snake is an inhabitant of Java and Siam, and is not, that I am aware of, found in India. I allude to it merely to show that there is at least one deadly form of Asiatic Crotalus. The Indian species are mostly arboreal, and though venomous, are much less dangerous and fatal than the venomous colubrine or viperine snakes, but deaths from their bite have been recorded.

e

The Crotalidæ of America are remarkable by a peculiar series of horny scales or rings at the tip of the tail, which make a rustling or rattling sound when the snake is agitated, and hence the name "rattlesnake." The only rudiment of this rattle in the Indian Crotalidæ is found in the Halys, where the tail terminates in a horny point or scale. The viperine snakes are as a rule viviparous. Dr. Anderson, of the Indian Museum, informs me that he has taken as many as forty young ones out of a Daboia Russelli.

I have heard it stated that the Trimeresuri are oviparous, perhaps ovo-viviparous, but I have no personal knowledge that such is the case.

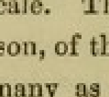
VIPERIDÆ.

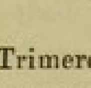
I describe the Viperidæ or vipers first, for although represented by only two species, yet one, the Daboia, so far surpasses any of the Indian Crotalidæ in death-dealing power, that, as Thanatophidia, they are entitled to precedence.

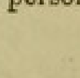
Gunther gives the following general description of the family:—

"Body robust; tail rather short, not prehensile; head broad or thick, generally scaly above, or incompletely shielded; no pit

Daboia pupil

A—In shade  A

B—In moderate light  B

C—In bright light  C in the loreal region ; eye of moderate size, with vertical pupil ; viviparous."*

The vipers are terrestrial snakes. British India produces only two forms, the Daboia and Echis, whilst the Crotalidæ are represented by a variety of Trimeresuri, Peltopelor, Halys, and Hypnale. The Crotalidæ have their most vigorous forms represented in America by the Rattlesnakes. The vipers have a formidable representative in India in the Daboia Russelli; there are others in Africa and Australia.

DABOIA.

There is only one species of this genus :

Daboia Russelli or Tic-polonga. Gunther.
Tic Polonga. Davy, Ceylon.
Coluber Russelli. Shaw.
Vipera Elegans. Daud :
,, Daboia. Daud :
Daboia Elegans. Gray.
,, Pulchélla. Gray.
,, Russelli. Gray.

Gunther gives the following description of the Daboia, which corresponds with those I have examined and experimented with here :—

" Greyish (light chocolate colour) brown with three series of large, black, white-edged rings : those of the middle series ovate, those of the outer, circular ; sometimes very small, black, white-edged occelli are scattered between the rings. A yellow line on each side of the upper surface of the head. The two lines convergent on the snout. Rostral and labial shields yellow, with brown margins ; a sub-triangular brown black-edged spot behind the eye. Belly uniform yellowish or marbled with brownish, generally more or less numerous semi-circular brown

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164 * Daboia Russelli has a round pupil. ~~Cope, Philadelphia~~.

carefully re-examining Daboia, I find that pupil is not round. When fully dilated it is nearly so, & the appearance is accordingly a dark coloured bead across the yellow iris. — It is ...lly oval and in a bright light contracted vertical slit.

spots as the hinder margins of the ventral shields. Ventrals 163-170. Sub-caudals 45-61."

I would remark on this, that the specimens I have examined vary a good deal in the form and arrangement of the rings and spots and of the colored patches on the head, but the description well describes their general appearance. The Daboia or Russell's Viper, is called by the natives about Calcutta, Uloo Bora, from the uloo grass in which it is often found. In Bengal it is also called Jessur. It is common in Bengal, and is frequently caught in the Botanic Gardens near Calcutta. It is common in the south of India, Ceylon, and Burmah. Gunther says it is known to Europeans in India as the Cobra Monil or beaded snake. I do not know whether it is found in Central India,* the North-Western, Central Provinces, and Punjab; if so, it is less common than in the south.

It is the Tic-polonga of Ceylon, and is justly dreaded there as a very deadly snake. Dr. Russell describes it in his work on Indian snakes, under the name of Katuka Rekula Poda. He says it is doubtful whether it is not as venomous as the cobra. My experiments incline me to agree with Dr. Russell, and to give it, at all events, a place next to the cobra. Fowls bitten by this snake expired in from 35 seconds to several minutes; dogs, from seven minutes to several hours; a cat in 57 minutes; a horse in 11½ hours. Death was not in any case so rapid as after the cobra bite, but though slower in its action, the poison seemed just as deadly. The blood remains fluid after death from Daboia poison, whereas after cobra poisoning it coagulates firmly on being removed from the heart and great vessels. The Daboia is nocturnal in its habits; in confinement it is sluggish, and does not readily strike, unless roused and irritated, when it bites with great force and determination.

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* Mr. W. T. Blanford says it is found in Central India.—Proc. As. Soc., Bengal, August 1870, page 257.

It probably is found all over the plains of India as well as in the hills.

X also, Seah Chunder Amaiter.

X It has been found in the Himalaya high as [illegible] feet in Kulu up to [illegible] feet [illegible] Cashmir [illegible]

When disturbed it hisses fiercely, and when it strikes, does so with great vigor. Its long moveable fangs are very prominent objects, and, with them, it is capable of inflicting a very deep as well as poisoned wound. The markings in its body are very beautiful, and justify the synonym V. Elegans. It lives on small animals, such as rats, mice, and frogs. My snake-man says it will go into water. It is, however, terrestrial and nocturnal in its habits; its loud hissing when disturbed is calculated to warn those who approach its dangerous proximity. Though so deadly, it does not appear, by the returns, to cause many deaths, but this may be owing to the fact that the natives seldom know, often do not see, the snake that has inflicted the fatal wound. It is much less known, and its misdeeds are therefore doubtless often ascribed to the cobra. In the official returns of deaths from snake bites, a large number is attributed to snakes unknown. If the real offender could be detected, it is probable that the Daboia would have a more prominent place than it occupies at present.

It is apparently a hardy reptile. I had one about 44 inches in length, which lived for a whole year without food or water; it obstinately refused either, and was vigorous and venomous to the last. It died suddenly at the School of Art, where it had been sent to be figured.

I have heard, I know not how far it may be true, that it often kills cattle, biting them when grazing. It attains to the length of fifty inches, probably more, but I have seen none of greater length. A specimen now before me is 44 inches long and 4½ in circumference.

ECHIS.

This genus contains only one Indian species, Echis Carinata. The native name I have been told is Afäe in Delhi; it is not known to the natives of ~~this part of~~ Bengal.

Pseudo Boa Carinata. Schneid:
Echis Carinata. Merr. Tent.

Tennent says of account seen in Ceylon [illegible] Ceylon P. 305

[illegible] that it is found in sunny places

49.

as

Dr. Russell has described and figured this viper in his great work on serpents, Horatta Pam., vol. 1, pl. 2.

1-another
in 2

It is much smaller than the Daboia; is venomous, but Gunther says its bite is not known to have proved fatal. This I think is very doubtful; one in my possession killed a fowl in 4 minutes, and a dog in about 4 hours.* I have received

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* Extracts from the Report of Dr. Imlach, Civil Surgeon at Shikarpore, dated 14th February, 1855, addressed to the Superintending Surgeon, Sind, on the snake season of 1854. Transactions of Medical and Physical Society of Bombay, No III., new series, 1855-56, page 80.

" Six months may be regarded on the average as the period during which snakes wander about, commencing from about the earlier part of May, and continuing until towards the latter part of October, or according as the cold season may set in, sooner or later.

The number of cases reported have amounted to 306; the mortality among this number to 63; giving a percentage of fatal cases of 20·58: not a very great proportion after all, considering the next-to-nothing remedial measures usually adopted by the gentle Sindians.

From among the 306 cases of snake-bite, 262 occurred in males, the remainder 44 having been in the instance of females; and the comparative mortality of males and females being respectively 53 and 10; giving the relative percentage mortality among males as 20·21, whilst on the part of females there is a slight increase, the proportion amounting to 22·72.

The small number of cases occurring amongst females (and of these only 10 fatal cases for the season) shows that the natives of this Collectorate [Upper Sind] have not resorted to " mortality from snake-bite," as a means of accounting for any murderous deeds; a practice which might have been supposed to exist among a class of people who, till within the past few years, had a sort of acknowledged claim to the lives of their female relations when caught in the act of, or suspected of fleshy weakness, and when of course it would have been their aim, as a matter of attempted self-protection, to have given forth as fair a reason for death as possible.

The Kuppur, which I take to be the Scytab Bysonata, and which to me appears simply to differ from the West Indian snake of that name in regard to colour, is without exception the most deadly poisonous snake in Sind; and a reference to the police returns shows that in by far the greatest majority of cases, serious injury and death have been caused from the bite of this species.

Fifteen inches may be regarded as about the average length of the Kuppur; the larger, and, I imagine, older specimens have but little exceeded in this, but their diameter has by about double exceeded that of the ordinary size of the reptile, which measures

The Echis is a very fierce and vicious viper. it throws itself into an attitude of defence & offence ~~[illegible]~~ making a peculiar rasping sound by rubbing its carinated scales against each other as it coils in many convolutions without changing its place. It dar[ts] very fine living specimen from Delhi, 20 inches long. 23½ It is a terrestrial snake, and is viviparous; it lives, according to Gunther, on Scolopendridæ, for he says he has found only these in its stomach.

I have never seen it in Bengal, nor am I certain that it is found there; but it is found in the North-West Provinces,

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somewhere from about 2 to 2¼ inches round the largest part of the body.

The head, covered with very small scales, is of a flat irregular hexagonal shape, the greatest length of side being from the point where the mouth ends backward. I much regret that it is not in my power to send a painting of the reptile. The extreme ferocity of expression, if one may use the term, is, I think, peculiar to the Kuppur. Compared with the head and body, the neck is comparatively small, the actual tail portion fines off somewhat abruptly, and barely exceeds an inch and a half in length, and is remarkably small compared to the circumference of the actual body. The marks on the head probably aid towards adding to an evil expression, but still, noting the general habits, you cannot help seeing that the brilliant eye indicates a vicious inclination, and even, however long you may leave the Kuppur unmolested, still you always find his crest erect and his head fixedly in the direction of the party who may be watching him, ready for the defensive. Opportunity having been frequent, I have over and over again watched his remaining for long in one position, and even when the Kuppur thinks fit to avoid his opponent, still the change of position is caused by a peculiar sliding movement backwards, the head invariably being directed towards his enemy.

The marks on the head, or rather what may be termed the forehead of the Kuppur, exhibits in white and brown, somewhat the appearance of a cross; the ground mark of the body is of a dull muddy grey colour, the sides of the body being marked along with crescentic double marks of black and white, the concavity of each being towards the abdomen.

In several specimens of this snake I have observed double or rather two fangs on each side of the jaw, but I omitted to make special note as to whether this is of common or unusual occurrence.

The poison of this snake introduced into the system of the fowl induces death in about three quarters of a minute.

Death in a fowl occurs much in the same way as in the human subject; the mucous membrane is powerfully acted on, the head gradually droops, the legs give way, and the creature rolls on its side in the last agony of passing life."

The Kuppur I think must be the Echis Carinata, as the description corresponds with that of this viper; and this would shew that it is more dangerous than Gunther supposes, and corresponds with the opinions expressed by Major MacMahon, Deputy Commissioner of Delhi, who says it has the repute of being a deadly snake.

[illegible] a distance of more than a foot, with its [illegible] wide open – The eye has a peculiarly [illegible] expression and the attitude [illegible] menacing [illegible] long & neck [illegible] very mobile [illegible] Daboia. The outer rows of scales are [illegible] downwards. with these it makes the rustling sound

I have had several very fine living Echis. for about 3 months and during that time there has been no exfoliation of the outer skin. They lost the brightness of color. and became thin and weak. & much less aggressive; their powers also diminished in activity—

Central Provinces, Sinde and Punjab, and generally in the South of India. Gunther says, "it is common in many parts of the Peninsula of India;" in the Annamallay Mountains; in the Carnatic, and the vicinity of Madras.

It is a small viper: a fine specimen ~~from~~ in the Indian Museum is twenty-two and a half inches in length, and about three in circumference, though no doubt it is somewhat shrunk by the action of the spirit.

The generic description, according to Gunther, is as follows:—

"Head covered with keeled scales; a pair of very small frontals behind the rostral shield. Nostril small, round and directed upwards, situated in a large nasal shield, which is subdivided behind the nostril. Sides of the head covered with keeled scales, two series of which are between the eye and the low upper labials; scales much imbricate, strongly keeled, in from twenty-five to twenty-nine series: those on the lateral series have their tips directed obliquely downwards. Sub-caudals one rowed."

with these it makes the peculiar rustling noise

The specific description of Echis Carinata is as follows:— "Brown or brownish grey, with a series of sub-quadrangular or ovate whitish spots, edged with blackish brown; a sub-semicircular whitish band on each side of each of the dorsal spots, enclosing a round dark brown lateral spot; a pair of oblong brown black-edged spots on the crown of the head, converging anteriorly; a brownish spot below and an oblique broad streak behind the eye. Belly whitish, with more less numerous round brown specks. Ventrals 149-154. Sub-caudals 21-26."

This definition accurately describes the individual before me—a specimen from the Indian Museum, and also a living specimen from Delhi. for which I am indebted to Major MacMahon Dy Commissioner of that district——

It is called about Delhi Afáe or Afái — an arabic and vulgarly pronounced Hafai by uneducated natives.

[redacted]

[redacted]

([redacted].)

Crotalidæ.

The family of Crotalidæ or Pit Vipers has several genera in British India. They are not so dangerous as their American congeners, though all are venomous.* They are remarkable by the pit or depression between the eye and the nostrils in the loreal region; the triangular broad head and the short thick body. The Halys is the only Indian genus or species that has any vestige of the caudal appendage which has given to some of the American Crotalidæ the name Rattle-snake; and in this species it is reduced to a simple horny spine at the end of the tail.

Many of the Indian Crotalidæ are arboreal snakes, and in colour resemble the foliage or branches of the trees in which they live.

The Crotalidæ are considered by Naturalists generally, I believe, to be viviparous, but I have recently been informed that Mr. Nicholson of Rangoon says that the Trimeresuri are oviparous, and that eggs have been removed by him from the body containing no appearance of an embryo; which would imply that the eggs would be laid, and the young developed like those of the colubrine snakes.

It is probable that they are ovo-viviparous, and the question of the liberation of the young from the egg before or after its extrusion from the oviduct, is not one of great physiological

* The Caloselasma Rhodostoma, found in Java and [redacted], is said to be very deadly. Kuhl saw two men bitten by the same snake die in 5 minutes.

Siam

importance, though interesting enough as a fact in the natural history of the individual genus or species. The generic distinctions of the Crotalidæ are described by Gunther as follows:—

"Body robust; tail of moderate length, or rather short, sometimes prehensile; head broad, sub-triangular, frequently scaly above or imperfectly shielded; a deep pit, the use of which is not known, on the side of the snout, between the eye and the nostril; eye moderate size, with vertical pupil; viviparous."

There are several Indian genera:—

Trimeresurus	..	T. Gramineus. T. Erythrurus. T. Carinatus. T. Annamallensis. T. Monticola. T. Strigatus. T. Mucrosquamatus.
Peltopelor	..	P. Macro~~lpis~~
Halys	..	H. Himalayanus. H. or Trigonocephalus Elliotti.
Hypnale	..	H. Nipa.

lepis

TRIMERESURUS.

Gunther's definition of this genus is the following:—

"Head triangular, covered above with small scales, except the foremost part of the snout and the supraciliary region, which generally are shielded. Body with more or less distinctly keeled scales, in from seventeen to twenty-seven series. Body and tail of moderate length, prehensile. Sub-caudals two-rowed."

These snakes are fierce and venomous, but very few deaths are ascribed to their bites. Some of the Trimeresuri attain to a considerable size: a T. Carinatus from the Indian Museum, captured at Port Canning near Calcutta, is 36 inches in length and nearly 4 inches in circumference, and is a much more powerful snake than a Bungarus Cœruleus, for example, now in my possession, thirty-one inches in length and $2\frac{1}{2}$ in girth, and which killed a dog in less than 3 hours, and a fowl in 3 or 4 minutes.

J. Andersonii

The fangs of the Trimeresuri are long, and capable of inflicting a deep puncture; it cannot therefore be the small size of the snake or of its poison fangs, that makes it less deadly: this is doubtless due to a less virulent venom.

I am compelled to differ with Dr. Gunther when he says, "The degree of danger depends little on the species which has inflicted the wound, but rather on the bulk of the individual, on the quantity of its poison, on the temperature, and on the place of the wound;" for though there can be no doubt that all the conditions he enumerates—size, quantity of poison, state of the snake at the time of inflicting the wound, temperature—have much influence on the action of the poison, yet, quantity for quantity, the poisons of different genera, even species, varies considerably in intensity. My experiments, as far as they go, seem to show that in equal quantities the poison of the Cobra is more active than that of the Hamadryad, which is three times its size.* That of the Bungarus Cœruleus, more deadly than that of the Bungarus Fasciatus, which is much larger. That of the Daboia, perhaps equal or little inferior to that of the Cobra, and far more deadly than the venom of the Bungarus Fasciatus, perhaps of the Bungarus Cœruleus, and Echis, and if we may depend on what is recorded, than of the Trimeresuri. My impression is, that of all the Indian terrestrial Thanatophidia, the Cobras stand first in the scale of destructiveness; the Daboia next; then the Hamadryad; next the Bungarus Cœruleus; then the Bungarus Fasciatus and Echis, the Crotalidæ and Callophides. My own experience is at present confined to the Cobra, Hamadryad, Bungarus Fasciatus, Bungarus Cœruleus, Daboia, Echis, and certain Hydrophidæ, but from what I have read and heard

* The Rev. Mr. Vinton, Karen Missionary in Rangoon, who has experimented frequently with the poisonous snakes of Burmah, says that he is convinced that the venom of the Ophiophagus is less deadly in equal quantities than that of the Cobra. That the Ophiophagus is more dangerous on account of the greater quantity of venom, and the pertinacity with which, when disturbed, it maintains its hold, apparently with the view of injecting as much of the poison as possible.

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from others, I gather that the Callophides and the Crotalidæ of British India come last in the scale. I exclude the Hydrophidæ for the present; these remarks applying chiefly to the terrestrial poison snakes. I am aware that it is stated on high authority that the Calloselasma Rhodostoma, a comparatively small species, attaining to three feet in length, of a genus of the Crotalidæ, and found in Siam and Java, is very deadly; but so far as I know there is no so deadly a member of the family of Crotalidæ in Hindustan. Further experiments will, however, I hope, enable me to speak more positively on this important point in the natural history of the Thanatophidia. Cantor,* Jerdon, Russell, and others who have experimented with the Trimeresuri, say that the effects of their poison are less dangerous than those of other venomous snakes. The symptoms are severe pain and swelling of the bitten part or of the whole limb, with nausea, sickness, depression, fever, and then sloughing of the bitten part, after which recovery is rapid. In weak or sickly individuals fatal results might occur, but such are exceptional.

In the long list of deaths from snake-bite in India in 1869, a few cases are recorded from Trimeresuri bites.

The Trimeresuri are said to be naturally sluggish, and are apt to lie quietly hidden by the leaves or branches they resemble in colour, until disturbed, when they are sometimes fierce and

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* Cantor says of the Trimeresuri: "Although the genus has venomous organs as highly developed as Crotalus or Vipera, the effect produced by wounds of two species at least appear to be less dangerous than might be *a priori* supposed.—*Journal, As. Soc., Bengal*, Vol. XVI., p. 1045.

According to Russell's experiments with the venom of T. Gramineus, chickens expired within 8 to 33 minutes, pigeons in 14 to 18 minutes; a pig recovered in 6 to 7 hours; a dog in 2 to 3 hours, after being wounded (Russel, Vol. I., p. 60.) Mr. Hodgson has seen a man who was wounded by this species suffer fearfully from ~~poison~~ and swelling, but he never heard of a fatal case.—*Transact. Zool. Soc., Lond.*, Vol. II., p. 307.

pain

Blyth says, in *Journal of Asiatic Society of Bengal*, 1851, p. 524: "A small T. Gramineus from Sylhet had bitten a laboring man, but the wound merely caused a painful swelling of the arm, which however did not prevent the patient from returning to his work after a few hours, *i. e.*, in the afternoon of the same day.

aggressive, bite savagely, and make a hissing sound as they prepare to strike, which they do by first drawing back the head and anterior part of the body, and then darting it forward with great rapidity. They, like the Daboia, are said to vibrate the tail at the same time; this is, I imagine, when the tail is not employed in clasping a branch of the tree, in which, as many of them are arboreal, they are most frequently found. Their food is said to consist of small birds, mammals, and tree and other frogs; in search of the latter the arboreal species are said to descend to the earth.

According to some Naturalists, Gunther and others, they are viviparous; but I am told that Mr. Nicholson of the Royal Artillery at Rangoon, who has had opportunities of studying their habits, states positively that they are strictly oviparous. Of this I have no personal knowledge.

I am indebted to Dr. F. Stoliczka, of the Geological Survey of India, for the following valuable notes on the habits and distribution of the Trimeresuri and other poison snakes:—

"*T. Gramineus*—I only saw once going up to Nynee Tâl, a little beyond Kalidunga, in the low hills. The specimen was on a bush, between thick foliage.

T. Erythrurus—I found very common about the lime-stone hills near Moulmein. They are exactly of the same green colour as the foliage between which they hide themselves. I saw small specimens very often on low plants. It was on some umbelliferous plant, growing about two feet, with a spreading crown of leaves above. The *Trimeresurus* had his prehensile tail wound below the top round the stalk, and was lying above on the leaf crown in a simple or double coil. They were very sluggish, and did not make the least attempt at moving off when I came near, and even took them off the plant; neither did they offer to bite, unless pressed with a stick to the ground. But when they once got excited they turned round furiously. One had broken both his fangs in striking them into the stick with which I pressed him to the ground.

In Penang I got also *Erythrurus* in a similar position as at Moulmein, on the large ferns that grow there. In the Wellesley Province I caught one on a low bush near the mangrove swamp.

T. Carinatus—I got on the north side of the road going up to Simla, and another specimen I found in the valley below Subathoo; both were on low bushes on the road, and appeared equally sluggish and lazy as the Moulmein *Erythrurus*.

I believe the *Trimeresuri* chiefly live on insects. I never found any vertebrate food in their stomach, though I dare say they do not despise it when they get hold of it without great difficulty. Whether they are more active at night, or, in fact, whether their habits are at all nocturnal, I cannot say. I should doubt it, though from the nature of their pupil they would appear to be so, but I think their habits are only crepuscular.

I did not observe *Callophis* alive, but from their external character of body they cannot be tree-snakes. I suppose their habits are similar to those of *Bungarus*, but their more vivid and variegated coloring would, I think, indicate a more diurnal than nocturnal habit. The peculiarly elongated poison glands have only been observed in *C. intestinalis* and *Bivirgatus*, both of which have very small heads. I am not aware that any of the other species have been examined.

As far as general distribution of all the *Crotalidæ* is concerned, they must be considered as characteristic of the Malay fauna, which is that of the Malay Peninsula, Burmah, Cachar, and Assam (here towards the east becoming Indo-Chinese,) Eastern Bengal, almost as far west as the Hooghly, the base of the Eastern and Central Himalaya, with the last remnants probably as far west as the Sutlej; though the Malayan character is strongly diminished west of Nepal. In South India, the Malabar Coast, with a few patches of higher hills, and the greater part of Ceylon, must have had originally a Malay fauna. As far as I know from the records of localities, Trimeresuri are found only in these localities of Malay fauna.

Halys—I should be inclined to consider as the representant of the Vipers of the old World: they characterise the temperate climates of the hills; but when Gunther says that they are only found on the northern side of the "Himalaya," he is incorrect. Of course, he has no notion of the climatal conditions, and strangely also, not of the geographical situation of the hills. What we call northern side of the Himalayan slopes is Thibet, that is, north of the central highest chain, and in Thibet there are no snakes, until we come down into the lower Indus, and into the less elevated country of Central Asia.

One thing is decidedly noticeable in the colour of these snakes; that they adapt themselves to the locality in which they live. *Halys* are dark-coloured like *Vipera Berus* of Europe, and are found on the ground. The dark-coloured *Trimeresuri*, as for instance, *T. monticola*, I met once only going up to Nynee Tâl on an old stump of a tree. The *T. convictus* of Penang is also met on the ground, and so also did I see the Nicobar *T. mutabilis*, only near the ground between shrubs. The green *Trimeresuri* are generally found higher upon trees or plants, and also possess, as a rule, a longer and more compressed body.

Daboia—I should call a characteristic Indian viper, and the same applies to *Echis*, though this latter is clearly of African type.

The *Callophis* belong to the Malay fauna, like the *Trimeresuri*; their head-quarters are the Malay Peninsula; the same is the case with *Opiophhagus*.

I think as most of the viperine snakes are viviparous, it seems not improbable that the *Trimeresuri* are also viviparous: but of course, without direct observation, we can form no certain opinion on such a point.

I do not know any external characters for distinguishing the sex, and have not heard that any record exists on that point. You find in my paper, *Tropidonotus platyceps*, that I noted the males to have stronger keeled scales than the females, but whether that will be confirmed in other species further observations must show.

T. Erythrurus—I got from Moulmein, Wellesley Province, Penang, and Java.

T. Purpureus.—Steindachner says it also occurs in the Nicobars. I did not get it there.

T. mutabilis and *Cantoris* are from the Nicobars and Andamans; they are not known from other localities.

T. convictus is as yet a unique specimen from Penang hills.

I believe *Erythrurus* has been got from Assam, *Gramineus* and *Carinatus* occur in Burmah, Assam, Cachar, Bengal, and the North-west Himalaya as far as the Sutlej (along the Hills), but I do not know of any recorded specimen from further westward. Perhaps Anderson may have got some for the Museum. ✕ *Monticola* is a true hill form of the Central and Eastern Himalaya, and the Khassya and Cachar Hills, and Anderson got it from Yunan. It evidently goes into the Indo-Chinese fauna."

✕ In October 1870 Dr Stoliczka brought me a very fine living specimen of T. Monticola from a height 5000 feet near Darjeeling"

THE THANATOPHIDIA OF INDIA.

By J. Fayrer, M.D., C.S.I.

(Re-published from the Indian Medical Gazette).

TRIMERESURUS.

Trimeresurus Carinatus.

Trimeresurus	Carinatus.	Gray.
„	Bicolor.	„
„	Porphyraceus.	Blyth.

A fine specimen from the Indian Museum, caught at Port Canning, near Calcutta, now before me, measures 36 inches in length, and nearly 5 in girth. It is of a dark grass green above, throughout, darker on the head and tail, and of a lighter green below, approaching white on the ventral surface. There is no light colored line running along the outer series of scales as in some specimens. The head is broad and triangular, covered with small carinated scales. The second upper labials form the anterior margin of the loreal pit. There is one well-developed azygos shield between the supra-nasals. The scales on the body are in 25 rows, and are prominently carinated.

This corresponds very closely with Gunther's description, which is as follows :—

"The second upper labial shield forms the front part of the facial pit. Scales in from 23 to 25 rows. Those on the crown of the head and on the temples small, strongly carinated; ventrals 164 to 169 ; sub-caudals 54 to 60. Grass green above, tail yellowish green ; a more or less distinct yellowish line runs along the outer series of scales, and is sometimes absent. Lower parts greenish white."

This species is found in Bengal, Sikkim, probably the Himalaya generally, and in Burmah. It resembles T. Gramineus very closely. Dr. Stoliczka says (Journal Asiatic Society, Part ii., No. 3 of 1870, page 218), the distinction is chiefly in the head, which is short and rather broad and stout, and in the large size of the supraciliaries. He says also that "there are usually one or two azygos shields; very rarely there is no azygos shield, but in such a case the supra-nasals just touch each other, not forming a broad suture as in T. Erythrurus."

"The general colour is usually green, sometimes there are large blackish spots on the sides; the lateral line is either well-developed, white margined with coral red below, or it is absent. Tail pale, ruddy above, usually equal to one-sixth the total length." Dr. Stoliczka speaks of a young specimen from the hills about 6,000 feet high, north-east of Simla.

The Trimeresurus Carinatus, T. Gramineus, and T. Erythrurus resemble each other very closely; apparently there is no certainty in either the number of scales, or the presence of the side line, or the rufous tint of the tail. I follow the order of authorities on Ophiology in describing them as different species.

I have had no opportunity as yet of testing the poisonous power of this snake.

Trimeresurus Gramineus.

Vipera Viridis.	Dand : Rept.
,, Gramineus.	Cantor.
Trimeresurus Viridis.	Gray.
,, Elegans.	,,
Coluber Gramineus.	Shaw.
Trimeresurus Gramineus.	Gunther.

There are several specimens in the Indian Museum, and one before me, $18\frac{1}{2}$ in length and $1\frac{1}{2}$ in girth, of which the tail measures $2\frac{5}{8}$, came from Assam.

In this snake the upper labial shield forms the front part of the loreal pit. There is an azygos shield between the supra-nasals, sometimes two small shields take its place.

It has 19 to 21 series of carinated scales. Ventrals 158 to 170; sub-caudals 58 to 71. The scales on the head are small and smooth, or indistinctly keeled. The color like that of Carinatus, lighter on the sides and belly; the tail is sometimes red; a yellowish or brick red line runs along the outer series of scales.

It is common in Assam and the Khassyah Hills. Dr. Stoliczka says he has never observed it in the interior of the N. W. Himalaya, though he has often found T. Carinatus in those localities. Dr. S. is doubtful of its being found in Ladak Proper, where, according to Gunther, it is met with, as the climate is too cold and the height too great.

He says (Journal Asiatic Society, Part ii., No. 3 of 1870, page 216) :—" It would be interesting to know which part of the country is alluded to (by Gunther), for Ladak Proper has scarcely any arboreal vegetation, except a few poplars and willows in the Indus Valley. I passed three times through Ladak (I mean the Upper Indus Valley about Leh, and the elevated country on both sides of it), but I never saw a single snake; and the existence of a Trimeresurus is of all the most improbable in a country situated above 10,000 feet, and subject to the most rigidly cold climate, so that hardly any aboreal vegetation can thrive."

T. Gramineus is smaller than T. Carinatus. Gunther says it attains to 32 inches, whilst he gives T. Carinatus 38. The specimen of T. Gramineus from the Indian Museum, from Assam, is a small one.

It is described and figured by Dr. Russell, in his great work on Indian Serpents, as Bodroo Pam. Plate 9, Vol. i.

Trimeresurus Erythrurus.

Trigonocephalus Erythrurus. Cantor.
Trimeresurus Albolabris. Gray.
Trigonocephalus Viridis. Schleg.

Gunther says that Russell describes it (vol. ii., plate 20) also as Bodroo Pam, a variety of that described in Vol. i., plate 9. It is very like the two preceding. Dr. Stoliczka says that its head is elongately oval, and more depressed than either T. Carinatus or T. Gramineus. The lips and chin are white, the lateral line is white bordered, with purple or greenish below. Color grass green, lighter on the sides and belly. Gunther says that old females do not show either the white lips or line. In this species there is not generally an azygos shield between the supra-nasals, but Dr. Stoliczka says that there is sometimes a small azygos shield. The scales on the body are strongly carinated, in 21 to 23 series. It is said (by Gunther) to grow to the length of 33 inches, and to be found in the Delta of the Ganges. Dr. Stoliczka found it common in the limestone hills about Moulmein, in Penang, and Java. The specimen now before me from the Indian Museum, measures 25 inches in length and 2¼ in girth ; the tail is 2⅝ inches in length. The Rev. J. G. Haensel, Missionary, in a letter to the Rev. C. L. Latrobe, writing about the Nicobar Islands, says:— "Serpents are numerous in some places, but they are far less abundant and numerous than on the coast of Coromandel. The chief cause of this difference I am apt to ascribe to a custom prevalent among the natives, of setting the long grass on the mountains on fire two or three times a year: as these reptiles like to lay their eggs in the grass, great quantities of them are thus destroyed.* One kind of serpent struck me here as a singular species; it is of a green color, has a broad head and

* This can hardly apply to Trimeresuri, which are said to be viviparous.

mouth like a frog, very red eyes, and its bite is so venomous, that I saw a woman die within half an hour after receiving the wound. She had climbed a high tree in search of fruit, and not observing the animal among the branches, was suddenly bitten in the arm. Being well aware of the danger, she immediately descended, but on reaching the ground, rolled to and fro, like one in a state of intoxication. The people brought her immediately to me ; and while I was applying blisters and other means for extracting the poison, she died in my hands."

Mr. V. Ball of the Geological Survey, who kindly furnished me with the above extract, also refers in his interesting account of the Nicobar Islands, published in the selections from the records of the Government of India, No. lxxvii, to a remark by Dr. Rink in his geographical sketch of those Islands, published in 1847, to the effect,—"Snakes of smaller size are to be met with in every excursion into the forest, but only two species are said to be poisonous (Trigonocephalus.) I have only once seen a native with a swollen leg resulting from the bite of a snake; and cases of death from it are said to be very rare."

The snakes alluded to in both these accounts are evidently Trimeresuri, and Dr. Rink confirms the opinion that they are less deadly than other poisonous snakes; on the other hand, the Rev. Mr. Haensel's account would make it appear that his specimen was very deadly, and from the description of the colors, shape of the head, and habitat, he is probably referring to Trimeresurus Carinatus or Erythrurus. The snake may have been an unusually vigorous one, and the woman may have been small and weak. Other instances of deaths from their bites have been recorded, but on the whole the weight of evidence shows them to be less venomous than the vipers.

Trimeresurus Anamallensis.

I have had no opportunity of studying the characters of this snake, or of comparing it with Gunther's description, which is as follows:—"The second upper labial shield forms the front part of the facial pit; generally a small shield between the supra-nasals. Scales on the head and on the body more or less distinctly keeled, in twenty-one series. Ventrals 148 to 158; sub-caudals 51 to 55. Ground color generally yellowish green, with a dorsal series of large rhombic black spots, each spot sub-divided by, or variegated with, yellow. Upper side of the head marbled with black in adult specimens, uniform greenish in young ones; a black or brown band runs from the back edge of the eye to the angle of the mouth. Supraciliary with one or two black cross streaks. Belly yellowish green, with numerous yellow and black spots along its side. Tail black, with yellow and green spots: young specimens may be recognized by the dark temple streak; but nearly all the other markings are very indistinct, and the ground color is a reddish olive; tail with white extremity."

A specimen received with others from the same locality has a brownish purple ground color, with a dorsal series of brown spots; belly marbled with purple; tail black, with irregular greenish rings, and with some indistinct small yellowish spots. This specimen also has the supraciliary divided into two, but, nevertheless, we consider it merely a variety of about a dozen specimens from the Anamallay Mountains: the largest is 24 inches long, tail measuring 3½ inches.

Gunther says,—"I have for some time considered this species as possibly indentical with Trigonocephalus (Cophias) Malabaricus, n. s. ? Jerdon, Journal, Asiatic Society, Bengal, 1854, xxii., page 523, which is characterized thus:—'Very closely allied to T. Nagamarginatus. Has twenty-one rows of smooth scales; ventrals 145 to 149; sub-caudals 48 to 53. Green above, with brown transverse and zig-zag markings, up to 2 feet long nearly, not uncommon in all the forests of the west coast.'

"It is almost impossible to recognize a species from such a diagnosis. Moreover, Mr. Jerdon describes the scales as smooth, whilst they are keeled in one species as in all the Trimeresuri. Mr. Elliot possesses a drawing of a young specimen named T. Malabaricus, Jerdon. It resembles one species in colorations, but has a white black-edged temple streak instead of a black one. Mr. Jerdon does not mention either a white or a black temple streak."

I have since received three specimens of T. Anamallensis from Dr. Shortt of Madras.

A is 19 inches long, of which tail is 2¾, and 1¾ inch in girth. It is of a light greenish color, with irregularly rhomboidal black or dark brown marks along the back.

The head is beautifully marked, marbled with the same colors, and there is a distinct dark line leading from the eye to the commissure of the mouth.

It has on the neck 22 to 26 rows of shields, middle of the body 23, further on 21, and posteriorly 16 rows. This is noteworthy, as Gunther says "simply in 21 series." 155 ventral shields, 57 sub-caudals, very closely the number given by Gunther.

B, a much larger specimen, by 27 inches long, of which the tail is 3½. It is 2¾ inches in girth. The body color is much the same as in A, but the dark markings are comparatively indistinct. The head in each specimen is very broad and triangular. It has 28 series of scales on his neck, and in the middle of the body only the regular number, 21. There is nothing else peculiar about it.

C is a large specimen, about the same size as B, but much decomposed. Its coloration is darker than that of A and B, but otherwise all the same.

All three have the supraciliary divided into two shields, as noticed by Gunther, p. 387.

Trimeresurus Wardii, Jerdon.

Gunther says of this :—" Quite indeterminable is another of Mr. Jerdon's species, for which he has proposed the name of T. Wardii."

Major Beddome, in the *Madras Quarterly Journal of Medical Science*, No. ix., July, 1862, page 2, describes it as follows :—" Greenish, with purplish brown diamond spots on back and sides, 12 to 14 inches long. Neilgherries."

Trimeresurus Andersonii.

Mr. Theobald has named what he considers a new species after Dr. Anderson, the Curator of the Indian Museum. It is described in his catalogue of the Asiatic Society, now Indian Museum, pp. 75 to 76. It has 25 rows of carinated scales, 182 ventrals, and 56 sub-caudals in one specimen, and 71 in the other ; girth $1\frac{5}{8}$, length 20 inches, length of tail $2\frac{1}{8}$. The second upper labial forms the anterior margin of the præorbital pit ; supra-nasals separated by an azygos shield. The color above and below is a uniform rich brown. Belly and sides marked conspicuously with white spots. Found in Assam. A second individual, named by Mr. Theobald in the same catalogue as T. Obscurus, has the "back of a uniform brown, sides green, spotted and mottled. Belly greenish white, brown barred and spotted, supraciliaries well defined." But it is very doubtful if this be distinct from T. Andersonii.

Museum Specimen ...	Length	20	inches.
	Girth	$1\frac{5}{8}$	"
	Tail	$2\frac{5}{8}$	"

Trimeresurus Mucrosquamatus.

Trigonocephalus Mucrosquamatus. Cantor.

The Indian Museum has at present no individual of this species, nor have I been able to obtain it. Gunther says it is found in the Naga Hills and Assam. Cantor describes it thus: "Brownish grey above, with black white-edged rings, covered with oval, half-keeled, pointed, imbricate scales; whitish beneath, dotted with black; ventrals 218, sub-caudals 91."

Gunther says, "this species has not been recognized by late Herpetologists," and that the typical specimen is lost; only the drawing of it made by Cantor is preserved in the library of the Oxford Museum.

TRIMERESURUS STRIGATUS.

Trimeresurus Strigatus. Gray.

Trigonocephalus Neilgherriensis. Jerdon.

This species is found on the Neilgherries and Deccan, and is common about Ootacamund.

A specimen in the Indian Museum measures 14½ inches, girth 1¼; it is brown, with a line of darker colored irregular vertebral spots. It has a horse shoe shaped whitish mark on the neck. There is a triangular dark spot below the eye and loreal pit, and a dark brown band leading from the eye to the neck. The lower jaw and belly marked with black spots. The end of the tail terminates in a scale, in young specimens it is white.

Gunther describes it:—"The shield, forming the front part of the facial pit, is separate from the second upper labial. Two supra-nasals in contact, on each side a smaller scale, and behind two large scales separated by an azygos scale. Supraciliary shield narrow; in large shields behind the ventral.

The whole upper surface of the head is covered with small, nearly smooth, scales. Nine or ten upper labials becoming smaller in size, behind scales distinctly keeled in twenty-one series; ventrals 136 to 142, sub-caudals 31 to 40. Tail but slightly prehensile, terminating in a short conical scale.

It is a small snake, the largest specimen Dr. Gunther has examined being 19 inches in length.

Major Beddome describes T. Neilgherriensis, (Jerdon):,— "Dark brown with black markings; 23 rows of carinated scales; scutæ 142; scutellæ 36."

It is the same species.

TRIMERESURUS MONTICOLA.

Pareas Maculata. Gray.

There are two fine specimens from the Indian Museum before me, both from Darjeeling, 23 inches in length and 3 inches in girth. The tail is 3¼ in length.

The other is 27 inches in length and 2 inches in girth.

The second upper labial forms the front of the pit. There are two small shields behind the nostril, sometimes a small azygos shield below this. The scales on the head are smooth, those on the body slightly carinated. There are twenty-three series. Ventrals 137 to 141; sub-caudals 41. The supra-ciliaries are very large.

The coloration varies, in one specimen it is pale brown, with a vertebral row of large, square, dark brown blotches. Along the sides a row of small dark spots. Belly dark mottled, a pale temple streak.

The larger male specimen, which is also from Darjeeling, is of a dark brown or almost blackish ash color with the rhomboid patches along the vertebra.

There is a peculiar mark in the middle of the neck like a U which is of a yellowish or whitish color.

This is a Himalayan species; both the Museum specimens referred to came from Darjeeling, but it is found also in Nepal, Sikkim, and probably in Khassyah and other parts of the Eastern Himalayan range.

I have also received a very fine living female specimen of T. Monticola from Dr. Stoliczka, who brought it with him from

Darjeeling; it was captured in October near a house in Rungby, 5,000 feet above the sea, and about 12 miles S. E. of Darjeeling. It is 29 inches long, of which the tail measures 3 inches, and at the thickest part of the body 3¼ in girth. It is of a cinnamon grey color, beautifully marked with square dark spots; the head is of a dark brown, with a metallic lustre, and the U shaped mark on the neck very distinct. There are 22 series of slightly carinated scales on the neck. The fangs are moderately large. The eye small, with vertical pupil.

The supra-nasals are separated by two small shields.

PELTOPELOR, GUNTHER.

Peltopelor Macrolepis.

Trimeresurus Macrolepis. Beddome.

There is only one species of this genus known; it was discovered by Major Beddome of Madras, and is now called the Peltopelor Macrolepis. It is arboreal, and nearly allied to the Trimeresurus; it comes from the Anamallay Mountains, where, Major Beddome says, it is common in the grass at 6,000 feet elevation. He also procured a specimen from the Puiney Hills, in the moist forests at 4,000 feet elevation.

Major Beddome's description is "dark green, lighter below, the lowermost row of scales on each side white, forming a white line on each side of the abdomen, (Gunther calls it a yellow line) scales in 12 to 14 rows; the lowest row the smallest, all pointed and very prominently carinated; head covered with very large plate-like scales. Ventral scutæ 133 to 138; subcaudals 53 to 56 pairs; rostral triangular, erect." The largest specimen examined by Gunther was 21 inches, of which the tail measured 4¾ inches.

HALYS, GRAY.

This genus has two species in Hindostan. It is characterized by its broad obtuse head, covered with shields. There are 23 to 27 series of carinated scales sub-caudals two rowed; tail short, not prehensile, terminates in a spine.

HALYS ELLIOTTII.

The first species is one found in the Neilgherries, and described by Mr. Jerdon, who named it Trigonocephalus Elliottii. (Journal, Asiatic Society, Bengal, xxii., 1854, page 523.) "Form massive; scales in 23 rows; ventral shields 151; sub-caudals 43. Olive green above; pearl white beneath; two feet long and upwards."

Found in the lower slopes of the Neilgherries.

There is no specimen of this snake in the Indian Museum. I depend on Gunther, Jerdon, and Beddome for the account of it.

HALYS HIMALAYANUS.

Trigonocephalus Affinis. Gunther.

A specimen from the Indian Museum before me measures 23 inches in length, $2\frac{1}{4}$ in girth. Gunther's description of it is: "Snout of moderate length, broader than long, with the nose rather protruding; rostral shield oblique, higher than broad; frontals well developed, not broken up into smaller shields. The anterior frontals short, transversely produced, and tapering in the sides, both taken together form a sort of crescent. Posterior frontals large, somewhat pointed in front, and rounded behind. Vertical and supraciliaries as usual in this genus; occipitals rather small, rounded. Five upper labials, a sixth and seventh being confluent with the temporals, the second is small, not entering the margin of the facial pit, the third enters the orbit. There is a series of three large temporal shields, the two hinder of which form a portion of the lip; the space between those temporal and the occipital is covered with small scales. Body of moderate length, rounded, its middle is covered with 23 series of strongly-keeled scales.

Ventrals 162 to 166 ; anal entire ; sub-caudals 43 to 51. The tail terminates in a long spine. Dark brown, with large band like spots across the back these spots are very indistinct, scarcely differing from the ground color, and becoming visible only by their black edges ; belly almost entirely black, marbled with yellowish. A broad blackish band runs from the eye along the series of temporal shields to the angle of the mouth it has a narrow black and white edge above and below, and is better defined in the young individual than in the old one. Lower labials marbled with yellowish and blackish." It is very common all over the North-west Himalayas. Dr. Stoliczka says "especially between 5 and 8,000 feet, but on the Hatu mountain near Kotegurh, and about Serahan, I observed it as high as 10,000 feet. It feeds principally on mice." The largest specimen he saw was 34 inches. In describing the character of H. Himalayanus Dr. Stoliczka says :—" The upper ground color of this snake varies from brownish green to almost brownish black, but generally with some lighter spots, bands or marblings, and that of the lower part is of a greenish yellow purple tinge, the purplish color sometimes predominating, especially on the sub-caudals; the whole of the lower side is more or less strongly marbled with greenish black, rarely is the under side nearly all black, but the chin is always yellowish. The upper labials are yellowish white, and in continuation of this colour, there is in younger specimens a very conspicuous whitish lateral band occupying the base of the ventrals and the adjoining row of scales. In old specimens, this lateral band is only indicated on the throat, becoming obsolete on the body."

He also says :—" All the specimens which I examined had only 21 series of scales. One nearly full grown, from the neighbourhood of Kotegurh, (north-east of Simla) measures 25½, of which the tail is 3½, terminating with a very small single sub-caudal scale. Ventrals 160, sub-caudals 42."

"It is met with on the paths generally after rains and in shady places between overhanging forest trees."

I have no information as to the degree of venomous power it possesses.

Hypnale, Fitz.

This genus has only one species, the Hypnale Nepa or Carawilla of Southern India.

Hypnale Nepa.
Coluber Nepa. Laur.
Carawilla, Davy.
Cophias Hypnale. Merr. Tent.
Trigonacephalus Hypnale. Wagl.
Trimeresurus Ceyloneusis. Gray.
Trigonocephalus Zara. Gray.

I have had no opportunity of studying this snake from nature, but Gunther gives the following description of it:—

"Head broad, triangular; snout covered with numerous small shields above, the crown of the head being normally shielded. Body of moderate length, with keeled scales in 17 rows. Tail rather short, not prehensile, terminating in a short conical scale. Sub-caudals two rowed. Ventrals 140 to 152, sub-caudals 30 to 45. Brown or grey or reddish olive, with a double dorsal series of brown or black spots, the spots of both sides sometimes confluent into cross bands. Sides and belly finely marbled and dotted with brown or black. Upper lip brown or black, well marked by a darker line running from behind the eye to the angle of the mouth: a more or less distinct white or whitish temporal streak above the dark line; sometimes continued along the side of the neck, with an interrupted brown band above and below it. Chin and throat blackish or brownish, variegated with yellow or grey. Sometimes specimens occur of a more uniform coloration; the dorsal spots, the dark temporal line, and a pair of whitish spots on each side of the throat are the most constant markings. Other specimens are flesh-coloured, with small black markings as described; all these varieties may be seen in fœtus taken out of the same female."

It is found in Southern India, Malabar, and the Anamallay Mountains; also in Ceylon. The largest specimen Gunther has seen is 19 inches, the tail measuring 2½ inches. It is viviparous. Gunther says he has found in one female five perfectly developed fœtus, five inches long, and in another seven eggs, which did not show any development of embryo.

"The Carawilla is much dreaded, although its bite is but exceptionally fatal to man, and in such cases death does not occur before the lapse of some days."

I have had no opportunity of testing by experiment the properties of this snake.

Russell describes it in his Indian Serpents, Vol. ii., plate 22.

THE THANATOPHIDIA OF INDIA.

By J. Fayrer, M.D., C.S.I.

(Re-published from the Indian Medical Gazette).

HYDROPHIDÆ.

The members of this family may be recognized at once by the peculiarities of their conformation, which is adapted to an aquatic mode of life.

They are all venomous, and inhabit the salt water estuaries and tidal streams ; they have a very wide range of distribution, being found in the Indian and Pacific Oceans, from Madagascar to the Isthmus of Panama. They are most numerous, Gunther says, in the Eastern Archipelago and in the seas between Southern China and North Australia, "being represented in the outskirts of the geographical range mentioned, by one species, and that the most common—Pelamis Bicolor."

I propose to describe some of those only that are found on the Indian Coasts. They are very numerous and many of them closely resemble each other, so that I shall figure and describe only the most remarkable.

The sea snakes have great varieties of form, but the transitions from one to another are very gradual. Some of them attain a considerable size ; Gunther speaks of some species attaining to the length of 12 feet. The longest I have seen is under five feet; there is no reason to believe that they attain to so great a size as certain fabulous stories would suggest.

They are very poisonous. The case related of a sailor of H. M.'s ship *Algerine*, who was bitten by one recently caught at Madras, proves them to be so. I am informed by Mr. Galiffe that a fisherman bitten by a salt water snake somewhere near the salt lakes, died in one hour and a quarter. And my own experiments and those of Mr. Stewart at Pooree prove that not only when able to bite voluntarily, but even when weak and unable to bite, when the jaws were compressed on the animal, death resulted. The fishermen on the coast know their dangerous properties and carefully avoid them.

They have smaller jaws and much smaller fangs, than the land snakes generally, with open grooves, though not always completely open as supposed by some naturalists; but the virus is very active and appears to act as speedily and certainly as that of the terrestrial poisonous colubrine snakes. They have an elongated body like the land snakes; in some instances it is short and thick, whilst in others it is very thick towards the tail and most disproportionately elongated and attenuated in the neck; the head is very minute. The hinder part of the body and tail is flattened and compressed vertically, almost like the fin or tail of a fish, and it answers the same purpose, for with it they swim with grace and rapidity. They swim like fish and live, with some exceptions, continually in the sea or tidal water. When thrown on the land by the surf, as they constantly are at Pooree and other places along the coast, they are helpless and almost blind. Their food consists of fish and other aquatic animals, which they pursue and overtake in the salt water. There are certain parts of the Bay of Bengal in which they are often seen in great numbers, and their movements in the clear blue water are very agile, graceful and beautiful.

The Platurus seem to be a transitional stage between the sea and land snakes; its general formation and large ventral scutæ indicate its power of going on land and probably seeking its food there as well as in the sea. The Hydrophidæ generally have no ventral plates, well marked. The abdominal scales differ little from those of the rest of the body, which are generally hexagonal laid side by side, occasionally slightly imbricate and in some tubercular, a small tubercule being found in the centre of each scale. Platurus has abdominal scutæ like the land snakes, and is sometimes found in marshy ground near the sea.

The nostrils, eyes and head shields of the sea snakes are peculiar. The eyes are small with circular pupils, which contract so much when the snake is taken out of water that it is said to be almost blind. The nostrils are on the surface, so that they can breathe when only the surface of the snout is above water. The openings are protected by a valvular apparatus internally.

The head shields are peculiar and differ in their arrangement from that of the land snakes.

The nasals are large and re-place the anterior frontals, which are absent.

There is a single pair of frontals, a vertical, a pair of supra-ciliaries, and a pair of occipitals; one ocular and one or two post oculars. No loreal. The labials are irregularly arranged and sub-divided.

" There is a triangular mental shield in front of the lower jaw, behind which the first pair of lower labials form a suture together; one or two pairs of chin shields follow." Enhydrina has a peculiar notch in the lower jaw, by which the gape can be much increased. This notch is filled by a lobular process of the rostral shield, which fits into it when the mouth is closed; on each side of this notch there is an opening for the points of the tongue to protrude. This again is shorter in Hydrophidæ than in terrestrial snakes, it is used as a feeler in the usual way

They are said to be very delicate and to die rapidly in captivity, even when preserved in tanks of salt water. Mr. Stewart of Pooree found that he could keep them alive for a short time by placing them in holes in the ground into which the sea-water percolated. A very fine specimen of Hydrophis coronata caught near Calcutta, and sent to me by me Mr. Galiffe, lived about ten days in a cage, occasionally being put into a jar of fresh water, and although many experiments were made to make it bite, in which its very small head must have been considerably bruised.

There are seven genera of this family :—

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

Pelamis.

But of these only four, I believe, are represented in the Indian Ocean, *viz* :—

Platurus.	Enhydrina.
Hydrophis.	Pelamis.

Of these, Platurus has two species : Hydrophis, about twenty-seven.

Enhydrina one, or according to some naturalists, two.

Pelamis one species.

PLATURUS.

Gunther gives two species of this genus, Platurus Scutatus and Platurus Fischeri. A very fine specimen from the Indian Museum, caught in one of the tidal streams near Port Canning, is 49 inches in length, of which the tail measured $3\frac{3}{4}$ inches, 4 in girth of body, and $2\frac{1}{4}$ girth of neck.

The first appearance of the snake is not unlike that of Bungarus Fasciatus, from its black and yellow ringed markings. The Platurus has several characters like those of the land snakes. The tail is not prehensile. The ventral shields are like those of the land snakes. Body is sub-cylindrical, and not compressed like the Hydrophidæ. The scales of the body are imbricate, smooth, 19 to 25 series. There are two series of subcaudals. The shields of the head are regularly disposed; two pairs of frontals, with an azygos shield between the hind pair. The eye is small. The nostrils are lateral in a single nasal shield; no loreal; one præ and two post-oculars; seven upper labials, the third and fourth of which enter the orbit; temporals scale-like. The throat has two pairs of chin shields anteriorly, and scales posteriorly. The tail is longer and thicker in males than females. The anal is bifid. The poison fang is short, a single small tooth is sometimes found behind the the fang.

I am indebted to Dr. J. Anderson, Curator of the Indian Museum, for the following description of the fine specimen previously alluded to, and which he considers to be *P. fischeri*, with some slight difference from Gunther's description.

PLATURUS FISCHERI. JAN.

"The specimen, which I provisionally refer to this species, has 19 rows of smooth scales round the fore part of the trunk, in longitudinal series, and 235 ventrals. There is no azygos shield between the posterior frontals, and in all of these characters it agrees with this species. But on comparing the head with Gunther's drawing, I find that the anterior frontals in my specimen differ from it, in being long and pointed anteriorly, and considerably larger than the posterior pair, and in the vertical being proportionally larger than in *P. fischeri*, and the occipitals larger and more pointed. It has one præ and two post-oculars, and the third and fourth labials are below the eye. Two pairs of large chin shields, the posterior shields with a large scale between their posterior extremities. It also differs from *P. fischeri* in having 56 black rings round the trunk instead of thirty-six, but I do not attach much importance to this as *P. scutatus* shows about an equal variation; but at the same time, Gunther's statement that his eight specimens show the same assemblage of characters as laid down in his description, the occurrence of 56 rings in my specimen suggests that their multiplicity is either due to greater age (it measures 49 inches in length) or to variation. The head too is wholly black, with the exception of a yellow band from the posterior margin of one eye to the other. The upper surface is olive green, and the sides and belly rich dark gamboge yellow, and the 56 rings are intensely bluish black, and the scales generally have a very bright shining lustre."

From Tolly's nullah, a tidal stream, Calcutta.

If this form should prove to be new, I would indicate it as *P. affinis*. New species, Anderson.

PLATURUS SCUTATUS.

Coluber Laticaudatus. L. Mus. Ad. Fried.

Laticauda Scutatæ. Laur. Syn. Rept. Cantor Mal. Rept.

Hydrus Colubrinus. Schneider.

Platurus Fasciatus. Latr. Rept.

Hydrophis Colubrinus. Schleg.

Gunther's description of this species is :—

"Generally an azygos shield between the posterior frontals; scales of the front part of the trunk in 21 or 23 longitudinal series; ventral shields from 213 to 241. Body surrounded by from 25 to 50 black rings. Crown of head black; the first and second black mark of the head and neck are joined below by a black longitudinal band, commencing from the chin; snout and back of head yellow, with a black band running through the eye."

It is common in the Bay of Bengal, and grows to five feet or more.

PLATURUS FISCHERI. JAN.

"No azygos shield between posterior frontals; scales of the front part of the trunk in 19 longitudinal series; ventral shields 232 to 241. Trunk surrounded from 33 to 36 black rings, which are broader than the interspaces. A black band crosses the occiput, and extends forwards over the vertical plate and over the lower jaw, but generally, it is not confluent with the next following ring. Upper part of the snout yellow; upper labials black."

Of eight specimens examined by Gunther, the largest was only 30 inches. The specimen described by Dr. Anderson is 49 inches.

ENHYDRINA.

ENHYDRINA. GRAY.

Gunther says there is only one species in this genus, which differs only from Hydrophis in the deep cleft in the lower jaw, where the mandibles do not unite, and the fold of integument connecting them forms a deep notch.

Dr. Stoliczka (Journal, Asiatic Society, No. iii, 1870, page 213,) says that there are two species of Enhydrina—E. Bengalensis, Gray, or E. Valakadyen, Boie, and E. Schistosa, Daud:

Russell, in his Indian Serpents, describes two species: "Valakadyen" and "Hooghly Pattee," as called by the natives. Dr. Stoliczka considers that these were really distinct species, the latter being very much less common than the former. No specimen at that time existing in the Indian Museum. In coloration they resemble each other, but Dr. Stoliczka says "the H. Schistosa is more slender, and its tail proportionally less in length; the head more ovately prolonged, and the gape wider: the shields of the head are consequently more elongated. The body is more compressed; the scales on it are along the back much elongated, imbricated and carinated, on the sides," more oval or hexagonal and less distinctly keeled round the middle: they vary in from 66 to 70 longitudinal series.

Other naturalists, I believe, consider that there is only one species, and that H. Schistosa is merely a variety.

Gunther's description is as follows:—

ENHYDRINA BENGALENSIS.

Valakadyen. Russell.

Hydrus Valakadyen. Boie.

Hydrophis Schistosa (not Daud.) Schleg. Fischer. Dum. Blb.

Hydrus Schistosus. Cantor.

Hydrophis Bengalensis. H. Subfasciata. Gray.

Enhydrina Bengalensis. E. Valakadyen. Gray.

Thalassophis Werneri. Schmidt.

"Head rather short, of moderate width; neck and body moderately elongate. Rostral shield very small, lobuliform, the projecting point fitting into a corresponding cavity of the lower jaw; the fourth upper labial shield below the eye; mental shield very narrow and long, situate in a groove; anterior lower shields much elongate. Throat covered with scales, without shields. One post-ocular, sometimes divided into two. Neck surrounded by 48 series of scales. Scales scarcely imbricate, hexagonal, each provided with a short keel; ventral shields not, or but little different from the scales of the adjoining series: they are 284 to 314 in number. Terminal scale of the tail rather large. The young has broad black rhombic bands across the back, which become fainter with age, and finally disappear altogether."

The fang of Enhydrina is short, but well marked; the groove is open part of its length but not throughout. The body is somewhat compressed; the belly carinate; the tail flat and compressed, almost like a fish's fin; the nostrils vertical; the eyes small.

I have received fine specimens from the neighbourhood of Calcutta from the tidal streams near Mutlah. One lived 24 hours after it reached me; it was made to close its jaws on a fowl, and killed it in seven minutes. Some hours after its death its jaws were forcibly closed on a fowl's thigh, and the bird died in four hours. The poison is evidently very virulent The color of the specimen which is thirty-six inches in length, and three and a half inches in girth, is bluish grey, with dark grey bands across the back; belly whitish. It is figured and described in Russell's Indian Serpents, vol. ii, table xi, as Valakadyen; vol. ii, table x, as Hooghly Pattee.

Russell says the Valakadyen has no fangs, but this is clearly a mistake, the fangs are well marked, and it is very poisonous. It is common in the Bay of Bengal, and is found in the tidal streams of the Sunderbunds. Fine specimens have been sent to me from the tidal streams near Calcutta. The largest specimen is 48 inches long, of which the tail is 5¼: largest part of body in girth is 5¾ inches; neck 2½. Colour bluish grey, with darker bands of deeper shade of same color. Belly whitish; tail compressed like the fin or tail of a fish. The specimen is a female.

PELAMIS.

This genus has only a single species, one of the most common of the sea snakes, and has the widest range of distribution. It is common in the Bay of Bengal and in all the eastern seas.

Gunther's description is—"Head flat, with very long spatulate snout: neck rather stout; body of moderate length. Nasal shields contiguous, longer than broad, pierced by the nostril posteriorly; only one pair of frontals. Scales not imbricate, not polished, tubercular or concave. Ventral shields none, or very narrow. Lower jaw without notch in front.

PELAMIS PLATURUS.

Pelamis	Platurus.	Linn.
,,	Bicolor.	Schneider. (Gunther.)
Hydrus	Bicolor.	Schneider.
Pelamis	Bicolor.	Daud. Schneider.
Hydrophis	Variegata.	Schleg.
,,	Pelamis.	Schleg.
Pelamis	Ornata.	Gray.

"Two or three post-orbitals, neck surrounded by from 45 to 51 longitudinal series of scales; 378 to 440 scales in a lateral longitudinal series, between the angles of the mouth and the vent. Coloration variable."

A specimen sent by Mr. Stewart from Pooree, is 12½ inches long, and is uniform black above, the sides and the belly being of a bright gamboge yellow, tail with black spots, separated by a well defined line. It is described as being very poisonous and killed a fowl rapidly.

It is called Kullundur by the native fishermen on that coast and is deemed by them to be very poisonous.

Gunther describes four varieties:

Variety α.—Color black above; sides and belly uniform, brownish olive; tail with black spots.

Variety β.—Back black; belly and sides brown, separated by a black and a yellow band. Large spots posteriorly.

Variety γ.—Black of back narrow, becomes sinuous behind middle of the body; posteriorly a dorsal series of rhombic confluent spots. Sides and belly with an irregular series of rounded, black or brown spots named sinuata.

Variety δ.—Yellow, with about fifty brown black-edged cross bands, extending nearly to the belly, which is crossed by narrow, vertical, brownish black streaks, alternating with the dorsal bands. Some of the dorsal bands are confluent, forming a zig-zag band. Head yellow, variegated with black."[1]

H. Variegata. Schleg.

P. Ornata. Gray.

Varietas Alternans. Fischer.

The individual from Pooree is the young of Variety α.

THE THANATOPHIDIA OF INDIA.

By J. Fayrer, M.D., C.S.I.

(Re-published from the Indian Medical Gazette.)

Hydrophis, Daud.

This genus has many species, and furnishes the greater proportion of sea-snakes found on these coasts. Gunther gives about 27 species as occurring in the Indian seas, and Dr. Anderson of the Indian Museum informs me that he has described two or three additional new species. It is very probable that others have not yet been described. They present considerable variety of form and coloration; some have elongated necks and small heads, the posterior part of the body being much larger than the anterior. Others have not this characteristic; but they have all a strong family likeness, and may be recognized at once by their compressed bodies, fin-like tails, and the general absence of well-marked ventral scutæ. They are all poisonous, and in the few that I have experimented with, or in those with which experiments have been made, and sent to me, the virus seemed very deadly. The fangs are small and grooved, the involution not being so complete as in the land snakes. They are entirely pelagic, though they may be found in tidal rivers, and when thrown on shore by the surf, or caught and placed on land, are helpless. They seem to be delicate and seldom live long in captivity—a H. Coronata sent to me from one of the tidal streams near Calcutta, lived some days, being occasionally placed in fresh water, and it proved its venomous properties by destroying a small chicken on whose thigh its very small jaws were forcibly closed.

Gunther's description of the genus is as follows:—"Posterior part of the body strongly compressed; head short or of moderate length, shielded above; only one pair of frontals; nostrils superior, in a single nasal shield, both nasals being contiguous to each other. Scales imbricate or not imbricate, not polished, generally with a tubercle or with a keel. Ventral shields very narrow, or quite rudimentary or entirely absent. Lower jaw without notch in front."

He divides them into two classes. Those in which the scales are more or less distinctly imbricate; and those in which the one placed side by side and not imbricate, and these again are variously sub-divided.

The following are the species said to be found in the Indian seas. I have given the description in detail, from Gunther, of those only that I have figured.* The others are to be found in his great work on Indian reptiles. I have selected characteristic species, and the figures are all from recent specimens, from the Bay of Bengal or tidal streams near Calcutta or from such as are preserved in the Indian Museum. It would protract this work to too great a length to describe or figure more than are sufficient, fairly to illustrate the most characteristic species of the genus.

* Hydrophis Jerdonii, Indian Coast and Penang.
H. Stokesii,—Doubtful.
H. Major,—Indian Ocean generally.
* H. Robusta,—Indian Coast, Indian Ocean generally.
H. Cœrulescens,—Bay of Bengal, Penang.
H. Aspera,—said to be found at Singapore.
H. Spiralis,—Indian Ocean.
* H. Cyanocincta,—Bay of Bengal, Ceylon, Indian Ocean.
H. Subcincta,—said to be from the Indian Ocean.
* H. Nigrocincta,—Bay of Bengal.

H. Torquata,—Penang, Soonderbunds, Bay of Bengal, Indian Ocean.
* H. Chloris,—Soonderbunds, Bay of Bengal.
H. Lindsayii,—Indian Coast.
H. Latifasciata,—Mergui.
* H. Coronata,—Bay of Bengal, Soonderbunds.
H. Diadema,—probably Indian.
H. Gracilis,—Indian Coast, Bay of Bengal.
H. Fasciata,—Indian Coast, Bay of Bengal.
H. Cantoris,—Penang.
H. Lapemoides,—Indian Coast, Ceylon.
H. Longiceps,—Indian Ocean.
H. Stricticollis,—Doubtful.
H. Ornata,—Indian Ocean.
H. Elliotti,—Indian Coast, Ceylon.
H. Pachycercus,—Indian Ocean.
H. Viperina,—Indian Coast.
* H. Curta,—Indian Coast, (near Pooree.)
H. Hardwickii,—Penang.
H. Fayreri, n. s. Anderson,—Indian Coast, Bay of Bengal, Pooree.
H. Crassicollis n. s. Anderson,—Bay of Bengal.

The following description of H. Jerdonii, H. Robusta, H. Cyanocincta, H. Nigrocincta, H. Chloris, H. Coronata, H. Curta, are all from Gunther.

Those of the new species, H. Crassicollis and H. Fayreri, are by Dr. Anderson of the Indian Museum.

The figures are from nature ; recent specimens from Pooree, or the Soonderbunds, or from those preserved in the Indian Museum.

HYDROPHIS JERDONII.

Hydrus Nigrocinctus, var., Cantor. Mal. Rept.
Kerilia Jerdonii. Gray. Viper snakes.

"Head short, with the snout declivous and rather pointed; body of moderate length. Frontal shields small, not much larger than præ-ocular; one post-ocular, five upper labial shields, the third and fourth of which enter the orbit, the last below the post-ocular; two or three larger temporals on the side of each occipital, the anterior of which enters the labial margin behind the fifth labial shield. Two pairs of chin shield in contact with one another. Scales imbricate, large, higher than long, with the apex slightly truncated; each scale with a strong keel; they are disposed in fifteen or seventeen series round the neck, and in nineteen or twenty-one in the middle of the body. Ventral shields distinct, but not twice as large on the scales of the adjoining series; bituberculate 235-238 in number. Anal shields small; terminal scale of the tail large; a series of seven simple teeth behind the grooved fang in front. Trunk with from thirty-four to thirty-eight cross bands, broadest on the back, and extending to the belly in young and half-grown specimens."

HYDROPHIS ROBUSTA.

Hydrophis nigrocincta. Schleg.

"Head of moderate size and width; neck and body not elongate. Two or three upper labials below the orbit; one post-ocular; anterior temporal shield large; two pairs of chin shields, which are in contact with one another. Thirty-one series of scales round the neck. Scales slightly imbricate, each with a sub-central tubercle; those on the highest part of the body are rounded or sub-truncated behind, as high as long. Ventrals twice or thrice as broad as the scales of the adjoining series, smooth, 310 in number. Terminal scale of the tail rather large. Trunk with thirty-five narrow, distant, black rings, extending round the belly, sometimes interrupted on the side and dilated on the back; head without markings in the adult; throat and belly whitish.

"This snake, of which we have examined two adult examples, 6 feet long, is found on the coasts of the main land of India, as well as in the Archipelago. It has been confounded with other species by all the previous herpatologists. The figure given by Fischer is very recognizable."

HYDROPHIS CYANOCINCTUS. THE CHITTUL.

Hydrophis cyanocinctas. Daud.
Léiosélasme striée. Lacép.
Hydrophis striata. Schleg.
Hydrophis sublævis. Gray.
Hydrophis subannulata. Gray.
Hydrus striatus. Cantor.

Head of moderate size and width; neck and body rather elongate; generally two labial shields below the eye; two post-oculars (exceptionally confluent into one); two or more temporal shields on the side of each occipital. Two pairs of chin shields, the anterior of which are in contact with each other. Twenty-nine to thirty-three series of scales round the neck. Scales slightly imbricate, rhombic, faintly keeled; those on the highest part of the body rather longer than high. Ventrals 320, 360, 406, 426, twice or thrice as large as the scales of the adjoining series; almost all are entire, not longitudinally divided, and bitubercular; four anal shields, the outer of which are larger than the inner; terminal scale of the tail rather small, or of moderate size. Greenish olive on the back, yellowish on the sides and belly; trunk with from fifty to seventy-five black cross bands, which are broadest on the back, and broader than the interspaces of the ground-colour; they are narrower on the sides, sometimes disappearing altogether with age on the sides and belly, or visible only as irregular spots on the ventral shields. In young and half-grown specimens they surround the body entirely, and are sometimes joined by a black band running along the whole line of the ventral shields. The head is greenish olive above, and yellowish on the sides; in the young black, variegated with yellow, the yellow colour sometimes forming a frontal and temporal band.

This is one of the commonest sea-snakes, occurring on the coasts of Ceylon, Madras, in the Bay of Bengal, in the East Indian Archipelago, and in the seas of China and Japan. It attains to a length of more than 6 feet. Old males have a remarkably thick and rounded tail.

Hydrophis Nigrocinctus.

Hydrophis nigrocinctus. Daud.

Enhydris nigrocinctas. Merr.

Head small; neck slender, its length being about one-fourth of the total; body moderately elongate. Rostral shield rather broader than long; only the fourth upper labial forms the lower part of the orbit; two post-oculars; three temporal shields on the side of each occipital. Two pairs of chin shields, the anterior of which are in contact with each other. Twenty-seven to twenty-nine series of scales round the neck. Scales imbricate, rhombic, keeled, those on the highest part of the body as broad as long. Ventrals distinct, not quite twice as broad as the scales of the adjoining series, smooth, 320, 331 in number. Four large anal shields. The tail terminates in a large scale. The trunk is encircled by 43, (53), 61 complete rings of black colour. The width of these rings is equal on the sides and on the belly; on the vertebral line only they are a little broader; they are narrower than the interspaces, which occupy from four to five transverse series of scales, whilst a black ring occupies only three.

The interspaces are greenish olive on the back, yellowish on the sides and on the belly. The crown of the head and the upper lip are blackish, a yellow band running along the whole upper margin of the head; lower jaw whitish. Tail with from nine to eleven black cross bars.

Hydrophis Chloris.

Hydrophis chloris. Daud.

Hydrophis obscura. Gray.

? Hydrophis gracilis. Cantor.

Head very small, of moderate width; neck very slender, the length of the thin part of the body being more than one-third of the total. Rostral shield very small, much broader than long; one post-ocular; the third upper labial is not in contact with the nasal. Two pairs of chin shields, in contact with each other. Thirty-one to thirty-three series of scales round the neck; scales on the back with a faint keel, and with a small tubercle near the apex. Ventral shields distinct, especially on the thin portion of the body, but not much larger than the scales of the adjoining series, 473-500 in number. Four anal shields, the outer of which are very large. Trunk greenish olive above, yellowish on the side and below: from fifty-nine to sixty-seven rhombic, blackish, bands across the back, which are much narrower and fainter on the sides, and extend round the belly; their angles on the vertebral line are sometimes confluent, especially on the anterior part of the body, where the yellowish ground-colour between the cross bands is sometimes reduced to round spots disposed in pairs. Head and anterior part of the belly entirely black. *Young* specimens have the markings of a deep black.

Hydrophis Coronata.

Hydrophis hardwickii. Gray.

Hydrophis fasciata. Gray.

Head very small, twice as long as broad; neck very slender, its length being more than one-third of the total. Rostral shield small, broader than long; one post-ocular; the third upper labial is not in contact with the nasal. Two pairs of chin-shields, which are in contact with each other. Nineteen to twenty-three series of scales round the neck. Scales imbricate, those on the highest part of the body higher than long, those on the sides with a small tubercle, those on the back with a keel. Ventral shields very distinct, nearly twice as large as the scales of the adjoining series, 321-337 in number, each with two small tubercles. Four anal shields, the outer of which are rather larger than the others. Trunk with from fifty-three to fifty-nine complete blackish rings, which are broader than the interspaces of the yellowish olive ground-colour. Head and ventral side of the thin neck-like portion of the body black; the former with a yellow horse-shoe-shaped mark across the frontals and nasals, and extending backwards over the superciliary edge to the temple. Tail with ten or eleven blackish cross bars.

HYDROPHIS CURTA.

Hydrus curtus. Shaw.

Lapenus curtus. Gray.

Hydrophis propinquus. Jan.

Head short, thick, obtuse; anterior part of the body stout; body not elongate. The occipital shields are always divided into two or more pieces, or entirely broken up into small shields. Two pairs of chin shields, separated in the middle by small gular scales. Only one post-ocular. Thirty to thirty-four series of scales round the neck; 209-252 scales in a lateral series between the angle of the mouth and the rent. Ventral shields nearly twice as broad as the scales of the adjoining series, 156-160 in number. Four small præ-anal shields. Fifty to fifty-three black bands across the back: they are broadest in the middle, nearly touching each other, and tapering on the sides; the yellowish ground-colour between them does not occupy more space than the bands. Generally the bands do not extend downwards to the belly, but sometimes they are continued as faint traces to the ventral shields, which are white, or, in the specimens with longer cross bands, blackish. A more or less distinct yellowish streak on the temple. Tail black, with only two yellow transverse spots at its root.

HYDROPHIS CRASSICOLLIS, N. S. ANDERSON.

Head hardly distinct from the neck. Neck and body of nearly equal girth throughout. Round neck 2″ 2‴; round middle of body 2″ 9‴. Body elongated; 34 series of scales round the neck; 40 round the middle of the body. Scales almost smooth on the neck and anterior third of the body, two feeble keel-like tubercles, one before the other, very obscure, but more strongly developed on the two posterior thirds. Ventrals twice the size of the adjoining scales, quite smooth, broken up here and there, on the posterior five-eighths of the body. Two pairs of anal shields, the central pair of moderate size, elongated, the external pair very large. The vertical is pointedly linguate. One præ, and two post-oculars. The 3rd, 4th and 5th labials enter the orbit, on one side, but only the 3rd and the 4th on the opposite side, the 5th being transversely divided into two shields which do not reach quite as high as the orbital margin. Two pairs of large chin shields, the anterior pair quadrangular and the posterior pair rather elongated. Olive yellow above, yellowish on the scales and under surface, 62 broad black bands on the back contracting to a point on the sides, but prolonged very indistinctly on to them, and the ventral aspect, where they expand as a large blackish spots. Near the tail the dorsal bands become connected together, and their continuations on the ventral aspect follow a similar arrangement. Six black rings on the tail, confluent below; the latter third entirely black.

Hooghly below Calcutta. Length (total) 4 feet 5″ 6‴, tail 4″ 3‴.

The peculiarity of this species is its elongated body, the uniform breadth which it preserves throughout its length, and the enlarged and smooth ventrals.

From the tidal streams near Calcutta.

Hydrohis Fayreri, n. s. Anderson.

Head short and thick; snout, broad and rounded. Body moderately long and stout, of nearly equal breadth thoughout, narrower on the anterior fifth. Frontal shields large, tapering, about the same size as the nasals. One præ-ocular, small, its broadest end pointing forwards; one post-ocular. Seven upper labials, the fifth the largest, the sixth and seventh labials with a shield above them, suggesting that they are only detached portions of a large sixth labial. Third and fourth labials entering the orbit, oblong, higher than broad, the first pair of lower labials meeting behind the chin shield, with a number of scale-like shields behind them. Thirty-four rows of smooth, non-imbricated and non-tuberculated scales round the neck. Those on the ventral surface larger than those on the back sides, but no distinct row of enlarged ventrals; the median rows, however, are slightly imbricate, and number 193 from the throat to the anus. Five pairs of small pre-anal shields. Thirty-nine series of broad, olive, brown, cross bands on the back, extending to the sides, but not into the belly, and rounded below, separated by narrow pale lines, about half a scale's breadth. Tail olive brown above, black on its lower third. Length $30\frac{1}{8}$, tail $3\frac{1}{8}$, gape $\frac{3}{4}$, Hab. Pooree, Cuttack coast.

This species appears to be closely allied to *H. Hardwickii*, from which it is distinguished by the absence of tubercles, in the adult, by the partial imbrication of the middle rows of ventral scales, and by their greater number.

The following species are briefly also described in Gunther's Synopsis. They are found in the Indian seas or on the coast:—

With scales more or less distinctly imbricate; in the following example, much imbricate, rather small, in forty-three to forty-seven series round the neck; ventral shields split into two. Hydrus. (Shaw.) Gray.

HYDROPHIS STOKESII.—Body stout.

Scales more or less distinctly imbricate, and in twenty-three to thirty-eight series round the neck; head not very small; anterior part of the body, (neck) not, or moderately slender. Hydrophis. (Daud.) Gunther.

HYDROPHIS MAJOR.

Head rather short and broad; neck and body of moderate length, one post-ocular. Belly with only a few ventral shields.

H. CŒRULESCENS.

Head rather small; neck and body somewhat elongate. One post-ocular; scales strongly keeled. Ventrals not much larger than the adjoining scales.

H. ASPERA.

Head of moderate size and width; neck and body somewhat elongate. Two post-oculars; scales strongly keeled, the keel of each scale, with two tubercular prominences.

H. SPIRALIS.

Head of moderate size and width; neck and body somewhat elongate. One post-ocular. Back with a series of black round spots alternating with black cross bands.

H. SUBCINCTA.

Head rather small and narrow; neck slender. Two post-oculars; twenty-three series of scales round the neck. Ventrals not twice as large as the adjoining scales. Trunk with forty-one cross bands.

H. TORQUATA.

Head rather small; neck slender. One post-ocular; thirty-three to thirty-five series of scales round the neck; ventral short.

With head very small; neck exceedingly slender. Lispala (Gray.) Gunther.

Lipala

H. Lindsayii.

The length of the thin part of the body is more than one-third of the total. One post-ocular; thirty-one to thirty-three series of scales round the neck. Trunk, with from forty-eight to fifty-eight blackish cross bands, extending to the middle of the side.

H. Latifasciata.

One post-ocular; twenty-three series of scales round the neck. Trunk with thirty-eight broad black cross bands confluent on the back and belly.

H. Diadema.

Two post-oculars; thirty-three series of scales round the neck. Trunk with sixty-two blackish rings.

With scales not imbricate, placed side by side. Head very small; neck exceedingly slender. Microcephalophis. (Leps.) Gray.

H. Gracilis.

One post-ocular; ventral shields 228 to 294, those on the hinder half of the body split into two.

H. Fasciata.

Two post-oculars; ventral shields 316, all undivided.

H. Cantoris.

One post-ocular; ventral shields 412 to 440, those on the hinder half of the body split into two.

Head of moderate size; anterior part of the body not, or moderately elongate. Thalassophis. (Schmidt.) Gunther.

H. Lapemoides.

Head narrow, elongate; body rather slender; two post-oculars; ventral shields twice as broad as the adjoining scales, 350 in number.

H. Longiceps.

Head narrow, elongate; body rather slender; two post-oculars; ventral shields twice as broad as the adjoining scales, 271 in number; scales keeled.

H. Stricticollis.

Head narrow, elongate; body rather slender; one post-ocular; ventral shields distinct, only the anterior being twice as broad as the adjoining series, 398 in number.

H. Ornata.

Head rather narrow, and produced; body somewhat elongate; two post-oculars; ventral shields twice as broad as the adjoining scales, 252 to 260 in number. Scales with a central tubercle, the first upper temporal shield much larger than high.

H. Elliotti.

Head rather thick and short; body of moderate length; two post-oculars; ventral shields nearly twice as broad as the adjoining scales 253 to 258 in number. The first upper temporal shield is not much larger than high; thirty-five or thirty-seven series of scales round the neck.

H. Pachycercus.

Head and body of moderate width and length; two post-oculars; 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; twenty-eight series of scales round the neck.

H. Viperina.

Head of moderate size and width; body of moderate length; two post-oculars; nasal shields as broad posteriorly as they are long; anterior ventral shields broad.

H. Hardwickii.

Head short and thick; body stout; one post-ocular; no distinct ventral shields. Trunk with from forty-one to forty-three blackish cross bands, not extending downwards to the belly.

~~THE THANATOPHIDIA OF INDIA.~~

DEATHS BY SNAKE-BITE IN THE BENGAL PRESIDENCY DURING 1869.

~~By J. Fayrer, M.D., C.S.I.~~

~~(Re-published from the "Indian Medical Gazette.")~~

On the 3rd of January, 1870, I addressed the following letter to the Secretaries or Political Agents of the following Governments:

Bengal,	Central Provinces,
North-West Provinces,	Central India,
Punjab,	Rajpootana,
Oude,	British Burmah,

soliciting information on the subject of loss of life from snake-poisoning in their territories :—

Sir,—Being engaged in an enquiry into the subject of snake-bites in this country, in the hope that, with other information of a scientific character, something may be elicited that shall tend to diminish the present great mortality from this cause, I shall feel greatly obliged if you will assist me by obtaining from all magistrates, district officers, medical officers, or others under Government, who may be able to furnish the information ;—a return showing the number of deaths that have occurred in their districts, from 1st January to 31st December, 1869, from snake-bites, giving the age, sex, occupation, and residence of those who have suffered, with the name of the snake, when procurable, by which the bite was inflicted.

To this I have received prompt and ample replies from a number of officers; and the following abstracts show not only the great mortality, but attest the interest evinced by these gentlemen, and the care and trouble with which, in many instances, they have prepared these returns. I feel much indebted to all who have so fully complied with my request, and take this opportunity of tendering my sincere thanks for the valuable information that has thus been placed by Government at my disposal.

The records represent, it is true, only a portion of India; as the Madras and Bombay Presidencies, as well as other parts of India, are not included. Had similar information been obtained from these Provinces, the list of mortality would doubtless have been much larger; as it is, the number of deaths is perfectly appalling, and the subject well merits close consideration, with the view of discovering, if possible, some remedy.

I have roughly classified the deaths under the head of the snakes that inflicted the fatal wound, but the records are rather vague on this point, and the information not always available. Still they are sufficiently explicit to make it clear, that in order of destructiveness, the Cobra occupies the first place on the list; the Krait (Bungarus Cœruleus) occupies the second place, whilst under the headings of "Other snakes, and unknown," must be included many deaths due to Cobra, Bungarus Cœruleus, Hamadryad, Daboia, Bungarus Fasciatus, Hydrophidæ, and some perhaps to Echis Carinata and the Trimeresuri; though as to the last there is reason to believe that deaths from their bites are comparatively very rare.

It has been suggested by those well qualified to form an opinion, that not a few of the deaths, especially of women, ascribed to snake-bites, might, if they could be traced to their real cause, be referred to a totally different heading. It may be so; but still the indisputable fatal cases of snake-bite are terribly numerous, and it is very probable that not all that have occurred are recorded.

The deadly nature of the bite of the Cobra, Hamadryad, Krait, and Viper, is shown in the numerous experiments that I have made on the lower animals; it is equally demonstrated, with reference to the human race, by the returns of the year 1869, and I fear the inefficacy of all the so-called antidotes is made equally certain.

My own impression, and it is derived from many experiments, is, that in case of a real bite, by which I mean when a healthy and vigorous Cobra, Hamadryad, Bungarus, or Daboia has imbedded its fangs and inoculated the poison, there is very little chance, if any, of saving life, unless the most immediate and vigorous aid be given, and even then, at the best, there is but poor chance of safety. No doubt many bites do not prove fatal, for the reason that the snake has been altogether or compara-

~~It appears from analysis of the returns that the greatest mortality from snake bite occurs in the Months of~~

~~The following tabular statement shows the ~~results~~ proportion of cases of death~~

Begin here

Sir H. Bartle Frere K.C.M. informs me that when he was Commissioner of Sind he instituted enquiry into the subject of deaths from snake bite in that province and it was no doubt owing to the police returns which were then sent into Government: that attention was first directed to the subject in Bombay Presidency, the Punjab & elsewhere

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The records of the Commissioner of Snakes office no doubt contain interesting information on the subjects. But speaking from memory Sir B. Frere says that one of the facts established by the returns was the enormous increase in the mortality from snake bites during the hot weather - This was partly owing to the people sleeping more out of doors at that season; but still more to the great quantity of inundated land which drove the snakes into the ~~to~~ gaps on the higher lands - ~~[illegible]~~ the mortality rising from an average of 2 or 3 per ~~[illegible]~~ week in the cold weather

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to as many as ten or twelve per week in the hot weather in a population of about a million and a quarter. The Rhinotaphy [?] as well as the Snake [?] returns showed a very high mortality.

No doubt the explanation given by Dr H. B. Fenn [?] of which I send an extract applies to the rest of India. & the mortality is greater in certain seasons naturally because the snakes are then concentrated in greater

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tively innocent, or that its poison has been weak or defective in quantity, or that the bite has been only partially inflicted.

It is quite possible too that the most vigorous snake may inflict a wound, even draw blood, without fatal poisoning, or indeed sometimes without poisoning at all. This is the case when it strikes without seizing, as snakes often do, or when they have expended their poison by previous biting, or in feeding, or have bitten through clothes or leather. The real bite, when the fatal hypodermic injection of the poison takes place, is when the snake seizes, retains its hold, and thoroughly imbeds its fangs in the part. That bites may be inflicted without poisoning was well shewn in an experiment with a Mongoose, when one of these creatures was shut up in a cage with a fresh and vicious Cobra. They fought for some time, and when removed from the cage they both bore marks of the fray, in bleeding wounds about the head. The Mongoose had suffered almost as much as the Cobra, but there were no symptoms of poisoning. It was certain that he had been bitten, and yet that he was not poisoned. Shut up in a cage, no antidote was available; it appeared either that he had some special immunity, or that—most improbable—the Cobra was harmless. The reason was soon explained. The Cobra was made to close its jaws on the Mongoose's thigh; it succumbed to the poison and died in a short time. The fact was the wounds in the head had been given, as I have said they may be, without injection of poison; they were scratches, and not the punctures through which the poison finds rapid and fatal entry into the circulation.

From such injuries, even when a certain amount of poison has entered, recovery is no doubt quite possible and probable, and much may be done to aid it by medical treatment and the use of stimulants. In cases where poisoning has been caused, but in a minor degree, recovery takes place partly from the inherent vigor of the individual, partly by the aid of treatment; but that any creature fairly bitten and poisoned by a vigorous Cobra, Hamadryad, Krait, or Daboia, and who would otherwise have died, has been saved from such death by what is popularly called an antidote, I confess that I fear there are not sufficient grounds for belief. I have shown by experiment that if the bitten part can be instantaneously and completely separated from the rest of the body by ligature or excision, poisoning may be averted by preventing entry of the venom into the circulation; whilst every other measure tried, whether local or constitutional, has entirely failed to do any good. The impossibility of applying this treatment in a great proportion of cases is obvious, and it must be remembered that even it has only succeeded occasionally. I propose to give an account of what may be done in snake-bite in all its forms, describing whatever may hold out any prospect of relief or recovery. Meanwhile, I would suggest the obvious necessity of endeavouring to prevent these numerous fatal accidents, by making generally known the appearance and habits of the Thanatophidia, and by instituting rewards for their destruction. With a plain description, and a faithful representation of each species in colours, such as I hope to give, every district, medical, or police officer, would be able at once to distinguish the venomous from the innocent snakes; and thus knowledge enough at least for all practical proposes, might be imparted to intelligent native subordinates, to enable them to recognise the poisonous snakes also. By offering a larger reward for these only, their numbers would soon diminish, and the people would be made acquainted with the characters that distinguish the venomous from the harmless snakes, and learn to avoid them. Thus only, I believe, can the evil be remedied, so long, at all events, as the mode of life among the lower and agricultural classes, those who mainly suffer, remains what it now is.

The following are abstracts of the returns above alluded to, and probably many of them are imperfect, for want of accurate records; some, I believe, underrate the mortality, as in the Calcutta return, which gives only six cases for 1869. Still they are sufficient to shew how great an evil exists in what, one would fain hope, may be regarded, to a certain extent, as a preventible cause of death.

I have received returns from the 9 Divisions, including 48 Districts in Bengal, shewing an aggregate of 6,219 deaths from snake-bite in the year 1869.

Of these, 2,374 were of males over 12 years of age; 2,576 were of females over 12 years of age; 663 of male children under 12, and 606 of female children under 12 years of age; making a total of 3,037 males of all ages, and 3,182 females of all ages.

Thus, of the 6,219 persons killed by snakes in one year in

Bengal, there was an excess of 145 females over the males; the adult females appear to have been the greatest sufferers, by 2,576 against 2,374; whilst, on the other hand, female children were fewer, being 606 against 663 male children.

The ages of the sufferers vary from 100 years to three months.

Although the returns are for the most part vague as to the snake that caused death, it is sufficiently evident that the several varieties of Cobra caused the greatest mortality. 950 deaths are assigned to this snake, 160 to the Krait or Bungarus Cœruleus, and 348 to other snakes not recognizable under their local vernacular names, 4,752 to snakes altogether unknown, most frequently, probably, not having been seen. Doubtless, as the Cobra is in excess in the recorded cases, so it is in those of "other snakes," and "unknown," whilst the remainder must be assigned to the Hamadryad, the Bungarus Cœruleus, Bungarus Fasciatus, Daboia Russelli, and probably a few to the Trimeresuri and Hydrophidæ. It is worthy of note, that of all the Divisions, the Presidency Division,—although the Soonderbund District furnished no return, and Calcutta gives only six deaths,—gives the largest mortality, being 1,341 deaths; whilst the lowest is in Cooch Behar, 79 deaths, the Garrow Hills District, of that Division, furnishing no return at all.

It is tolerably evident, notwithstanding the great mortality, that it is only an approximation to that which really occurs, for some Districts have sent no returns at all, whilst others have probably not recorded all that occurred.

From Orissa I have received returns of three Districts, shewing that in 1869, 350 deaths occurred. Of these, 137 were adult males, 138 adult females, 44 boys and 31 girls under 12 years of age. Here also, although the difference is expressed only by 1, the adult female exceed that of the adult male mortality; whereas among children the male exceed the female deaths by 13.

It appears that 128 deaths were due to Cobras, 2 only to the Krait, 52 to "other snakes," and 168 to "snakes unknown"; but a large proportion of these, no doubt, were also due to Cobras, some to the Krait, Daboia, Hamadryad, and it is possible in this Division, having a considerable tract of seaboard, that some deaths may be ascribed to the salt-water snakes, or Hydrophidæ.

From Assam I have received the returns of seven Districts, in three of which no reports are made. The other four give an aggregate of 76 deaths. Of these 50 were adult males, 14 adult females, 9 boys, 3 girls; the male in this case much exceeding the female deaths.

Twelve deaths are ascribed to other snakes than the Cobra or Krait; 64 were caused by snakes unknown. I think it is more than probable that these returns only represent part of the mortality from snake-bite in Assam.

From Oude I have received the returns of twelve Districts, by which it appears that 1,205 persons died of snake-bite in that province in 1869. Of these, 364 were adult males, 558 adult females, 137 boys and 146 girls under 12 years of age.

The adult females were thus 194 in excess of the males, and the young girls 9 in excess of the boys. 607 deaths were caused by Cobras, 105 by Kraits, 20 by "other snakes," and 473 by "snakes unknown." Several infants of tender age perished, and the ages of the sufferers range from 100 years to one month.

The District of Gondah appears to have been most fatal, giving 206 deaths.

From Central India I have received from 14 Districts reports of only 90 deaths. Of these 38 were of adult males, 36 adult females, 8 boys, and 8 girls. The number of males and females is thus as nearly as possible equal, there being a slight excess of males. 21 deaths are ascribed to the Cobra, 37 to "other snakes," and 32 to "snakes unknown." Western Malwah, of all the Districts, furnishes the largest number of deaths by 42.

From the Central Provinces I have received no returns, but am informed officially by the Secretary to the Chief Commissioner, that 606 persons died of snake-bite in the year 1869 in those provinces; no details are given.

From Rajpootana no returns have been received, as I am informed by Colonel Keatinge, in an official communication, that "the Native Governments never receive detailed reports of this nature."

From the North-West Provinces I have received reports from 8 Divisions, including 38 Districts, giving a total of 1,995 deaths, of which 653 were of adult men, 953 of adult women, 199 of boys, and 190 of girls under 12 years of age.

The women were therefore 300 in excess over the men; whilst the boys exceeded the girls by 9.

The Cobra is accountable for 854 deaths, the Krait for 92, "other snakes" for 63, whilst to "snakes unknown" the large number of 986 is assigned; no doubt the majority of the "other snakes" and "snakes unknown" were Cobra and Krait.

From British Burmah I have received returns from Arracan, Pegu, Tenasserim, and Shewé Gyen, giving a total of 120 deaths from snake-bite in the year 1869. Of these, 95 were of men, or boys over 12 years of age, 22 of women over 12 years, 3 of boys under 12, and no girls under that age. In this case the male preponderate largely over the female deaths of all ages, 98 males and 22 females having suffered.

Forty deaths are attributed to the Cobra, and all the rest, with a few exceptions, to the Viper (Daboia), the remainder being ascribed to Hamadryads and Hydrophidæ. In one case a master of a ship died at Moulmein from a bite inflicted when bathing—no doubt, from some form of Hydrophis.

From the Punjab I have received returns from the 10 Divisions into which that province is divided, from 32 Districts, giving the number of deaths from snake-bite as 755. Of these, 434 were from males, 184 from females above 12 years of age, 77 boys and 32 girls under 12, making 727. The remaining 28 to make up 755 was the total deaths of the District of Umritsur, in which return the ages and sex are not distinguished. The males in this part of India appeared to have suffered more than the females, in the proportion of 511 males to 216 females. The earliest age recorded was that of an infant 1 day old. Only 76 deaths are ascribed to the Cobra, none to the Krait, 240 to other snakes, 437 unknown. Among these no doubt many were due to the Bungarus, Cobra, and probably to the Echis Carinata.

The total number of deaths recorded therefore stands thus:—

Bengal, including Assam and Orissa ..	6,645
North-West Provinces	1,995
Punjab	755
Oude	1,205
Central Provinces	606
Central India	90
British Burmah	120
Total	11,416

This, large as it is, I fear, cannot be regarded as the real mortality in these Provinces, nor may the numbers be accepted as an absolutely true indication of the relative frequency of deaths in each. The information from which these records were framed was probably only partial and imperfect. I believe that if systematic returns could be kept by the police in every district, sub-division, and municipality, the number of deaths recorded would be much larger. I believe also that were such information available and collected from the whole of Hindostan, it would be found that more than 20,000 persons die annually from this cause alone.

If the suggestions that I propose to make, together with a description of the poisonous snakes to which this mortality is due, contribute towards diminishing this mortality, I shall feel satisfied that the investigations of the past three years have not been without results.

The area represented by these returns,* is, I should think, rather less than half that of the Peninsula of Hindostan; but from a return, for which I am indebted to W. W. Hunter, Esq., LL.D., C.S., I find it represents a population of 120,972,263.

* For returns see accompanying statement.

Return shewing the number of Deaths from Snake-bites, in the year 1869, in the Province of Bengal.—Population, including Orissa and Assam, 48,358,134.

Divisions.	Districts.	Men and Boys over 12.	Women and Girls over 12.	Men and Boys under 12.	Women and Girls under 12.	Total Deaths in Districts.	Total Deaths in Divisions.	Names of Snakes. Cobra (Kála Gokurrah, Gomunna.)	Krait.	Other Snakes.	Unknown.	Remarks.
Bhaugulpore and Sonthal Pergunnahs.	Bhaugulpore ...	87	78	28	11	204	......	17	5	2	180	One man said to be 140 years old.
	Monghyr ...	62	64	13	14	153	......	......	6	13	134	
	Purneah ...	34	24	13	6	77	......	1	......	37	39	One was from a Scorpion bite.
	Deoghur ...	18	14	8	4	44	......	21	9	7	7	
	Godda ...	14	9	8	1	32	......	4	4	......	24	
	Nya Doomka ...	8	8	8	1	25	......	......	......	......	25	
	Rajmehal ...	30	24	9	5	68	......	68	......	......	......	
	Total Deaths in Bhaugulpore, &c. ...	253	221	87	42	603	603	111	24	59	409	
Burdwan.	Bancoorah ...	47	48	2	6	103	......	2	......	4	97	
	Beerbhoom ...	26	24	......	7	57	......	9	5	2	41	
	Burdwan ...	29	48	2	9	88	......	45	......	2	41	
	Hooghly ...	97	93	21	13	224	......	12	......	1	211	
	Howrah ...	73	88	18	24	203	......	17	......	2	184	
	Midnapore ...	196	217	46	70	529	......	43	......	32	454	
	Total Deaths in Burdwan ...	468	518	89	129	1,204	1,204	128	5	43	1,028	
Chittagong.	Chittagong ...	5	8	2	...	15	...	...	...	...	15	
	Tipperah ...	42	19	3	7	71	...	...	...	3	68	
	Noakhally ...	36	41	8	13	98	...	...	...	...	98	
	Total Deaths in Chittagong ...	83	68	13	20	184	184	...	...	3	181	
Chota Nagpore.	Hazareebaugh ...	10	19	6	3	38	...	7	7	...	24	
	Lohardugga ...	74	33	7	8	122	...	23	36	12	51	
	Maunbhoom ...	57	29	4	1	91	...	44	47	...	...	
	Singbhoom ...	11	10	...	...	21	...	...	...	2	19	
	Total Deaths in Chota Nagpore ..	152	91	17	12	272	272	74	90	14	94	
Cooch Behar.	Garrow Hills ...	...	...	...	...	...	...	...	...	...	...	No report sent.
	Darjeeling ...	1	...	1	...	2	...	2	...	...	...	
	Gowalpara ...	13	15	7	2	37	...	...	...	2	35	
	Julpigoree ...	19	19	2	...	40	...	7	...	21	12	
	Total Deaths in Cooch Behar ...	33	34	10	2	79	79	9	...	23	47	
Dacca.	Backergunge ...	89	77	32	27	225	...	5	...	1	219	A boy one year old.
	Cachar ...	5	...	1	...	6	...	...	...	...	6	No name of snake recorded.
	Dacca ...	70	80	22	35	207	...	2	...	27	178	A girl seven months old.
	Furreedpore ...	37	37	19	10	103	...	1	...	...	102	A boy three months old.
	Mymensing ...	83	87	33	29	232	...	...	...	6	226	
	Sylhet ...	37	20	17	11	85	...	...	...	22	63	
	Total Deaths in Dacca	321	301	124	112	858	858	8	...	56	794	
Patna.	Chumparun ...	6	9	3	6	24	......	9	6	1	8	Includes two from Centipedes.
	Gya ...	27	21	7	5	60	......	6	1	......	53	
	Patna ...	67	76	21	18	182	......	55	16	3	108	
	Sarun ...	36	39	8	6	89	......	36	10	......	43	
	Shahabad ...	4	8	......	3	15	......	9	1	......	5	
	Tirhoot ...	40	35	13	6	94	......	18	7	1	68	
	Total Deaths in Patna	180	188	52	44	464	464	133	41	5	285	
Presidency.	Calcutta ...	2	3	......	1	6	......	1	......	......	5	
	Jessore ...	134	153	59	49	395	......	17	......	41	337	
	Nuddea ...	129	242	44	53	468	......	217	......	7	244	
	Soonderbuns ...	......	......	......	......	......	......	......	......	......	......	No report sent.
	24-Pergunnahs ...	163	196	64	49	472	......	51	......	82	339	
	Total Deaths in the Presidency ...	428	594	167	152	1,341	1,341	286	......	130	925	
Rajshahye.	Bograh ...	54	66	11	15	146	......	......	......	......	146	
	Dinagepore ...	65	92	22	19	198	......	43	......	6	149	
	Maldah ...	34	35	12	7	88	......	13	......	9	66	
	Moorshedabad ...	65	116	23	17	221	......	4	......	......	217	
	Pubna ...	82	76	28	27	213	......	......	......	......	213	
	Rajshahye ...	118	150	......	......	268	......	150	......	......	118	
	Rungpore ...	38	26	8	8	80	......	......	......	......	80	
	Total Deaths in Rajshahye. ...	456	561	104	93	1,214	1,214	210	......	15	989	
	Grand Total of Deaths in Bengal ...	2,374	2,576	663	606	6,219	6,219	959	160	348	4,752	

Return shewing number of Deaths from Snake-bites, in the year 1869, in the Province of Assam.—Population 1,53

Division.	Districts.	Men and Boys over 12.	Women and Girls over 12.	Boys under 12.	Girls under 12.	Total Deaths in Districts.	Total Deaths in Division.	Names of Snakes. Cobra (Kála Gokurrah, Gomunna.)	Krait.	Other Snakes.	Unknown.	Remar
Assam.	Cossyah & Jynteah Hills	......	......	......	......	......	......	......	......	......	......	No deaths report
	Durrung ...	7	3	3	1	14	......	......	......	1	13	
	Kamroop ...	35	8	5	1	49	......	......	......	8	41	
	Lukhimpore ...	......	......	......	......	......	......	......	......	......	......	No deaths report
	Nowgong ...	8	2	1	1	12	......	......	......	3	9	
	Seebsaugor ...	......	1	......	......	1	......	......	......	......	1	
	Naga Hills ...	......	......	......	......	......	......	......	......	......	......	No deaths report
	Total Deaths in Assam..	50	14	9	3	76	76	......	......	12	64	

Return shewing number of Deaths from Snake-bites, in the year 1869, in the North-West Provinces.—Population 30,

Divisions.	Districts.	Men and Boys over 12.	Women and Girls over 12.	Boys under 12.	Girls under 12.	Total Deaths in Districts.	Total Deaths in Divisions.	Names of Snakes. Cobra (Kála Gokurrah, Gomunna.)	Krait.	Other Snakes.	Unknown.	Remar
Meerut.	Dehra Dhoon ...	......	......	......	......	......	......	......	......	......	......	No report sent.
	Saharunpore ...	23	19	4	3	49	......	15	......	3	31	
	Mozuffernugger ...	9	6	1	2	18	......	......	......	......	18	
	Meerut ...	10	11	3	1	25	......	25	......	......	......	
	Boolundshuhur ...	8	15	3	1	27	......	......	......	5	22	
	Allyghur ...	14	16	1	2	33	......	......	......	2	31	
	Total Deaths in Meerut.	64	67	12	9	152	152	40	......	10	102	
Agra.	Muttra ...	8	11	1	1	21	......	......	......	2	19	
	Agra ...	9	14	3	2	28	......	......	......	2	26	
	Furruckabad ...	9	16	2	1	28	......	1	......	......	27	
	Mynpoorie ...	......	......	......	......	......	......	......	......	......	......	No report sent.
	Etawah ...	11	20	......	3	34	......	......	......	......	34	
	Etah ...	9	14	......	2	25	......	......	......	......	25	
	Total Deaths in Agra...	46	75	6	9	136	136	1	......	4	131	
Rohilcund.	Bijnour ...	32	76	8	10	126	......	......	......	......	126	
	Moradabad ..	28	71	17	21	137	......	45	......	6	86	
	Budaon ...	21	56	7	13	97	......	92	......	3	2	
	Bareilly ...	97	145	40	45	327	......	325	......	1	1	
	Shajehanpore ...	36	55	13	7	111	......	15	......	......	96	
	Terai Pergunnahs ...	......	......	......	......	......	......	......	......	......	......	No report sent.
	Total Deaths in Rohilcund ...	214	403	85	96	798	798	477	......	10	311	
Allahabad.	Cawnpore ...	18	23	8	5	54	......	......	......	......	54	
	Futtepore ...	27	46	9	2	84	......	5	......	......	79	
	Bandah ...	51	98	10	13	172	......	117	38	5	12	
	Humeerpore ...	31	24	7	7	69	......	......	......	......	69	
	Allahabad ...	......	......	......	......	......	......	......	......	......	......	No report sent.
	Jounpore ...	14	11	4	3	32	......	......	2	2	28	
	Total Deaths in Allahabad ...	141	202	38	30	411	411	122	40	7	242	
Benares.	Azimgurh ...	13	12	3	1	29	......	9	6	4	10	
	Mirzapore ...	30	47	7	4	88	......	......	7	6	75	
	Benares ...	31	24	5	15	75	......	17	4	......	54	
	Ghazeepore ...	27	12	6	6	51	......	37	......	6	8	
	Gorruckpore ...	52	58	21	8	139	......	85	33	1	20	
	Bustee ...	4	12	4	1	21	......	18	......	3	......	
	Total Deaths in Benares ...	157	165	46	35	403	403	166	50	20	167	
Jhansie.	Jhansie ...	16	18	3	1	38	......	24	......	1	13	
	Jalaon ...	......	......	......	......	......	......	......	......	......	......	No report sent.
	Lullutpore ...	1	1	......	......	2	......	......	2	......	......	
	Total Deaths in Jhansie	17	19	3	1	40	40	24	2	1	13	
Ajmere.	Mahairwara ...	......	......	1	......	1	......	......	......	......	1	
	Ajmere ...	......	......	......	......	......	......	......	......	......	......	No report sent.
	Total Deaths in Ajmere	......	......	1	......	1	1	......	......	......	1	
Kumaul.	Kumaon ...	8	9	2	5	24	......	24	......	......	......	
	Ghurwal ...	3	10	2	3	18	......	......	......	11	7	
	Total Deaths in Kumaon ...	11	19	4	8	42	42	24	......	11	7	
	Total Deaths in N.-W. Provinces ...	650	950	195	188	1,983	1,983	654	92	63	974	
	One District added, name not known ...	4	2	4	2	12	12	......	......	......	12	
	Grand Total of Deaths in N.-W. Provinces	654	952	199	190	1,995	1,995	654	92	63	986	

Return shewing number of Deaths from Snake-bites, in the year 1869, in the Punjab.—P

Divisions.	Districts.	Men and Boys over 12.	Women and Girls over 12.	Boys under 12.	Girls under 12.	Total Deaths in Districts.	Total Deaths in Divisions.	Names of Snakes. Cobra.	Krait.	Other Snakes.	Unknown.
Delhi.	Delhi ...	8	6	1	1	16	......	5	......	......	1
	Goorgaon ...	6	13	4	1	24	......	10	......	1	1
	Kurnaul ...	26	7	3	......	36	......	12	......	2	2
	Total Deaths in Delhi...	40	26	8	2	76	76	27	......	3	4
Derajat.	Dera Ismael Khan ...	15	4	2	2	23	......	3	......	10	1
	Ghazee Khan ...	......	......	......	......	......	......	......	......	......	......
	Bunnoo ...	4	1	1	1	7	......	......	......	5	
	Total Deaths in Derajat	19	5	3	3	30	30	3	......	15	1
Hissar.	Hissar ...	11	8	2	2	23	......	8	......	10	[illegible]
	Rhotuck ...	13	11	5	2	31	......	......	......	16	[illegible]
	Sirsa ...	7	1	1	......	9	......	4	......	2	[illegible]
	Total Deaths in Hissar	31	20	8	4	63	63	12	......	28	[illegible]
Jullundur.	Jullundur ...	5	8	2	......	15	......	......	......	10	[illegible]
	Hooshyarpore ...	15	9	5	2	31	......	......	......	28	[illegible]
	Kangra ...	22	17	1	5	45	......	......	......	25	[illegible]
	Total Deaths in Jullundur ...	42	34	8	7	91	91	......	......	63	[illegible]
Lahore.	Lahore ...	38	9	8	2	57	......	......	......	31	[illegible]
	Goojranwalla ...	23	1	2	......	26	......	......	......	10	[illegible]
	Ferozepore ...	7	7	4	1	19	......	6	......	3	[illegible]
	Total Deaths in Lahore	68	17	14	3	102	102	6	......	44	[illegible]
Mooltan.	Mooltan ...	22	5	2	......	29	......	......	......	28	1
	Jhung ...	30	7	3	1	41	......	6	......	9	26
	Montgomery ...	6	3	1	......	10	......	1	......	......	9
	Mozuffergurh ...	27	7	3	2	39	......	4	......	4	31
	Total Deaths in Mooltan ...	85	22	9	3	119	119	11	......	41	67
Peshawur.	Peshawur ...	1	......	1	......	2	......	......	......	1	1
	Hazara ...	2	......	1	1	4	......	2	......	2	......
	Kohat ...	......	......	......	......	......	......	......	......	......	......
	Total Deaths in Peshawur ...	3	......	2	1	6	6	2	......	3	1
Rawul Pindee.	Rawul Pindee ...	31	15	6	......	52	......	1	......	10	41
	Jhelum ...	14	5	4	2	25	......	......	......	3	22
	Goojrat ...	......	......	......	......	......	......	......	......	......	......
	Shahpore ...	22	7	4	1	34	......	10	......	5	19
	Total Deaths in Rawul Pindee ...	67	27	14	3	111	111	11	......	18	82
Umballa.	Umballah ...	29	21	3	1	54	......	......	......	......	54
	Loodianah ...	1	......	......	......	1	......	......	......	......	1
	Simla ...	......	......	......	......	......	......	......	......	......	......
	Total Deaths in Umballa ...	30	21	3	1	55	55	......	......	......	55
Umritsur.	Umritsur ...	......	......	......	......	28*	......	......	......	16	12
	Goordaspore ...	14	10	3	3	30	......	4	......	9	17
	Sealkote ...	35	2	5	2	44	......	......	......	2	42
	Total Deaths in Umritsur ...	49	12	8	5	102	102	4	......	27	71
	Grand Total of Deaths in the Punjab ...	434†	184†	77†	32†	755	755	76	......	242	409

Deaths from Snake-bites in the Province of Oude, in the year 1869.—Population 11

Districts.	Men and Boys over 12.	Women and Girls over 12.	Boys under 12.	Girls under 12.	Total Deaths.	Names of Snakes. Cobra (Kala Gokurrah, Gomunna.)	Krait.	Other Snakes.	Unknown.	
City of Lucknow ...	1	2	......	1	4	......	4	......	......	
District of Lucknow ...	7	16	2	4	29	28	1	......	......	
Oonao ...	14	19	6	......	39	34	5	......	......	
Roy Bareilly ...	15	22	3	4	44	......	21	3	20	A boy 1
Gondah ...	54	103	22	27	206	......	......	......	206	No name
Kherie ...	57	52	19	20	148	139	2	7	......	A boy 1 100 ye
Pertabgurh ...	4	9	5	3	21	12	6	......	3	
Sultanpore ...	27	36	9	8	80	55	9	2	14	
Fyzabad ...	22	74	5	10	111	22	18	8	63	A girl 4 these.
Hurdui ...	46	48	21	16	131	90	3	......	38	A girl 10
Seetapore ...	35	55	8	12	110	88	16	......	6	
Baraitch ...	45	58	21	23	147	48	20	......	79	A boy 1
Barabankie ...	37	64	16	18	135	91	......	......	44	A boy 1
Total ...	364	558	137	146	1,205	607	105	20	473	

Return shewing the number of Deaths from Snake-bites, in the year 1869, in the Province of Orissa.—Population 3,151,47

Division.	Districts.	Men and Boys over 12.	Women and Girls over 12.	Boys under 12.	Girls under 12.	Total Deaths in Districts.	Total Deaths in Division.	Names of Snakes. Cobra (Kála Gokurrah, Gonunnus.)	Krait.	Other Snakes.	Unknown.	Remarks.
Orissa.	Balasore ...	36	41	6	5	88	......	27	......	2	59	
	Poorie ...	41	25	17	6	89	......	41	......	5	43	Girl 18 months old.
	Cuttack ...	60	72	21	20	173	......	60	2	45	66	Woman 100 years old
	Total Deaths in Orissa	137	138	44	31	350	350	128	2	52	168	

Return shewing the number of Deaths from Snake-bites, in the Central Provinces, for the year 1869.—Population 9,668,1
Population of Berars 2,220,074.

Remarks.—No details given from these Provinces; the total of 606 only being returned.

Return shewing the number of Deaths from Snake-bites, in the year 1869, in the Province of Central India.—Population not

Districts.	Men and Boys over 12.	Women and Girls over 12.	Boys under 12.	Girls under 12.	Total Deaths in Districts.	Total Deaths in Divisions.	Names of Snakes. Cobra (Kála Gokurrah, Gonunnus.)	Krait.	Other Snakes.	Unknown.	Remarks.
Indore Presidency ...	......	......	......	......	......	......	......	......	......	......	No report.
Gwalior Agency ...	......	......	......	......	......	......	......	......	......	......	No report.
Bhopal Agency ...	1	1	......	1	3	......	......	......	......	3	
Bundlekund Agency ...	......	......	......	......	......	......	......	......	......	......	No report.
Nagode Agency: Rewah ...	3	1	2	1	7	......	7	......	......	......	
Nagode Agency: Nagode ...	2	5	......	2	9	......	1	......	......	8	
Nagode Agency: Myhere ...	......	5	......	......	5	......	4	......	......	1	
Goonah Agency ...	......	......	......	......	......	......	......	......	......	......	No report.
Bheel Agency ...	2	4	3	1	10	......	3	......	3	4	
District Bheel Agency ...	1	1	2	......	4	......	3	......	......	1	
Mhow Cantonments ...	2	......	......	......	2	......	......	......	......	2	
Neemuch Cantonments ...	......	......	......	......	......	......	......	......	......	......	No report.
Superintendent Ruttam ...	3	4	......	1	8	......	2	......	3	3	
Western Malwah ...	24	15	1	2	42	......	1	......	31	10	
Total Deaths in Central India ...	38	36	8	8	90	90	21	......	37	32	

Return shewing number of Deaths from Snake-bites, in the year 1869, in the Province of Burmah.—Population 2,395,98

Division.	Districts.	Men and Boys over 12.	Women and Girls over 12.	Boys under 12.	Girls under 12.	Total Deaths.	Names of Snakes. Cobra.	Krait.	Other Snakes.	Unknown.	Remarks.
Burmah.	Arracan ...	2	......	......	......	2	2	......	......	......	
	Pegu ...	72	19	1	......	92	28	......	58	6	
	Tenasserim ...	12	3	1	......	16	5	......	7	4	
	Shwye-Gyeen ...	9	......	1	......	10	10	......	......	......	
	Total Deaths in Burmah ...	95	22	3	......	120	45	......	65	10	

Grand Total of Deaths from Snake-bites in 1869.—Population, excluding that of Central India, 120,972,263.

Provinces.	Men and Boys over 12.	Women and Girls over 12.	Boys under 12.	Girls under 12.	Total Deaths.	Snakes. Cobra.	Krait.	Other Snakes.	Unknown.	Remarks.
Bengal	2,374	2,576	663	606	6,219	959	160	348	4,752	
Orissa	137	138	44	31	350	128	2	52	168	
Assam	50	14	9	3	76	......	......	12	64	
N.-W. Provinces	651	952	199	190	1,995	854	92	63	986	
Punjab	* 434	* 184	* 77	* 32	755	76	......	242	437	* The addition of 28 to the grand marked * will give the Grand 755.
Oude	364	558	137	146	1,205	607	105	20	473	
Central Provinces	......	......	......	......	606	......	......	......	......	No details furnished.
Central India...	38	36	8	8	90	21	......	37	32	
Burmah	95	22	3	......	120	45	......	65	10	
Grand Totals ...	† 4,146	† 4,480	† 1,140	† 1,016	11,416	‡ 2,690	‡ 359	‡ 839	‡ 6,922	† The addition of 606 to the totals marked † will give the Total 11,416. ‡ The addition of 634 (i. e., 60 28) to the grand totals marked give the Grand Total 11,416.

Or about one in every ten thousand. The returns from which these abstracts were made were furnished by Government.

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NOTES ON DEATHS FROM SNAKE-BITE IN THE BURDWAN DIVISION.

An Official Document communicated with permission, by

Dr. Fayrer, c. s. i.

The area and population of the six districts, which form the Burdwan Division, are given as follows :—

	Square Miles.	Population.
Bancoorah ...	4,683	7,42,300
Beerbhoom ...	2,330	7,43,685
Burdwan ...	2,962	10,80,967
Hooghly ...	1,457	1,370,120
Howrah ...	550	5,64,000
Midnapore ...	4,834	12,00,000
Total ...	12,816	5,701,072

2. The number of deaths from snake-bite during the last nine years is shown in the annual printed Police Returns to have been as follows :—

1860	878
1861	989
1862	1,041
1863	1,048
1864	1,035
1865	1,184
1866	929
1867	984
1868	1,144
Total ...	9,232

3. There may be a little inaccuracy in the above figures; but they have been compiled over a series of nine years, and it cannot be questioned that they show that there is a mortality of above 1,000 persons every year in a population of nearly 6,000,000 people.

4. Annexed is a table showing the number of men, women boys, and girls, killed by snake-bite in each year in each district. The mortality is greatest among the grown-up women. They are apparently most often the sufferers; because the greatest number of snake-bites occur, when the women go out of their houses very early in the morning whilst it is still dark; or when they go to the wood-stacks for wood for the household fires, and are bitten by a snake that has taken refuge in the wood-stack.

5. The deaths from snake-bite are most numerous in the district of Midnapore, where 530 deaths from this cause were reported in 1865. They are least numerous in Beerbhoom, where the largest number of cases reported in any year was 60 in 1868.

6. Seeing how large the mortality from snake-bite is, it would be very desirable to ascertain if there is any feasible plan for reducing it. The subject is one in which I took an interest some years ago, and the first orders for paying a reward for the destruction of poisonous snakes were issued under my signature, when Sir F. Halliday was Lieutenant-Governor of Bengal.

7. In the records of the Burdwan Commissioner's Office, there is a large bundle of papers showing what was done in former years, when a reward for killing poisonous snakes was sanctioned by the Government of Bengal in certain districts, and I proceed to give the leading facts contained in those papers.

8. It appears that Sir Frederick Halliday, the Lieutenant-Governor of Bengal, in his Resolution dated 12th June, 1858, reviewing the annual Police Returns of the Burdwan Division for the year 1857, was struck by the large number of accidental deaths

attributed to snake-bite, in the districts of Midnapore and Howrah, and he authorized the grant of a reward of 4 annas (6*d.*) each for every venomous snake of which the destruction could be satisfactorily proved to the Magistrate.

9. On the 19th September 1859, the Lieutenant-Governor, Sir John Peter Grant, at the request of the Commissioner of Burdwan, sanctioned a reward of 2 annas (3*d.*) a head for every venomous snake killed in all the six Districts of the Burdwan Division. In communicating these orders to the Magistrates, the Commissioner, Mr. Young, instructed them that each venomous snake must be killed in the presence of either the Magistrate or one of his subordinates; so that the order thus issued was equivalent to an order to catch the snakes alive, and bring them in to the Magistrate to be killed in his presence.

10. In due course, the several Magistrates reported on the effect given to the above orders.

11. The Magistrate of Midnapore, Mr. R. V. Cockerell, on the 6th December 1861, reported that, in 1858, when the reward was 4 annas for dead snakes, there had been an expenditure of Rs. 1,961 and annas 8 for 7,846 snakes. But when the reward was reduced to 2 annas for snakes to be brought in alive, the reward failed to afford sufficient inducement, and the amount paid as reward dwindled away as follows:—

	Snakes.	*Reward.*		
		Rs.	As.	P.
1859	... 957	124	4	0
1860	... 217	27	2	0
1861	... 8	1	0	0

12. The Magistrate remarked that there were few persons who would risk their lives to bring in a live snake for the sake of two annas.

13. It is to be observed that the reward of 4 annas for dead snakes was in force up to September 1859, so that the lower rate for live snakes only took effect in 1860.

14. The Magistrate reports, that the deaths by snake-bite were as follows:—

1858	...	...	451
1859	...	...	481
1860	...	...	353
1861	...	...	390

15. The Magistrate of Howrah, Mr. J. P. Grant, on 24th December 1861, reported that the operations in his district were the following:—

	Snakes.		*Cost.*
From July 1858 to December 1859.	692 at 4 Annas	...	Rs. 173 0 0
From June to December 1860.	168 at 2 „	...	„ 21 0 0
From June to December 1861.	169 at 2 „	...	„ 21 2 0

16. The number of deaths from snake-bite reported were—

In 1857	...	...	157
„ 1858	...	...	147
„ 1859	...	...	153
„ 1860	...	...	149
„ 1861	...	...	154

17. The Magistrate observed that the reduction of the reward from four annas to two annas was impolitic, and he recommended that the higher rate should be re-introduced.

18. The Magistrate of Hooghly, Mr. A. V. Palmer, reported on 6th November 1861, that no rewards had ever been paid for the destruction of snakes in his district. He considered the reward of two annas was insufficient.

19. The deaths from snake-bite were—

In 1858	...	...	197
„ 1859	...	...	221
„ 1860	...	...	210

Up to 30th September.

In 1861	...	...	172

20. He remarked that females appear to suffer more than males, and he suspected that cases were reported as deaths from snake-bite, where death arose in attempting to procure abortion.

21. The Magistrate of Burdwan, Mr. S. Hogg, reported that Rs. 64-2-0 had been disbursed for killing 513 venomous snakes, and that the deaths were as follows :—

			Persons.
In 1859	...	...	81
„ 1860	...	...	57
„ 1861	...	...	50

22. The Magistrate of Beerbhoom, Mr. H. A. R. Alexander, reported on 16th December 1861, that from October 1859 to November 1861, 715 snakes had been killed at a cost of Rs. 89-6-0. He states that the whole number may be said to have been caught within a radius of two miles round the town of Sooree, and the head quarters of Beerbhoom, the reward of 2 annas no being sufficient to induce people to bring snakes from a distance, or to make the professional snake-charmers exert themselves. There were three deaths from snake-bite in Sooree in 1859, but none in 1860 and 1861. He recommends that the reward should be continued.

23. The Magistrate of Bancoorah Mr. Wells, on 26th November 1861, reported that no reward had ever been paid in his district, the reward of two annas being insufficient to induce people

to bring in live snakes, and he adds that a professional snake-charmer would gain more by keeping a live snake when caught. He proposes that the reward should be paid for all venomous snakes brought in dead or alive, *their heads being cut off in the presence of the Magistrate,* to prevent the people from claiming the reward more than once for the same snake.

24. Unfortunately for Mr. Wells, as will be seen presently, the Commissioner, Mr. Plowden, adopted this suggestion, and authorized the payment of the reward for all venomous snakes brought in dead or alive, provided that their heads were cut off in the Magistrate's presence. He also proposed to the Government to raise the reward to four annas, and this was sanctioned by the Government on 21st February 1862.

25. The Magistrate of Bancoorah, on 14th July 1862, reported that the increased reward had produced its effect; 47 snakes had been brought in on one day, and 70 snakes on another day, and Rs. 89 had been spent in less than a month. He, therefore, proposed to reduce the reward to 2 annas, but the Commissioner declined to listen to him.

26. Again on 21st July, the Magistrate of Bancoorah repeated his proposal to reduce the reward. He says, "97 snakes were brought in on Saturday and 118 to-day. Numbers of persons are making a profession of killing snakes; a woman who could only earn one anna by a whole day's work is getting four day's pay for a single snake." He goes on to point out that no provision has been made in his budget estimates for this large expenditure.

27. Again the Commissioner turned a deaf ear to the Magistrate, remarking that he was glad to hear of so many snakes being killed, the reward having been raised with this object. He warned the Magistrate to be careful to have all the snakes' heads cut off in his presence.

28. On the 26th August 1862, the Magistrate of Bancoorah reported to the Commissioner that he had sent to the High Court a revised supplementary budget estimate of Rs. 20,000 for contingent charges, in supercession of his original budget estimate of Rs. 1,788, the difference between these sums being on account of the rewards for killing snakes. He begged permission to defer the payment of further rewards till the revised budget was sanctioned; but the Commissioner authorized him to go on making payments.

29. On the 1st September 1862, the Government of Bengal wrote to the Magistrate of Bancoorah for an explanation as to his revised budget estimate for Rs. 20,000 under the head of "Law and Justice," observing that it did not appear to have been framed on carefully-considered data. He was also required to state by what means he had satisfied himself that all the snakes were poisonous snakes; and if the heads of all the snakes had been actually cut off in the presence of himself or his assistants or deputies.

30. Before replying to this letter, the Magistrate of Bancoorah on 18th September, had written to the Commissioner for leave to appoint a ministerial officer of his Court, to superintend the cutting-off of the heads of the poisonous snakes and to pay the reward. He adds: "It takes an hour at least to see it done, and the stench from snakes brought in from a distance is dreadful." He suggests that the duty might devolve on the new Police then about to be established.

31. The Commissioner replied that the Magistrate himself must see to the decapitation of venomous snakes.

32. The Magistrate next applied for permission to deduct one pice from each reward of four annas, to remunerate an apprentice on his establishment, who had been engaged in keeping the accounts and recording the names of the recipients of rewards. He observes, "The stench of the dead snakes is so bad, that the duty is a most

disagreeable one. The man has been working all this time for nothing"; but the Commissioner declined to comply with this request.

33. On 19th September 1862, the Bengal Government directed that the Magistrate should continue to pay the rewards in anticipation of the sanction of a special grant.

34. On 20th October, the Commissioner reported to Government that, from 29th May to 14th October 1862, 18,423 snakes had been killed, giving an average of 110 snakes a day, and he applied for a grant of Rs. 10,000 to provide for the rewards, at the same time proposing to reduce the reward to two annas a snake.

35. On 19th November 1862, the Magistrate again begged the Commissioner to transfer the duty of seeing the snakes' heads cut off to the new Police. He writes "after sitting in Court a long time working hard, it is particularly sickening to stand over putrid snakes for an hour to see their heads cut off. I shall moreover have to go a mile away to do this duty, as every one complains so of the fearful smell, that I have been obliged to remove to a distance the place for receiving them."

36. But the Lieutenant-Governor of Bengal, Sir Cecil Beadon, declined to sanction this. The Lieutenant-Governor expressed his opinion, that the amount expended in rewards for snakes killed was enormous, and suggested the idea that snakes might be bred for the sake of the reward. The reward was reduced to two annas, orders were also issued for the preparation by the Magistrate of a list of the particular kinds of snakes ascertained to be beyond all doubt venomous and dangerous to human life.

37. On the 8th December 1862, the Magistrate of Bancoorah reported that, he had spent Rs. 10,863-2-0, in rewards for killing venomous snakes up to that date.

38. On the 17th December, the Magistrate of Bancoorah reported that, he had consulted the Civil Surgeon about the list of the different kinds of venomons snakes; but that officer was unable to furnish the information wanted, the Magistrate, therefore, sent up a list of fourteen local Bengali names of venomous snakes, all of which he believed to be species of the cobra tribe.

39. On the 6th January 1863, the Government of Bengal remarked that, whereas from 29th May to 14th October, 18,423 snakes had been killed, from 15th October to 7th December, the number had increased to 25,029, giving an average of 463½ per diem. The Lieutenant-Governor expressed his surprise, that the average number of snakes killed daily should have increased during the cold weather, and the Magistrate was requested to submit an explanation on this point.

40. On 17th January 1863, the Government of Bengal forwarded a copy of an order from the Government of India in the Financial Department to the following effect: " His Excellency the Governor-General-in-Council sanctions an additional grant of Rs. 4,000, under " F, IX. Miscellaneous" (to which head the Rs. 1,778 provided under " F, III, Law and Justice" should be transferred) with the remark that the circumstance of the Magistrate of Bancoorah having asked for an additional grant of Rs. 20,000, indicates apparently his inexperience in supervising the above expenditure, which is of a character to require vigilant check."

41. On the 17th January 1863, the Magistrate of Bancoorah explained the increase of snakes caught in the cold weather which the Lieutenant-Governor had noticed. He ascribes it to the " increased expertness of " the snake-catchers, and the very large number of persons who abandoned their other occupations and devoted themselves exclusively to this lucrative source of livelihood. In the earlier part of the year, snakes were only sought for and brought in from the immediate neighbourhood of the station, whereas latterly, the source of supply extended for miles round."

42. On the 16th January 1863, the Government of Bengal remarked, with reference to the list of venomous snakes furnished by the Magistrate (*vide* para. 38), that it was clear that he had been lavishing Government money in rewards for snakes without any regard to the description of snakes brought in. He was ordered to stop payment of any rewards until furnished by Government with a list of venomous snakes.

43. In reply to this letter, the Magistrate remarked that he had taken great pains to discriminate between venomous and non-venomous snakes, and that if he had been less careful, a sum of Rs. 40,000 would not have sufficed for payment, on account of all the snakes for which the reward was claimed.

44. On the 20th February 1863, the Government of Bengal sent a list of venomous snakes prepared by Surgeon-Major T. C. Jerdon of the Madras Army, and ruled that rewards should be given only for those snakes named in Dr. Jerdon's list.

NOTE BY DR. FAYRER.

Colubrine Snakes.

Are very poisonous.

The poisonous snakes of Bengal are—

Naja Tripudians—Bengalli name. Gokurrah or Keoautiah, of each of which there are several varieties.

Ophiophagus Elaps—Bengalli name. Sunkerchor.

Bungarus Cœruleus—Bengalli name. Krait, Dhumun Chiti. a

Bungarus Fasciatus—Bengalli name. Sankni, Raj-Samp.

Vipers.

Daboia Russellii—Bengalli name. Bora Seah-Chunder.

Crotalidæ.

Not so deadly;

Trimeresurus, Gramineus.

T. Carinatus. all green color } Vipera Viridis. Harewah, native name.

T. Erythrurus—Bengalli name. ~~Harewah~~.

The Viper *Echis Carinata* is hardly found in Bengal. It is common in the South, and in the North-West, it is very venomous.

The *Chersydrus Annulatus*, is a fresh water snake, and is not venomous.

The *Trigonocephalus Elliotti*, is not that I know of, found in Bengal.

2

45. A copy of Dr. Jerdon's report is appended in full. The poisonous snakes mentioned by him are :—

1. Naja Tripudians. The cobra, called in Bengalli Keoautiah or Gokurrah.
2. Hamadryas Elaps, or Sunkerchor.
3. Bungarus Lineatus. (? Cæruleus) The Krait.
4. Bungarus Fasciatus. Raj Samp.
5. Daboia Elegans. Russel's Viper.
6. Echis Carinata. Another Viper.
7. Trimeresurus Viridis. A bright green snake.
8. Trigonocephalus Elliotti.
9. Chersydrus annulatus. A water snake.

Nos. 6, 8 and 9 are not known in Bengal.

46. On the receipt of this list, some correspondence followed, the Magistrate hesitating to recommence paying rewards whilst so large a sum advanced by him on this account remained unadjusted in his books; but eventually, on 23rd April 1863, he was authorized by Government to go on paying rewards for the destruction of the several species of snakes specified in Dr. Jerdon's list.

47. But from this date very little was done. On the 25th July 1863, the Government of Bengal forwarded copy of a letter from the Government of India in the Financial Department, making a further grant of Rs. 9,000, and containing the following remark :—

"His Honor in Council is doubtful of the expediency of giving rewards for killing snakes in Bançoorah and districts similarly circumstanced. The expenditure on account of snakes in the district of Bancoorah has been upwards of Rs. 12,000 for the year, and His Honor is under the impression that the money is entirely thrown away. The district contains a great deal of low thick jungle, growing on a dry soil, which is just the place for snakes, while the villages are so sparsely peopled, and cultivated spots occur only at such distances, that in a great majority of cases;

these reptiles can increase their numbers undisturbed. The reduced reward of two annas is even now sufficient, with the number of poisonous snakes that exists in Bancoorah, to induce a native to undertake their destruction as an easy mode of obtaining a living, with no fear of failure of the source from which it would be derived. The plan of granting such rewards is, therefore, not intended to extend over tracts of country covered with jungle, where noxious animals and reptiles are professionally hunted out from wild recesses where they do no harm."

48. After this strong expression of the opinion of Government, the Commissisoner, Mr. Montresor, submitted a report which showed that the expenditure in other districts for rewards for killing snakes had been very inconsiderable; and he recommended that the system of giving rewards should cease altogether. Accordingly on 8th September 1863, the Government of Bengal directed that the practice of granting rewards for killing snakes should be discontinued.

49. There are certain lessons to be derived from the above correspondence, but the tabular statement shows that, the heavy expenditure in 1861-62 in Bancoorah, had no effect in reducing the death-rate from snake-bite in that district in those years. In Midnapore, the number of deaths decreased from 481 in 1859, to 353 in 1860, but in the other districts, there is not anything to show that any practical effect was produced.

50. It would be difficult for the Government in the face of the results here shown to renew the offer of a reward for killing snakes, unless certain safeguards for the proper expenditure of the money can be proposed; but such safeguards do not at present suggest themselves to me.

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6-21.—If roused, it tries to move, but it immediately falls over; the claws are contracted.

6-25.—Tries to rise when roused, and to attack with its beak, but droops immediately after the excitement.

6-30.—Brightness of the eyes diminished; lies prone, resting the head on the point of the beak.

6-38.—Lies helpless and motionless on the ground; slow, feeble respiration.

6-40.—Dead.

After death, Dr. Stolitzca remarked that the blood from the wound was very thin and watery. The bitten leg was discolored, and, when pressed, a quantity of gas escaped in bubbles. Decomposition seemed to be setting in very rapidly.

The bird was bitten at 5-7 p. m., and died at 6-40 p. m.; *i. e.*, in one hour and thirty-three minutes. The dead bird was given to a Felis Chaus (wild cat); it was eaten with avidity, and no unfavourable result occurred to the cat.

This experiment, like others tried with the Bungarus Fasciatus, seems to prove that its poison, though deadly, is neither so fatal nor so active as that of the Cobra. This may be due not only to some difference in the activity of the poison itself, but also to the nature of the instrument with which it is inoculated. The Bungarus, though a large, powerful, and very vicious snake, is armed with very small fangs, and penetration, even under the most favourable circumstances, must be much less than in the case of the Cobra, or of the viperine snakes, which have much longer fangs. The difference in this respect is very striking between the poisonous colubrine and the viperine snakes. The fangs of the Cobra, Bungarus, and other colubrine snakes are much smaller than those of the viperine snakes. Of the latter, the Daboia is the only representative in Bengal; whilst the Crotalidæ, or pit vipers, are represented in India by the different species of Trimeresurus, some of which are almost as formidable as the Crotalus horridus, or Rattlesnake of America, but comparatively rare.

Experiment No. 3.

Another paddy-bird, Ardea Leucoptera, inoculated, at 5-27 p. m., in the wing, with some of the same Cobra poison, 11 days old, that had been used for the Ptyas, a short time before. The puncture bled freely.

5-29.—The bird is apparently unaffected.

5-32.—Inoculated again with a quill-pen into a puncture in the hind leg, as the first inoculation seems to have taken no effect.

5-35.—Walks sluggishly. Feathers have a draggled appearance; some are erect; the bird shakes himself frequently; seems very uneasy; vomited some shrimps recently eaten.

5-40.—Staggers in walking; very weak in inoculated leg.

5-42.—Crouching; cannot balance itself when it tries to stand; point of the beak resting on the ground.

5-44.—When roused, tries to walk, but falls over.

5-46.—Eyes closed; slight convulsions.

5-50.—Generally convulsed.

5-52.—Dead.

The dead bird was eaten by a dog without producing any evil result to that animal. In this instance, the poison was at first imperfectly inoculated into the wing, and apparently without any result after 5 minutes, when it was again inoculated in the wing at 5-32 p.m.; death occurred at 5-52, or in 20 minutes.

It is worthy of remark that this poison was 11 days old, and was probably not very effectively inoculated, as the hypodermic

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NOTE.—The most common of the colubrine order of poisonous snakes in Bengal are:—

1*st.*—The Naja Tripudians, (Cobra di Capello, Bengalee names Keautia, Gomuna, or Gokurrah—Kala Nag,) several varieties common in Bengal.

2*nd.*—Bungarus Cæruleus, Bengali name Krait, not so common near Calcutta.

3*rd.*—Bungarus Fasciatus, Bengali name Sankni. Common.

4*th.*—Xenurelaps Bungaroides from Cheerapoonjee.

5*th.*—Ophiophagus, or Hamadryas Elaps, said to be found about Mutlah, Sunderbuns; doubtful?

Of the Viperine order—Crotalidæ.

6*th.*—Trimeresurus Carinatus } I don't know the native name: these
7*th.*— " Gramineus } are tree snakes.

Viperidæ.

8*th.*—Daboia Russelli, (Russell's viper, or Vipera Elegans, Native name Bora.)

9*th.*—Echis Carinatus, but this probably not found in Bengal Proper.

The fresh water snakes, Homalopsidæ, are all innocent, I believe; but the Hydrophidæ, or salt water snakes of the Bay of Bengal, and salt water of the river, are all venomous.

syringe was not used, the poison being inserted into the wound with a quill, and yet the bird died in 20 minutes. Whereas a similar bird, bitten by a fresh and vigorous Bungarus, did not die for one hour and thirty-three minutes.

EXPERIMENTS WITH THE VIPER OF RUSSELL, "DABOIA RUSSELLI," (VIPERA ELEGANS); BENGALI NAME "BORA."

Having procured two full-grown snakes of this species, I made the following experiments.

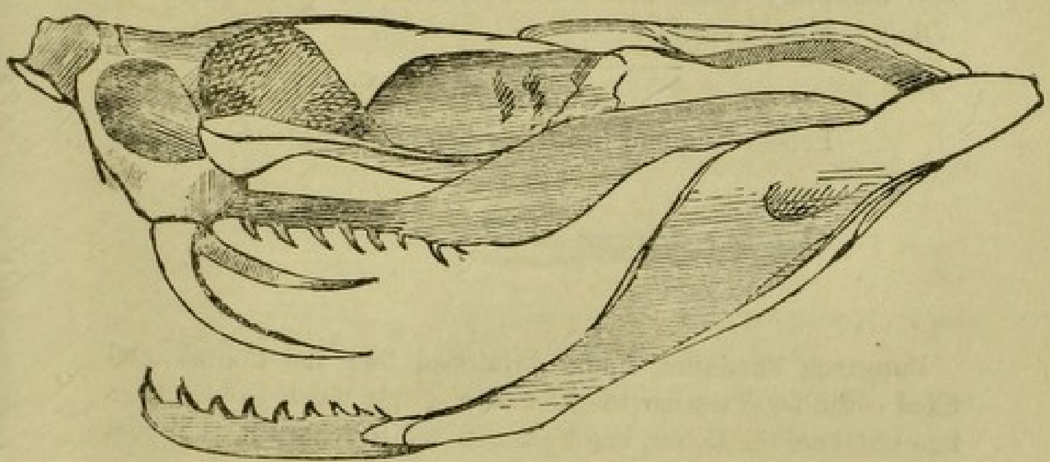
The Daboia Russelli is very different from the colubrine snakes; it belongs to the sub-order of viperine snakes, family Viperidæ. Of these, only two are known in British India, the Daboia and Echis. The former only is found in Bengal, where it is known as the "Bora," and is justly dreaded as a most venomous snake. It has various synonyms; the most familiar, perhaps, is that by which it is known in Ceylon, the Tic Polonga; it is also known in Southern India by the name of Cobra Monil. It is found in the Peninsula of Southern India, and even in the Himalayas, it is said, at a height of 5,500 feet, for it has been found at Almorah. It grows as long as 50 inches, and is a very powerful and dangerous snake; it is much thicker than the Cobra; its markings are very beautiful; a series of black, white edged, rings ovate and circular, on a greyish brown ground, white belly with black spots. Its head is covered with scales, not shields; its nostril is very large; the head is broad and well defined from the neck, which is not extensible like that of the Cobra.

But the striking difference is in the poison fangs, which are very much larger than those of the Cobra. They are recurved, erectile, and very movable; so much so, that when the snake is angry, and about to strike, you can see the fangs erected and depressed quickly in a vibratable manner, totally different to the fixed and much smaller fangs of the Cobra and other poisonous colubrine snakes. (*Vide* sketch.)

There is only one species of Daboia, and that may be found about Calcutta. I have been informed that it is not uncommon in the Botanical Gardens, and that cattle, as well as men, have met with their deaths from its bite.

The two brought to me were nearly full-grown, and apparently active and vigorous. The snake-catchers who brought them, and who handled Cobras with the greatest ease and freedom, from fear would not attempt to seize the Daboia by the neck, as they said the risk was too great.* The snake did not appear at all more active than the Cobra, and, when seized by the tail, was not more capable of turning on his captor; but when the head was confined by compressing the neck with a stick against the ground, it struggled and made fierce attempts to bite, during which, the mouth being open, the gape of which is very wide, the erective and vibratile movements of the fangs that I have mentioned became visible. This snake is the only species of its genus known in India.

VIPER.



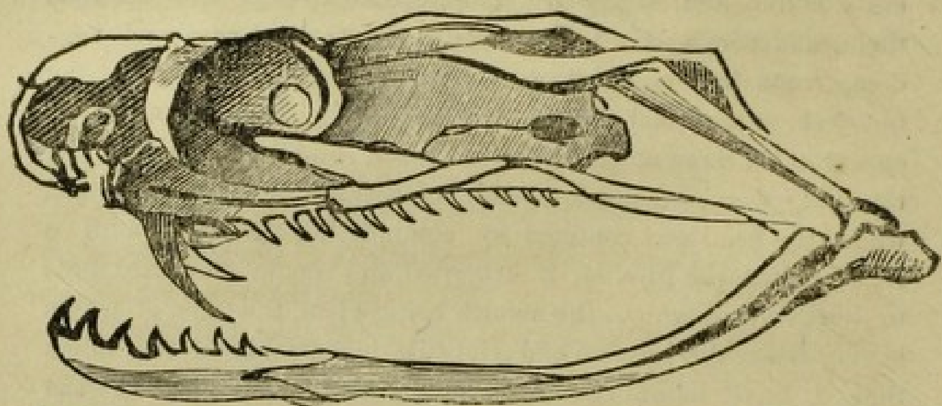
Daboia's poison fang.

Daboia Russelli.—Viperine snake with erectile fangs, short and mobile maxillary bone.

When the jaws are opened, the short maxillary bone with its fang is pushed forward, and the fang is erected.

* They did so on a future occasion.

COLUBER.

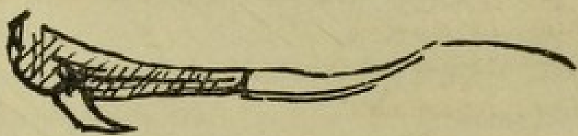


Naja Tripudians, or Cobra di Capello.—Colubrine venomous snake with fixed fangs, long maxillary bone not movable.

The maxillary bone does not move, as in the Daboia, and the fang is always erect.

COLUBER.

Poison fang and maxillary bone of Bungarus.



Bungarus Fasciatus. Fang developed like the Cobra's, and fixed; the fang similar to the Cobra's, only much smaller, less known than the Cobra, but I am inclined to regard it as almost as dangerous as that snake.

The above sketches represent the relative size of the fangs in the different snakes when full-grown.

The great difference that exists between the fangs of the venomous Colubrine and Viperine snakes has not, I think, been sufficiently dwelt on by any author with whom I am acquainted.

It is not only in the greater length and size of the fang, but also in the anatomical arrangement, by which it can be erected or depressed at pleasure, that the Vipers are distinguished from the Colubrine snakes which have shorter and fixed fangs.* The structure of the fang itself is also

* The fangs in all snakes are themselves fixed and anchylosed in the maxillary bone. In the Viperine snakes this bone moves freely, and with it the poison fangs.

characteristic. The Cobra's poison-tooth, for example, is like a leaf folded in closely, whilst the fang of the Daboia and other of the Viperidæ is a long perforated tube, and the fang of the Hydrophidæ is an open groove.

Experiment No. 4.

A pariah dog, full-grown, was bitten in the thigh, at 4-27 p.m. of 11th July, by a nearly full-grown, active Daboia. The dog whimpered when the snake's fangs penetrated. He was released, having been held while the snake bit him, and almost immediately, *i. e.*, at 4-28, fell over with a convulsive movement; became paralysed for the moment, and howled violently; as he lay on the ground, the bladder was emptied.

4-29.—In a state of violent tetanic spasm.

4-31.—Lies motionless; eyes bright; muscular system generally twitching.

4-35.—Lies apparently paralysed, but looks about him.

4-37.—Attempted to get up; staggered a few steps, and lay down again.

4-42.—Cannot walk. Lies paralysed; shews no sign of pain.

4-50.—Much in the same state.

5-35.—Lies paralysed, but breathing goes on.

Died a few minutes later.

Thorax opened. Lungs collapsed, not congested; heart natural; auricles and ventricles contained fluid blood.

It is noteworthy that this dog, after the first violent outcry when he fell over, one minute after being bitten, appeared to suffer no further pain; indeed, it seemed unconscious of anything. There was no convulsion. General paralysis, the sphincters included. Gradual sinking from exhaustion. The heart's action continued to the last, and, even after apparent death, the rythmical movements were observed.

The dog was bitten at 4-27 p. m., and died at about 5-40; nearly one hour and a quarter.

The first effects on the nervous system seemed much more violent than in the Cobra bite, and paralysis seemed to follow more quickly, but actual death was longer in taking place. A dog bitten by a Cobra died in about half an hour. The dog bitten by the Daboia died in an hour and a quarter. Possibly, the Cobra injected a larger quantity of poison than the Daboia; and indeed it struck me that there was not so great an effusion of poison from the Daboia as from the Cobra. There may have been something in the mode in which the bite was inflicted. The Cobra was held by the neck, his mouth almost forcibly opened, and his fangs made to imbed themselves in the bitten object; whilst, on the other hand, the Daboia was not so held or applied, for the snake-man was afraid to seize him by the neck, and could only fix him by compressing the neck on the ground with a stick, in which position the animal bitten was presented to the snake.

EXPERIMENT No. 5.

A full-grown male cat was bitten by the same snake, in the hind leg, at 4-18 p. m. The Daboia, being secured as before described, plunged his fangs, but not deeply, into the limb; no immediate paralysis of the limb followed, as in the Cobra bite, but the animal was almost immediately affected, and at 4-22, *i. e.*, in four minutes, was in convulsions, which did not last long, nor were attended by any outcry as in the dog bitten by the same snake. The general convulsions soon subsided, and were followed by general paralysis, the animal lying prone on the ground, with its breathing much accelerated, and with spasmodic twitchings of the muscles of the trunk and extremities.

4-30.—Lies perfectly powerless, breathing rapid; frothing at the mouth, and making efforts to vomit. Bladder and rectum emptied, voided sanguineous mucus.

4-31.—Made an effort to rise; staggered a few paces and fell.

4-35.—In the same state; muscular twitchings continue; cannot move.

4-45.—Still alive, and much in the same state.

5 p. m.—Still alive; muscular twitchings continue, but fainter; breathing hardly perceptible.

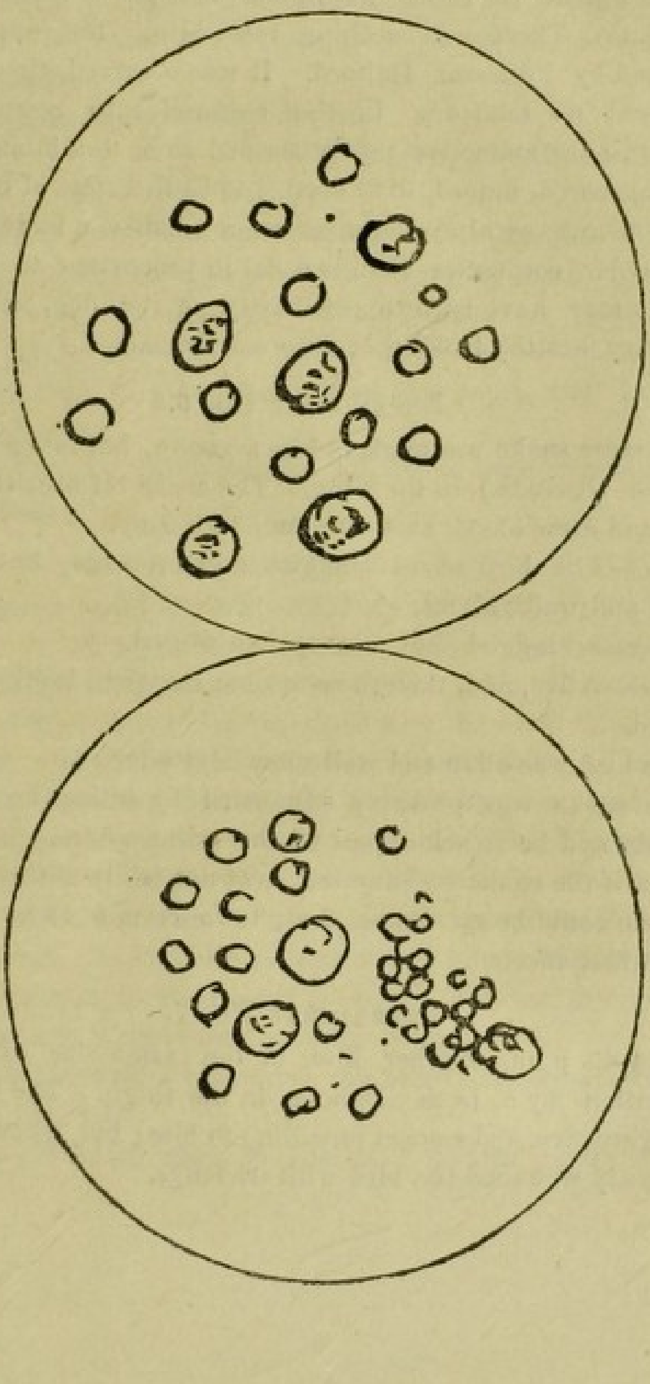
5-15.—Quite dead.

The cat was bitten at 4-18 p. m., and died at 5-15 p. m., *i. e.*, in fifty-seven minutes. As in the case of the dog, the effects of the poison seemed to affect the nerve-centres more violently than the Cobra poison. Consciousness was probably earlier annihilated, but total death occurred later.

I examined the appearances after death, and found that, at 5-45 p. m., or in half an hour, the blood had not coagulated.

The lungs were not in the least congested; there were no clots in any of the cardiac cavities. Blood taken from the right auricle was dark and fluid, but speedily reddened on exposure to the air. Examined later, the power of coagulation appeared to have been perfectly destroyed. I took some away for microscopical examination, and it remained perfectly fluid.

MICROSCOPICAL APPEARANCE OF BLOOD OF A CAT POISONED BY DABOIA RUSSELLI.
Nachet, $\frac{1}{8}$th object-glass, No. 3 eye-piece.



I examined the blood most carefully, and repeatedly, under the microscope with 1-8th object-glass and No. 3 eye-piece, Nachet, and I found the appearances depicted in the sketch ; they differ very little, if at all, from those of ordinary blood. The only thing suggestive of any change in the corpuscles was, that, in one or two specimens examined, there were more granular corpuscles than may be considered as the natural relative proportion to the red corpuscles ; but, after the most careful examination, I was unable to detect any other change in their form or appearance. There was nothing resembling the appearances described by Professor Halford. It was observed, though, that there was no tendency in the corpuscles to aggregate in rouleaux ; the attractive power seemed to be annihilated. The blood appeared, indeed, to be dead,—to be in a state of necræmia.

The microscopical appearances seem to shew a larger number of granular corpuscles than is usual in proportion to the red ; but this may have been a peculiarity of the dog, which was not a very healthy looking or vigorous animal.

Experiment No. 6.

The same snake was made to bite a young, but full-grown kite (Milvus Govinda,) in the wing. The snake bit near the second joint, and drew blood, at 4-40 p. m., 11th July.

4-50.—The bird seems sluggish, and crouches, but is easily roused and walks about.

5 p. m.—Sluggish, but moves when roused.

5-38.—Alive, and, though somewhat sluggish, is otherwise unaffected.

The bird was alive and well some days after.

The snake was probably exhausted by biting the other two animals, and he struck a part of the wing where, probably, the poison, if the snake had any left, was not easily absorbed.

There could be no doubt that, to a certain extent, the bird was at first affected.

Experiment No. 7.

At 4-49 p. m., another kite, of the same size as the last, was bitten by a fresh Daboia in the thigh. The snake was not aggressive, and seemed unwilling to bite ; but, when irritated, it slightly wounded the bird with its fangs.

4-55.—Looks stupified; feathers all erect.

5 p. m.—The bird is sluggish, and breathing hurriedly; it is unable to walk, and its claws are contracted into a ball.

5-8 p. m.—Tried to rise, and fell over dead.

Death occurred in 19 minutes. Blood examined under microscope; no change could be detected.

Blood remained fluid after death; no coagulation.

Experiment No. 8.

A full-grown Daboia was bitten freely, at 5-8 p. m., by a fresh and vigorous Cobra, which plunged its fangs more than once into the Daboia.

5-40.—The snake was unaffected.

On the 16th July, the Daboia was as well as ever; the Cobra bite had had no effect.

The experiment, so far, certainly seems to prove that the venomous snakes have no power of poisoning each other, and limited power of injuring the non-venomous snakes; but these experiments are liable to so many sources of error, that it is impossible to generalise yet on this point, and I consider it still *sub-judice*.

Dr. Fayrer, Dr. Stolitzca, and Mr. Seeva were present at these experiments.

Experiment No. 9.

A large powerful dog was bitten in the hind leg by a Daboia Russelli, at 12-50, on the 20th July, 1868. The snake struck twice, but did not seem to bite severely. This Daboia is one that was used in the last experiment on the 11th July, and has been in a cage since; it is not known whether it has eaten or not since the last experiment. It seemed vigorous and savage, striking at anything that was brought near it. The dog was held, and immediately after being bitten had a supposed antidote, of which I may have more to say on a future occasion, administered. As it took a minute or two to pour the drug down the dog's throat, it was impossible to say how far the struggles were due to fear, and how far to the poison.

12-54.—Released; ran across the room staggering, and dragging the hind leg.

12-55.—Walking about in the same manner, very restless;

breathing hurriedly, and frothing at the mouth. The dog was kept walking about by one of the attendants.

12-56.—Sat down exhausted; breathing very hurried; frothing at the mouth; eye bright and intelligent.

12-57.—Another dose of the drug administered.

12-58.—In violent convulsions; cold water poured on the head gave relief; struggled and sat up, but could not stand.

1 p. m.—Struggles violently; is paralysed in the hind quarters; constant spasmodic twitchings of the eyelids and other muscles. He rolls his head and body about where he sits, and has the appearance of extreme intoxication.

Cold water constantly poured on the head, and efforts made to rouse the dog by trying to make him walk. The breathing is hard, with a peculiar puffing of the cheeks, like that of an apoplectic person. Holds up his head, and is quite conscious, but can neither stand nor walk.

1-12.—Another dose of the drug administered, and more cold water poured on the head; fresh efforts made to rouse the dog.

1-13.—Made an effort to rise; succeeded in staggering away a few paces.

1-20.—Seems better; can walk a little, but staggers.

1-25.—More sluggish; again lies down. The same puffing of the cheeks, and deep breathing. Evacuations at first natural, becoming frequent, and consisting of bloody mucus. I should also note that he has made several efforts to vomit, but the drug does not appear to have been rejected.

1-30.—Puffing of the cheeks, frothing at the mouth, and deep breathing continue. The dog appears conscious, though intoxicated.

1-37.—Becoming weaker; lies on the floor paralysed. The puffing and flapping of the lips and cheeks continue.

1-45.—Much in the same condition; has just vomited a quantity of thick mucus, and has passed a quantity of sanguineous mucus.

Rose, and again staggered a few paces. Is able to raise his head, which he does when water is poured on it.

For the rest of the report I am indebted to Mr. Sceva, who was present after I was obliged to leave.

At 2-50, the spasmodic movements of the body ceased for a few minutes, and the dog raised himself on his forelegs. He was then removed to a cooler place, and, raising his body, gentle exercise was given by lifting him alternately by the shoulders and hips, rubbing and moving his legs. He seemed to improve again somewhat. He was punkahed, and cold water was dashed on his head, whilst he was again exercised as before ; on leaving his body unsupported, he sunk upon his haunches, but immediately after raised himself without assistance, and attempted to walk. The convulsive movements again returned, with hurried respiration, and he remained in that state until he died at 3-49 p. m.

Bitten at 12-50, died at 3-49 p. m. ; very nearly three hours.

The action of this snake's poison is evidently somewhat different to that of the Cobra. The dog was a very healthy and powerful animal, and the snake was not fresh, but still death occurred within three hours. In this case, the bitten limb was paralysed, as in the case of the dog bitten by the Cobra. The first shock to the nervous system was not so severe in this case as in that of the other dog bitten by the Daboia. This may have been due to the fact that in the former case the dog was smaller, and the snake was fresh. I do not at present offer any opinion on the so-called antidote, further than that, in this particular case, I believe it was altogether inert.

The effect of the poison in causing profuse mucous discharge from the stomach and blood and mucus from the bowels is worthy of notice. I examined the blood after death, and found the corpuscles shrivelled and collapsed, but not otherwise changed.

Experiment No. 10.

20th July, 1868.—A young, but very active and vigorous pig was bitten at 12-27, very slightly in the right thigh, by a fresh Cobra, but it was doubtful, at the time, whether the fangs had penetrated. The pig made his escape, and was caught and brought back in a few minutes apparently unaffected.

At 12-35, he was bitten again by a small, but vigorous Cobra of the spectacled variety, called by the natives " Gomuna" or " Gokurrah." This time the animal was really bitten in two places in the thigh.

12-36.—Struggled violently, and lay down; then got up and struggled violently to get loose from the cord by which he was secured.

12-38.—Lies down and rises again; hurried breathing; is very restless; tries to run about; begins to stagger and falls; at 12-40 is unable to rise.

12-42.—Is convulsed.

12-43.—Lies paralysed, breathing deeply; muscular twitchings.

12-48.—Dead.

The pig was bitten at 12-35, and died at 12-48, that is, in thirteen minutes. This disposes of the question of the immunity of pigs from the poisonous effects of the venom of the Cobra.

Experiment No. 11.

A small Tropidonotus Quincunciatus (grass snake) was bitten by the spectacled Cobra that killed the pig, at 1-12 p. m.

1-16.—Very sluggish.

1-20.—Tosses its head about in a convulsive manner.

1-25.—Dead; died in 13 minutes.

Experiment No. 12.

Two innocuous snakes, Dendrophis Pictus, (tree snakes,) one about 3-4 inches long, the other rather smaller, both long delicate reptiles, bitten at 1-7 p. m. and 1-8 p. m. by the same Cobra that bit the Tropidonotus.

1-12.—Sluggish.

1-15.—The small snake dead.

1-16.—The larger one dead. They simply seemed to become sluggish and powerless; there were no convulsions, no writhings, or contortions. They became powerless and died.

After they appeared quite dead, for a moment or two, the tail of each moved slightly.

Large snake bitten at 1-7, died at 1-16.

Small snake bitten at 1-8, died at 1-15.

In one case death occurred in 9 minutes; in the other in 7 minutes.

The Cobra must have been much exhausted, for it had bitten several times before biting these snakes.

EXPERIMENT No. 13.

At 1-15 p. m., a Dhamin (Ptyas Mucosus) was bitten in three places by the same spectacled Cobra that bit several other animals.

1-30 p. m.—No apparent effect; the snake is as active as ever.

1-32 p. m.—Bitten again by the same Cobra in the mouth and body.

1-38.—No effect.

1-43.—No effect. Bitten again in the mouth and body by a Cobra that has been in one of the cages, and has not bitten for some time.

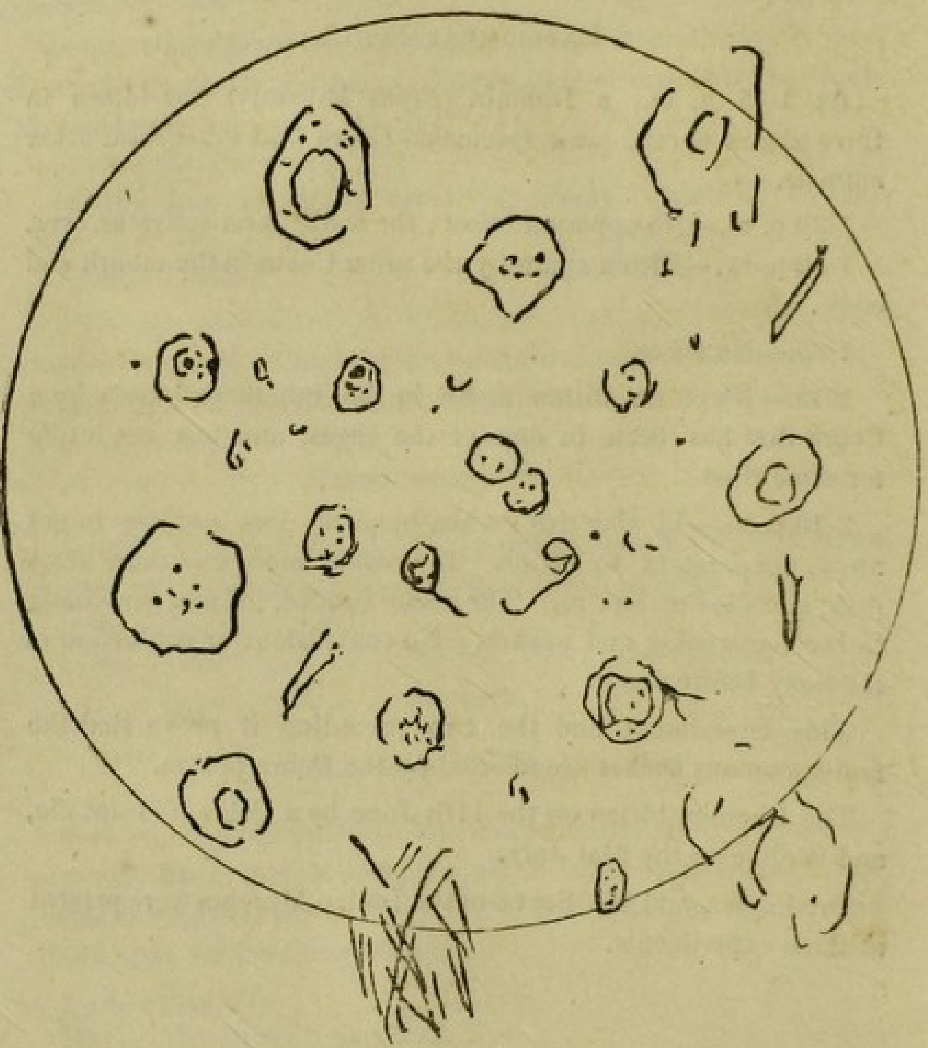
2-10 p. m.—Is sluggish; when handled, does not try to get away, nor attempt to strike. It became more and more sluggish, and died at 8 p. m. The snake seemed, to me, gradually to become weaker and weaker. No convulsions or contortion of the body before death.

This experiment and the two preceding it prove that the non-venomous snakes are affected by the Cobra poison.

The Dhamin, bitten on the 11th June by a Cobra, did not die, and is alive on the 21st July.

Dr. Fayrer, and Mr. Sceva of the Indian Museum were present at these experiments.

Reaction acid; poison slightly viscid and opalescent.



APPEARANCE OF COBRA POISON UNDER MICROSCOPE.*
Nachet, ¼ inch; eye-piece No. 3. Lamplight. 10th June, 1868.

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* This sketch is one of the two which should have appeared in the last number. The other sketch has been incorrectly engraved, and will not now appear at all. As a corresponding illustration appears, however, in this number, the mistake is of no consequence.—ED., *I. M. G.*

19 th series.

ON THE INFLUENCE OF THE POISON OF BUNGARUS CŒRULEUS OR KRAIT.

By J. Fayrer, M.D., C.S.I.

Re-published from the Indian Medical Gazette.

July 7th.—Through the kindness of Dr. Richards, Civil Surgeon of Bancoorah, I have had the opportunity of making the following experiments with Bungarus Cœruleus. The snake was about thirty inches in length, and of the thickness of one's little finger; it was vigorous, but was casting its cuticle. It reached Calcutta a day or two ago in a tin canister, perforated with a few air holes; a snake partly decomposed (species not distinguishable) and a small frog in a similar condition, were found in the tin case when opened. These looked as if they had been rejected when half digested.

Present: Dr. Fayrer.

Experiment No. 1.—At 7-50 a.m., a fowl was bitten in the thigh; the Bungarus on this occasion did not appear to bite very fiercely, but the bite left two points marked with blood. The fowl ran about apparently unconcerned for a few minutes, and was not the least lame on the bitten leg. 8-3.—Apparently not affected. 8-15.—Is drowsy; droops and hangs its head; walks lame. 8-20.—Convulsed. 8-30.—Lies paralysed and is unconscious. 8-35.—Dead—in forty-five minutes.

At 2 p.m., the fowl was opened and blood removed; the heart contained a black, and at one part partially decolorized clot. The remainder of the blood that was pressed only, was altered in appearance: it looked like port wine and water, and after standing for some time, formed an imperfect coagulum. The parts about the fang punctures were livid.

EXPERIMENT No. 2.—A full-grown and vigorous pariah dog was bitten in the outer part of the thigh by the same Bungarus at 1-48 p.m. of the 7th July. The punctures drew blood, and the dog winced and gave signs of pain for a moment.

For some minutes after the bite the dog seemed quite unaffected, he ran about as before, was neither lame nor affected in any way. 2-20.—Seemed restless, but active as before. 3-20.—Salivation and frothing at the mouth commencing. 3-4.—Nausea and vomiting. 3-42.—Trembling, depressed; head drooping; is evidently much affected by the poison. 3-55.—Involuntary defecation and micturition; lies down on its side; unable to raise its head. 4-22.—Breathing hurried; lies quiet; eyes wide open; pupils dilated. 4-33.—Convulsions commencing; pupils widely dilated; is unable to move. 4-55.—Convulsed. 5-4.—Appears dead, but the heart still beats; respiration has ceased. 5-6.—Remains in the same condition; heart beats fainter. 5-12.—Faint, irregular, cardiac beats still felt. 5-30.—Dead—in three hours and forty-two minutes. Body opened in one hour after death, and blood removed from great vessels.

Examined at 8 a.m. next morning: an imperfect coagulum had formed, but the blood generally looked dark and grumous. I sent it to Dr. Cunningham for examination, and append his report, which is interesting, as it indicates a different condition of the blood to that of other snake-poisoned animals.

MY DEAR DR. FAYRER,—The blood which you sent me this morning was quite different in its characters from the specimens which I examined previously.

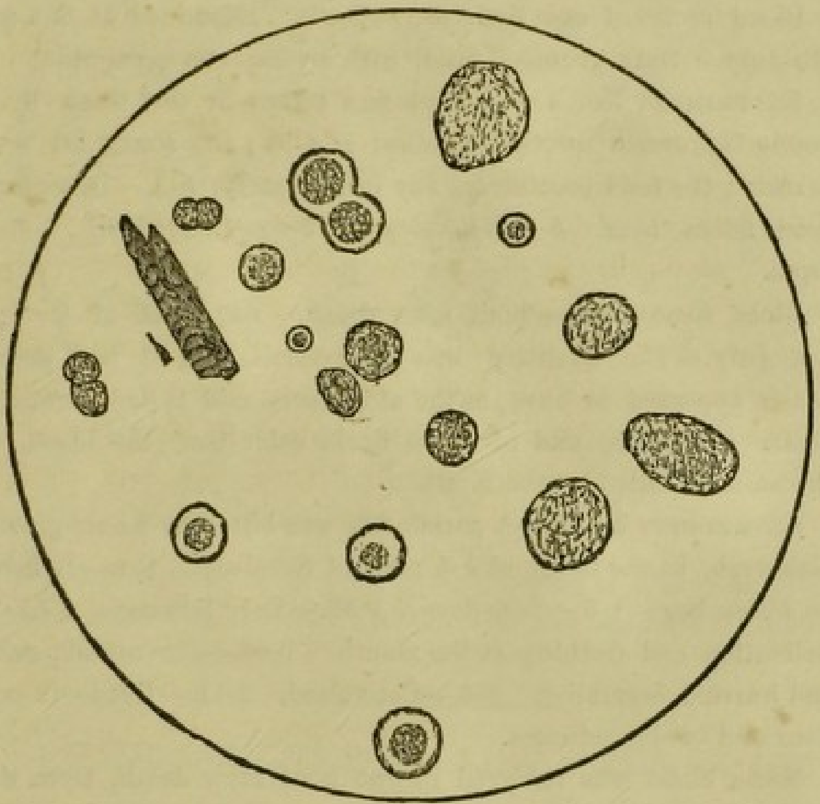
The reaction was faintly and permanently acid.

The red corpuscles were in irregular masses, and had lost all distinctness of outline, and became semifused, as it were. The colouring matter had dissolved out, dyeing the serum, and white corpuscles brownish. The white corpuscles were in some places in large masses visible to the naked eye. The most remarkable thing about them, however, was their extreme distension in many cases. I could find no cells that were not recognizable as more or less distended white corpuscles. Herewith I enclose a sketch of some of various sizes.

Yours very truly,

Friday. D. D. CUNNINGHAM.

P. S.—It would be very interesting to know if the reaction was acid immediately after death.



EXPERIMENT No. 3.—At 4-56 p.m. a fowl, two-thirds grown, bitten in the thigh by the same Bungarus; on this occasion the snake bit very fiercely, and was with difficulty made to let go his hold. The puncture drew blood; for some minutes not affected. At 5-4, crouching; seems uneasy. 5-7.—Quite lively when roused. 5-8.—Drowsy; eyes closed; head began to droop. 5-12.—Very drowsy; head and wings drooping; crouches; head falls over; rest-on point of beak. 5-14.—Cannot stand; lies motionless. 5-45.—Convulsed. 5-55.—Dead—in fifty-nine minutes. The bite on this occasion was very vigorously inflicted.

These three experiments shew how dangerous this snake is. This is the third animal it has destroyed in one day, and is apparently as vigorous as ever, and it is quite a small specimen.

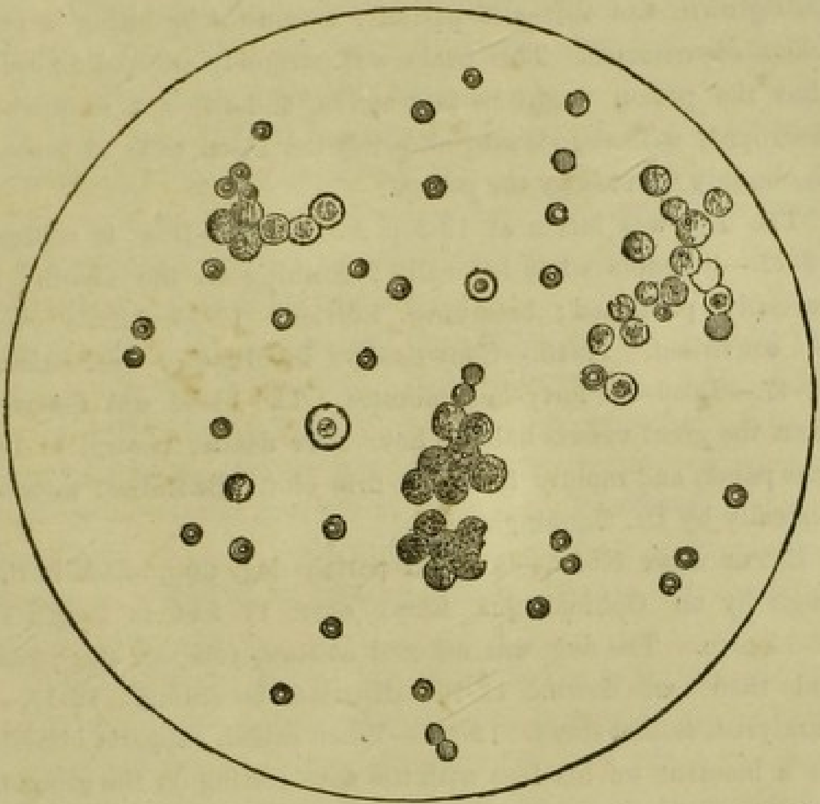
Blood removed one hour after death. Examined at 8 a.m., 8th July.—Dark grumous fluid, with an imperfect coagulum.

Experiment No. 4.—A fowl was bitten in the thigh by a young Gokurrah (spectacled cobra) at 4-59; the snake bit very fiercely; the fowl became drowsy immediately. 5-3.—Drooping; head fallen over. 5-4.—Paralysed. 5-6.—Convulsed. 5-7.—Dead.

Blood removed one hour after death. Examined at 8 a.m. 8th July.—The quantity was very small, and it had dried, but it appeared to have, as the attendants said it had, formed a firmer coagulum, and of more florid color than the blood of the animals killed by the Krait.

Experiment No. 5.—A pariah dog was bitten by a half-grown Gokurrah, in the thigh, at 1-2 p.m. of 8th July. 1-4.—Is lame on bitten beg. 1-8.—Lies down. 1-50.—Very lethargic. 1-55.—Salivation and frothing at the mouth. 1-59.—Convulsed; deep and hurried breathing. 2-6.—Convulsed. 2-14.—Dead—in one hour and twelve minutes.

Some blood was removed in one hour after death, from the great vessels. It formed a firm bright-red coagulum, very different in appearance to the blood of the dog killed by the Krait. I examined it at 6 p.m., and found it in this condition. It was neutral as shewn by blue litmus paper. After examination under the microscope, Dr. Cunningham gives the following sketch and remarks:—



Clots firm, very dark with distinct masses of white corpuscles; serum neutral, reddish from abundance of free unaltered red corpuscles; white cells normal.

ON THE INFLUENCE OF SNAKE POISON ON THE BLOOD.

THE following experiments made with Ophiophagus Elaps, Naja Tripudians, Bungarus Fasciatus, and Bungarus Cœruleus were for the purpose of examining the condition of the blood after death from the poison of those snakes.

Present: Drs. FAYRER, N. CHEVERS, and D. CUNNINGHAM,—July 9th, 1870.

EXPERIMENT No. 1.—A pariah dog, of about ten months old, was bitten in the thigh by a Gokurrah (spectacled cobra), about half-grown, and that was partially exhausted by biting in previous experiments. This snake was purposely selected in order that the poison might be less active, and life not so quickly destroyed, with the view of allowing the blood time to become thoroughly affected by the poison.

The dog was bitten at 12-3 p.m. 12-20.—Dog is restless. 12-32.—Staggers when he walks; frothing at the mouth; is partially paralysed; breathing hurried. 12-35.—Falls over, is convulsed. 12-45.—Convulsed; involuntary evacuations. 12-47.—Dead—in forty-four minutes. The blood was removed from the great vessels half an hour after death; neutral to litmus paper, and rapidly formed a firm clot. Examined microscopically by Dr. Cunningham.

Experiment No. 2.—A small pariah dog, pup, bitten in the thigh by an Ophiophagus Elaps over 11 feet in length at 12-15 p.m. The dog was affected at once, jumped, staggered, and then sat down. 12-16.—Hurried breathing. 12-17.—Paralysed, cannot stand. 12-18.—When raised, supports himself for a moment on his legs with the nose resting on the ground, and then falls over. 12-19.—Convulsed. 12-21.—Respiratory movements have ceased; heart's beats still felt. 12-22.—Dead—in seven minutes. Blood removed half an hour after death: reaction neutral; coagulated at once into a firm clot. It is not of so natural a red as in the clot of the blood of the dog killed by the cobra.

Experiment No. 3.—A young dog was bitten in the thigh by the same krait (Bungarus Cœruleus) that bit the dog in Experiment No.— at 12-7 p.m. 12-45.—Seems sluggish. 1-10.—Sluggish, no other change. 1-13.—Bitten again by the same krait in the thigh. 1-22.—Sluggish, sits with the head drooping. 1-40.—Seems drowsy, but is easily roused. 2-5.—Almost paralysed, cannot stand, the legs fail, and he sinks down when raised on his feet. 2-15.—Involuntary defecation. 2-17.—Convulsed. 2-19.—Respiration has ceased; heart still beats.

2-20.—Heart still felt. 2-22.—Dead—in two hours and fifteen minutes. The blood was removed an hour after death, and sent to Dr. Cunningham for examination.

In this case it clotted and was not discolored as in the case of the first dog killed by the same krait.

The rigor mortis occurred in less than an hour. There was no extraordinary rapidity in decomposition of the body, though the weather was very hot and damp.

EXPERIMENT No. 4.—A fowl was bitten in the thigh by the same krait at 12-24 p.m. 12-35.—Drowsy. 12-58.—Eyes closing, begins to droop. 1-10.—Legs weak, crouches. 1-15.—Droops its head. 1-20.—Head fallen over, resting on point of beak. 1-25.—Quite paralysed; slow, deep breathing. 1-40.—Convulsed. 2-12.—Dead—in one hour and forty-eight minutes. Blood removed about an hour after death, sent to Dr. Cunningham for examination.

This little snake is two feet seven inches in length, and one and three-fourths in circumference, but is very deadly, as these experiments prove; it has since the 7th July killed two dogs and three fowls; the action of the poison is slower, but it appears to be as fatal as that of the cobra.

During the last two days the krait has cast its cuticle, and now shews its markings beautifully. The dark brown, almost black, distinct white rings, with a pearly white abdomen.

Rigor mortis was complete in this fowl in 45 minutes after death. Decomposition was not more rapid than in death from ordinary causes. It died at 2-55 p.m.

There was no evidence of decomposition at 1 a.m., notwithstanding the great heat and humidity of the atmosphere.

EXPERIMENT No. 5.—*July 9th.*—A dog, about six months old, was bitten in the thigh by a full-grown Bungarus Fasciatus at 11-59. 12-45.—No apparent effect. 1-15.—Slight sluggishness; no apparent change otherwise. Bitten again by the same snake. 1-22.—Sluggish. 1-41.—Seems drowsy, but is easily roused.

2-5.—Seems more drowsy; staggers. 2-14.—Stands with difficulty. 4-2.—Is able to walk, but is lame. 5-30.—Drowsy; eyes half closed. 7-15.—Coughs. 10-14.—In the same condition. 11-20.—Still coughing, and vomited.

July 10*th*.—5-15.—Seems unable to stand. 6-5.—Drowsy, but standing. Noon.—Appears in the same condition, and remained so all day; refuses food. 9 p.m.—In much the same condition; coughing frequently.

July 11*th*.—5-30 a.m.—Cannot stand. 11-30.—Cannot stand. 12-30.—Cannot stand. 3-15.—Purged. 6-55.—Lies quiet, with the eyes half opened. 8-30.—Seems very much depressed.

July 12*th*.—6-10.—Breathing hurried. 8-30.—Dying. 11-30. —Very low. 2-10.—Found dead—had been dead probably an hour or more, as the body was quite rigid. This dog lived for upwards of seventy hours after being bitten by this Bungarus (Sankni), a very large and powerful snake of about five feet in length. It had been some weeks in captivity and may have been weak, but it bit fiercely when roused, and drew blood.

It is evidently less virulent than its smaller congener, the Krait. The blood coagulated after death, and was sent to Dr. Cunningham for examination. The rigor mortis was complete.

Experiment No. 6.—A half-grown cat was bitten in the thigh by the same Bungarus Fasciatus, at 12-36, *i. e.*, immediately after the dog. The snake seemed to bite reluctantly until excited, when it appeared to strike its fangs deeply. The cat immediately became rigid, its pupils widely dilated, and its tongue protruded. These symptoms, I believe, were due to excitement, rage, or fear, for on being placed on the ground, it rapidly recovered.

The pupils contracted, and it seemed unaffected a quarter of an hour after being bitten. It was not affected after this, and on the 12th, when the death of the dog is reported, it is quite well. I am inclined to think that this snake was either exhausted, or that its fangs were imperfect.

2 m 5.

EXPERIMENTS ON THE POISON OF SNAKES.

By J. Fayrer, M.D.

Present: Dr. Fayrer, Dr. F. Stoliczka, and Mr. V. Ball, Curators of the Indian Museum, and Mr. Sceva.

Experiment No. 1.

August 6th, 1868.—At 12-13 p.m. a Cobra was bitten in two places, about six inches from the head, where the scales had been previously scraped off, and in the mouth, by a very large and powerful light-colored spectacled Cobra, 5 feet 6 inches in length. The bitten snake was then put into a separate box with a wire gauze front, for observation. There could be no doubt in this case that the bites were severe, and that the poison was inoculated. At 2-30, when I left, the snake seemed to be unaffected. At 9 p.m. Mr. Sceva reports that the bitten Cobra does not seem to be much affected.

2-30 p.m., 8th August, about 50 hours afterwards, this snake is apparently unaffected.

Experiment No. 2.

6th August.—A Bungarus Fasciatus, nearly full-grown, was bitten by the same Cobra at 12-22 p.m., at about eight inches from the head. The snake was bitten twice; the Cobra took firm hold, and implanted the fangs deeply.

At 2-30, when I left, there was no change; the Bungarus seemed unaffected. The Bungarus died at 7-30 p.m. of the 7th, about 29 hours after being bitten. At 1 p.m. of the 7th, he still seemed well.

Experiment No. 3.

At 12-27 p.m., 6th August, an innocuous snake, Dendrophis, long and delicate, beautifully marked with red spots along the spine, was bitten by the same Cobra, about the middle of the body.

12-30.—Appears slightly affected and is sluggish. It does not try to make its escape so vigorously as it did.

12-53.—Sluggish, but, apparently, very slightly affected. The Cobra is apparently partially exhausted, as it had been made to bite two other snakes in two places, and in this forced biting much of the poison is lost.

12-54.—Bitten again, near the same spot, by a fresh and large black Cobra. It soon became very sluggish, but made no convulsive movements. It simply seemed to become paralyzed, and was dead at 1-8 p m. Death occurred in 14 minutes after the second bite, in 41 minutes after the first bite. The effect of the poison on the harmless snakes seems, from this experiment, to be comparatively feeble and slow. The bitten snake was small and delicate, the Cobra was fresh and very powerful, and at least 5½ feet long.

Experiment No. 4.

A Dryophis, (green tree snake,) about 3½ feet long, was bitten by the first-mentioned large, light-colored Cobra, in the middle of its body, at 12-28 p.m.

12-52.—Slightly affected, rather sluggish ; but it is combative, and attacks if approached. At 12-55 it was bitten again by the large black Cobra mentioned in Experiment No. 3. It rapidly became affected. Became very apathetic and sluggish. At 1-3 p.m. apparently nearly dead. At 1-4 dead.

This experiment, like No. 3, shews the effect of the Cobra poison on the innocuous snake. The Dryophis died in nine minutes after the second bite, in 36 minutes after the first bite. The first Cobra was evidently exhausted. The second was fresh and vigorous, having only once bitten the Dendrophis. I believe that, had it bitten a warm-blooded animal, of about the same strength as the Dendrophis, death would have occurred more quickly. The Dryophis was twice the size of the Dendrophis, and, although it was bitten after it, died in a much shorter time. It was either more susceptible, or more deeply bitten.

Experiment No. 5.

A pariah dog was bitten in the thigh by a large and fresh black Cobra, at 12-37 p.m. Immediately afterwards, about 20 props of a solution of strychnia, (of the strength of gr. i to ʒi,) equal to $\frac{1}{3}$rd of a grain, were injected with a hypodermic syringe into the same thigh.

12-39.—Tetanic twitchings of the limbs commenced, and gradually continued, becoming more intense, till, at 12-42, the animal was in a state of general tetanic spasm of all the muscles of the body. The ears were erected, the pupils dilated to excess, the body rigid, and the limbs extended in an intense state of tetanic convulsion.

12-43.—Dead. Spasm relaxed just before death.

In this case death occurred in six minutes, and was due entirely to tetanus. There was neither time nor opportunity for any manifestation of the effects of the snake-poison.

Experiment No. 6.

A pariah dog was bitten in the thigh by a powerful and fresh black Cobra, at 12-45. Immediately afterwards, about 15 drops of the strychnia solution were injected with the hypodermic syringe into the same thigh.

12-46.—Bitten leg partially paralyzed, and dragged. The dog ran across the room, the legs twitching violently.

At 12-47 it fell over in a state of rigid tetanic spasm.

12-48.—Every muscle in the body in a state of rigid spasm. But it was remarked that the bitten leg was not so much affected by spasm as the other leg. The paralyzing action of the snake-poison, apparently, so far counteracts the action of the strychnia.

12-50.—Spasm relaxed.

12-51.—Dead.

Death occurred, evidently from tetanus, in six minutes.

Experiment No. 7.

A full-grown male cat was bitten in the thigh, at 1-20 p.m., by a Daboia Russelli, about two-thirds grown, and, apparently, quite fresh and vigorous. Ten drops of a solution of strychnia, of the strength of gr. 1 to ʒi, that is, $\frac{1}{6}$th of a grain, were injected at 1-23 p.m.

1-24.—The bitten leg is partially paralyzed. The cat lies quietly, looking about it.

1-25.—Spasmodic twitchings began.

1-26.—Stretched out in a violent tetanic spasm. Pupils very widely dilated.

1-27.—Spasm relaxed. Dead. In this case the strychnia seemed rather to accelerate death than to improve the animal's condition. The action of the snake-poison had clearly commenced, but it was at once obscured by the symptoms of poisoning by strychnia, and the cat died in a state of complete tetanus. The strychnia was suggested as an antidote to snake-poison. These experiments do not support this theory.

Experiment No. 8.

A large Dhamin (Ptyas Mucosus) was bitten by a fresh and powerful Cobra, at 12-53 p.m., about eight inches from the head, the scales having been previously scraped off, to ensure the penetration of the Cobra's fangs. Bitten also in the mouth, at 12-54, by the same Cobra.

At 1-8 p.m. still active.

1-10.—Appears slightly sluggish.

1-30.—The same.

At 2-30, when I left, it was in the same state.

On the 8th August I learnt that the Ptyas died at 3-20 p.m., rather less than 23 hours after being bitten. It appeared to have partially recovered from its lethargy during the day, but relapsed and died; as it had been in the cage for some time, and was well and active, there can be no doubt, I think, that its death was due to the Cobra bite.

Experiment No. 9.

A very large and powerful Cobra, the same that bit in Experiments 1, 2, 3, and 4, had about 25 drops of the solution of strychnia (gr. i to ʒi) injected into the anterior part of its body on the ventral aspect, at 1 p.m.

At 1-2 p.m. muscular twitchings began. The hood seemed to be shrivelled up and contracted. The head was erect, and longitudinal folds formed in its skin.

At 1-4 p.m., in a state of violent tetanic spasm. The body set in short waves, as though it had been petrified in that condition, and the whole curved rigidly to one side.

1-6.—Continues in the same state, rigid as stone.

1-10.—Spasm relaxing; twitchings generally throughout the body and the head.

1-12.—The only sign of life, an occasional twitch.

Dead. 1-14.—Spasm relaxed.

Experiment No. 10.

A Cobra, about 4 feet long, was injected with 15 drops of Cobra poison, partly taken from another Cobra, partly from itself, at 1-56 p.m., at about 4 inches from the head.

At 1-58, twitching of head and neck when erect. Hood began to shrivel.

At 1-59, twisted itself up into a rigid series of coils, like a snake cast in metal, in which state I lifted it up with a stick and rolled it on the floor.

It remained in this condition, the head twitching.

At 2-25 the coils were unfolded, and it was quite dead.

The symptoms of poisoning here were more those of strychnia than snake-poison; and I cannot help thinking that such may possibly have been the fact. The same hypodermic syringe was used as in the other experiments, but, as it had been most carefully washed several times before the experiment, it is difficult to conceive how such can have been the case, unless a very small quantity had been left imbibed by the packing of the piston. As the result was so different to that of other inoculations of Cobras by Cobra poison, I cannot help suspecting this may have been the case, and it is sufficient to throw a doubt on the validity of the experiment. It would, however, prove the extreme susceptibility of the snake to the action of strychnia.

Experiment No. 11.

At 2 p.m., a large Cobra had about 15 drops of his own poison injected with the hypodermic syringe, about 8 inches from the head. The needle was inserted in the ventral surface, and it is probable the lung may have been penetrated.

At 2-5 p.m. the snake was moving about, apparently unaffected.

2-10.—He was thought to appear rather sluggish.

2-30.—Apparently as vigorous as ever.

At 9 p.m. it was reported by Mr. Sceva that the Cobra was very sluggish, and likely to die.

At 12-30, 8th August, the Cobra still alive, and apparently not affected; nearly two days after the experiment.

Experiment No. 12.

At 2 p.m., a large Cobra had about 12 drops of poison, partly his own, partly from another Cobra, injected about 8 inches from the head. No effect was apparent when I left at 2-30 p.m. But at 9 p.m. of the same date, Mr. Sceva reported that it died at 7-40 p.m. It became more and more sluggish and lethargic, until it was quite dead, but there was no convulsive movement and tetanic spasm.

It appears probable, to say the least of it, that death in this case was caused by the poison. It is possible that the needle may have penetrated the lung, or some large internal vessel, and that it caused death either by hæmorrhage or embolism. I had not an opportunity of examining the snake after death, and I cannot, therefore, regard the experiment as conclusive.

The Cobras used in these experiments were remarkably large and vigorous.

Present: Dr. Fayrer, Dr. J. Ewart, Professor of Physiology, and Mr. Sceva, of the Indian Museum.

Experiment No. 13.

August 8th, 1868.—A full-grown Cobra had about 25 drops of fresh Cobra poison, taken from another snake immediately before the experiment was performed, injected by means of the hypodermic syringe into the body, at about 8 inches from the head.

At 12-50 the snake appeared unaffected in strength and activity, striking at anything that approached it ; but it voided a large quantity of light brown fluid *per anum*.

On the 12th August it was still quite well.

At 2-30, when I left, it was as well as ever.

Experiment No. 14.

A half-grown fowl was bitten in the thigh by a Daboia Russelli at 1 p.m.

It fell over in violent convulsions, as it was placed on the ground, and in less than 90 seconds it was completely dead. This is the most rapid action of snake-poison I have yet seen.

Experiment No. 15.

About half a drop of venom was with difficulty obtained from the same Daboia. These snakes, with their long mobile fangs, do not shed their poison into a shell or spoon covered with a leaf so readily as do the Cobras. This very small quantity of the venom was injected, by means of the hypodermic syringe, into the thigh of a half-grown fowl. At 12-2 p.m., when placed on the ground, it walked a few steps, as though nothing had happened. In about 80 seconds it suddenly fell backwards, and rolled over in violent convulsions. At 12-4-10, that is, in 130 seconds, it was dead. These two experiments shew the terribly deadly nature of the Daboia's poison, and also the difference of its mode of action from that of the Cobra. In the one case death being preceded by violent convulsions, in the other by paralysis and lethargy.

The quantity of the poison inoculated must have been very small in both cases; for the snake did not imbed his fangs or shed a very large amount of poison; and in the second experiment, where the quantity was certainly not more than half a drop, part of that must have been absorbed by the padding of the piston, and a small part lost by adhering to the syringe, or by escape, owing to the piston not being absolutely air-tight. It is also worthy of notice that this is the same snake that has been used in former experiments, and that it has been in a cage now for some weeks. It appears that it and its companion have eaten some small frogs lately.

Experiment No. 16.

One drop of poison, taken from a spectacled Cobra, was injected, at 1-14 p.m., by means of the hypodermic syringe, into a fowl's thigh.

In 50 seconds it was walkingabout with that leg partially paralyzed. At 1-16 it was pecking at the punctured part; wings drooping. At 1-19 it sat down, head hanging, and supporting itself with the point of the beak resting on the ground, growing gradually more comatose, and generally paralyzed.

At 1-22 in the same state. One drop of the strychnia solution, about $\frac{1}{60}$th of a grain, was injected into the thigh. At 1-23½ it appeared quite paralyzed. When thrown from the hands to the ground, the wings involuntarily performed the movements of flying, and it alighted gently, but lay there perfectly motionless. At 1-25 tetanic twitchings of muscular system were apparent. At 1-26 general muscular quivering, and slight spasmodic extension of the legs. At 1-27½ dead. The contents of the cloaca were evacuated just before death. The action of the strychnia was apparent, but it did not in any way seem to ameliorate the condition induced by the Cobra poison.

The fowl was larger and stronger than those in the preceding experiments, and a full drop of poison was injected. Death did not occur for 13½ minutes, and the symptoms differed from those in the birds poisoned by the Daboia, whose more rapid death was preceded by violent convulsions.

Experiment No. 17.

A large pale-colored Cobra had 10 or 12 drops of freshly extracted Cobra poison injected into the anterior ventral aspect of the body, about 8 inches from the head, at 1-43 p.m.

At 2-30 the snake seemed unaffected. On the 12th August, at 5 p.m , the snake remained perfectly well.

Experiment No. 18.

A large pale-colored Cobra had ten drops, equal to $\frac{1}{8}$th of a grain, of a solution of strychnia injected into the anterior part of its body, near the head, at 1-50 p.m. At 10-52 tetanic twitchings commenced. At 10-53 it became rigidly fixed in undulating curves, with a general lateral curve of its entire length. The hood completely shrivelled up, and the head twisted to one side. In this spastic condition the snake was as rigid as a bar of wood. In 7½ minutes after the strychnia had been injected, the Cobra was quite dead ; muscular twitchings had passed away just before death ; rigidity remained for a short time after it.

The snake, notwithstanding its cold blood, is very susceptible to the poisonous effects of strychnia. The object of the experiment was not only to test the action of strychnia on the snake, but also to shew that the method of injecting the poison was an effective one, and that as the snake-poison was injected in precisely the same way, failure in its action could not be attributed to the mode of administration.

Experiment No. 19.

At 2-6 p.m. a full-grown Cobra had six drops of fresh Cobra poison injected under the skin with the hypodermic syringe, about 8 inches from the head.

Seven minutes after voided a quantity of dark-colored fluid from the cloaca.

2-30.—Unaffected.

On the 12th, at 5 p.m., still quite well.

In these three experiments, 13, 17, 19, the Cobra poison, though fresh and thoroughly well injected into the Cobra, had no effect. Four days after the experiment, the snakes injected were unaffected. I am, however, still not satisfied that the Cobra may not be poisoned to death by the venom of its own species, and shall make further experiments before recording any decided opinion.

Experiment No. 20.

Ten drops of carbolic acid were injected, at 2-9 p.m., by means of the hypodermic syringe, into a Cobra, at about 8 or 10 inches from the head.

In half a minute it was affected with muscular twitchings and tremor; the anterior 12 inches of the snake affected with paralysis agitans.

Vermicular movements throughout the body.

2-12.—Universal paralysis.

2-14.—Dead.

The snake is evidently very susceptible to this poison, as it also is to the strychnia. No warm-blooded animal could be more so. This, I think, seems to shew that, apart from any immunity peculiar to the reptilian circulation, it has a special toleration of the poison of its own species; for it certainly is not easily, if at all, affected by it, as the majority of the experiments hitherto performed tend to shew that neither by inoculation of the poison by the syringe, nor by biting, is any deadly effect produced.

In my last report, in alluding to the poison fangs of different snakes, I described them simply as they appear, and not according to their development. But as this may be misunderstood, I would here remark that, though different in form and size, they are all developed on, and are modifications of, the same plan. The fang is a long tooth, consisting of dentine and pulp. This is folded on itself, and thus forms the poison duct, constituting a conical tube. The canal thus formed lies on the convex side of the fang, which is recurved, and is in front of the pulp. The poison canal is, in fact, enclosed in a circular canal of dentine, the fibres of which are arranged vertically around the duct.

This inflection or involution is more or less perfect according to the age of the tooth, or according to the genus of the snake. In some, as in the Hydrophidæ, the inflection is never completed, and the canal remains an open groove.

In the Elapidæ, as in the Naja and Bungarus—the involution is sufficient to close the canal, but the vertical line of union, as well as the triangular opening at the base, and that of exit near the apex, can be seen: whilst in the Viperidæ and Crotalidæ the involution is so complete, that the tooth presents the appearance of a perforated tube, and the inflection or involution of the margins is not seen.

These poison fangs, which are connected with the maxillary bones, are anchylosed to them when they are in working order. The supplementary fangs, of which there is always a good supply in different stages of growth, are loose, and lie covered by the fold of mucous membrane and gum which envelopes the poison fangs, and protects them when not in use. A second, or even third, fang may be anchylosed with the principal one to the maxillary bone; and I have before me a skull of a Daboia, for which I am indebted to Mr. Sceva, in which this is the case; and where there are five well developed poison fangs on each side, of which on one side *two* are anchylosed to the maxillary bone. The muscular apparatus by which the fangs are moved, the jaws opened, and the poison gland made to shed its contents through the hollowed tooth, are very complex and beautiful. I hope, on a future occasion, to give some account of this, as well as of the osseous details concerned in the movements by which the deadly wound is inflicted.

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EXPERIMENTS ON THE INFLUENCE OF SNAKE-POISON.

By J. Fayrer, M.D.

Present: Dr. Fayrer, Dr. Ewart, Professor of Physiology, and Mr. Seeva, of the Indian Museum.

August 15*th*, 1868.—The object of these experiments was to make careful observations of the symptoms during the action of the poison, to note the pathological changes during life and after death, and the microscopical appearances of the blood of a mammal in the healthy state, immediately before submitting it to the influence of the snake-poison, and to compare these appearances with those of the blood of the same animal after death from the snake-poison.

The examination was made with the greatest care by Professor Ewart and myself with two microscopes, the power used being $\frac{1}{4}$-$\frac{1}{5}$ of an inch, and they were repeated many times.

Experiment No. 1.

At 11-59 a.m., a small pariah dog was bitten in the left hind-leg, just above the carpal joint, by a Daboia, the same snake that had been used in former experiments. The dog was put near the snake, which, though excited and hissing loudly, appeared disinclined to bite; on being irritated, it struck the dog in the leg as described; the wound bled freely.

It was nearly five minutes before the dog shewed signs of the effects of the poison. He then began to stagger and seemed weak, and as if unable to co-ordinate the muscular movements of the limbs.

At 12-6 he lay down, breathing heavily; at 12-7 he rose and staggered a few steps and vomited.

12-9. Gradually subsided on to his left hind-quarter;

looks vacantly about him, but intelligent when spoken to. There is no indication of any suffering.

12-11.—Walks about when led, but very sluggish, and wants to lie down; weak in the bitten leg.

12-18.—Is walking slowly, staggering in the hind-quarters; has his head depressed, with the neck stretched out. Cold water dashed over the head seemed to rouse him partially.

12-22.—Lies down, weak and exhausted; no convulsions. Looks as though he were going to sleep. Takes no notice when spoken to.

12-42.—Lying down sluggish, and disinclined to move; can walk a little when roused.

12-46.—Respiration deep. Lying on the right side; appears generally paralyzed.

12-57.—Insensible; catching respiration.

1-5 p.m.—Dead.

Died in 66 minutes.

Post-mortem, soon after death. Part above the ankle-joint, where the animal was bitten, ecchymosed to an extent of 2 inches, and discolored by dark bloody fluid.

Decomposition commencing.

A coagulum corresponded to the points at which the fang had penetrated.

Blood in femoral vein fluid.

Thorax opened. Lungs pale and bloodless; completely collapsed when the thorax was opened.

Heart's right cavities contained fluid blood. The blood pressed out of the heart and from the great vessels in the thorax was fluid, with no tendency to coagulate. The left side of the heart empty.

The liver healthy. Spleen enlarged. Stomach contained a quantity of food. Kidneys healthy.

Brain taken out and carefully examined; it was healthy-looking and firm, perhaps more anæmic than quite natural. The blood was kept until next day, and there was no coagulation.

Up to 1-54 p.m., no *rigor mortis.*

The blood was most carefully examined before the dog was bitten, during the operation of the poison, and after death. There was nothing suggestive of the changes described by

Professor Halford. The red corpuscles remained altogether unaltered. In one of the examinations after death, a few more of the white corpuscles were seen than we had observed in other specimens, but there was no peculiarity about them; and after most careful and repeated examinations, we could detect nothing that confirmed Dr. Halford's observation.

Experiment No. 2.

A healthy medium-sized dog was bitten, at 12-40, in the left hind-leg by the Daboia Russelli. It was not certain that the fangs penetrated. The mouth of the snake was also brought in contact with the right thigh and the lower part of the abdomen, and the fangs were struck lightly into the parts. The snake was one that had been used on former occasions, and was weak, and probably almost exhausted of poison.

1-20 p.m.—Lies down; looks depressed; evidently affected by the poison.

2-3 p.m.—There has been very little change during the last 40 minutes. Lies down quietly. There are abdominal contractions, as of irregular action of the diaphragm.

5 p.m.—When roused moves about, but is sluggish and weak. Steps irregularly with a staggering gait, crossing the hind-legs, at other times keeping them wide apart. After walking a little, the steps became more regular and steady. The dog having usually been fed at this time, food was offered, but he refused it.

6-30.—Quiet; no symptoms of pain or convulsions; perfectly conscious; when spoken to, responds readily by raising his head and wagging his tail. Is insensible to pain if irritated in any part of the body.

In some of the former experiments it seemed as though anæsthesia were produced on the limb that had been bitten.

The dog gradually drooped, without any sign of pain; no spasm. Died at 8-15 p.m.

Bitten at 12-4.

Died at 8-15.

Eight hours and eleven minutes after being bitten.

In this case death was very slow and painless. It seemed more like a gentle lethargy stealing over the animal, and gradually increasing until death. There was no sign of pain; no convulsions; just before death the defecation was of a muco-sanguinolent character, having been perfectly natural before being bitten. The body was examined soon after death.

On raising the integument, it was found that the deepest wounds from the snake's fangs had been received in the middle of the lower part of the abdomen, but they had not penetrated deeper than the adipose tissue.

Several small punctures (4 or 5) were found in the side of the abdomen and in the inner part of the thigh.

The *post-mortem* appearances of the thoracic and abdominal cavities were exactly the same as in the former case, except that the spleen was healthy in this case.

The blood was watched for 14 hours, and it did not coagulate; and, being carefully examined under the microscope, presented no change from the normal condition.

The results of these experiments, which were conducted with great care and every precaution to exclude sources of error, may, I think, be accepted as almost conclusive that death is caused by the action of the poison on the nerve-centres generally, and not by its operation on any special one. The condition of the thoracic viscera proves that it is not due to pulmonary congestion or asphyxia. The fluid state of the blood, although no change in its corpuscular elements is appreciable, tends to show that it is the direct channel through which the nerve-centres are injured. In both these cases death took place slowly, giving ample time for any changes, such as described by Dr. Halford, to take place. It is worthy of notice that in both cases there was absence of any convulsions or tetanic spasms. This may be attributed to the animals having received a smaller dose of the poison, and that administered by comparatively exhausted snakes. In other cases, when the animal bitten was smaller, and the Daboias were more vigorous, the effect in producing convulsions was marked, and death took place more rapidly. Where the poison operates slowly and feebly, as in these cases, there is very little, if any, difference in the symptoms from those produced by the Cobra-poison administered under the same conditions.

EXPERIMENT NO. 3.

August 17th, 1868.—A half-grown pig was placed in a large box with a full-grown Cobra, of the variety called by the natives *Keauteah*. The snake had been used before, had been some time in confinement, had probably not eaten for some time, and consequently might be expected to be weak and comparatively feebly poisonous. The snake seemed indisposed to bite until irritated, and the pig stepped on him, when he seized it by the right forefoot, just above the hoof, and drew blood. The pig lay down at once, appeared very much frightened; the snake also appeared terrified by the pig, and lay for a moment, as though he were seriously injured.

The pig made no attempt either to attack the snake or defend himself; he merely tried to get out of the way. The snake bit at 11-55 a.m., and as the pig was lying down, the bitten leg was drawn up in a jerking and convulsive manner.

11-59.—Got up and ran about the room; the bitten limb evidently weak. Lay down again; right fore-leg twitching in a convulsive manner; is generally restless.

12.—Rose and lay down again. The bitten leg always convulsed in lying down; places it under its body, as though to prevent the involuntary movement; working the mouth; making efforts to retch.

12-3.—Roused up; squealing lustily; quite able to walk when roused, but when left to himself lies down; eyelids droop, and looks sleepy.

12-5.—Roused; rests himself against the wall.

12-6.—Resists efforts to rouse him.

12-10.—Lying down; bitten leg uneasy, but not so much convulsed as at first. When roused, he walks; appears to be much weaker.

12-17.—Lying in the corner of the room with his left side against the wall. Twitching occasionally in the bitten limb. Eyelids closed occasionally. One can now see that he has been bitten just above the hoof posteriorly.

12-25.—Can use the limb; holds it up when he stops; limb convulsed at longer intervals.

12-28.—Lies down; some slight general uneasiness. Convulsive twitching affected posterior extremity.

12-30.—Fore-leg put forward; then convulsion more evident. When roused, walks; holds up the limb as if from pain in pressing it on the ground; puts it down when pushed.

12-45.—Roused up. Twitching. Lies down.

1 p.m.—Unless roused, lies down against the wall. Twitching now in right hind-leg.

1-32.—Pig bitten again by a new and fresh Cobra in left thigh and in the snout.

1-35.—Twitching in the bitten leg.

1-40.—Gets up when roused; still twitching in hind-leg.

2-7.—Good deal of twitching in hind-leg; twitching in rapid succession; it sometimes affects corresponding anterior extremity. Twitching also of the facial muscles and of the orbiculares palpebrarum. Lying flat on his side with his legs stretched out.

2-15.—Roused him up; great loss of nervous and muscular power. When he got up, he did so with much difficulty; propped himself up against the wall; staggered and fell down.

2-25.—Very lethargic; cannot stand; when placed on his legs, he falls down; same debility characterizing general muscular system noticed in those muscles which affect the organs of *speech*. His squeal is now a mere whine. He is anæmic, conjunctivæ pallid. The right fore-leg first bitten is ecchymosed much up to the elbow-joint. Considerable twitching in muscles of the face, showing that the poison has affected this part in the same way as it has the muscles of the fore and hind-legs.

2-40.—Respiration catching; gasping; convulsed in the posterior extremities; lips, mouth, and conjunctivæ pallid; eyes fixed; insensible to light; pupils dilated; irides unacted upon by light; almost comatose.

Bitten first at 11-53.

Bitten second time at 1-32 p.m.

Died 2-50, nearly 3 hours after being first bitten.

Sect. cadav. Blood in sinuses of the brain, as in the whole venous system up to the right auricle and ventricle, which were distended with blood. Sections of brain, thalamus, and corpus striatum and medulla oblongata, pallid in the extreme; scarcely a vascular point to be seen.

Lungs quite collapsed and anæmic; left ventricle and auricle empty.

Liver, kidneys, &c., healthy.

Wounds.—Right forefoot bitten at 11-53 a.m., and leg greatly ecchymosed; coagulum marks the entry of the fang. Tissues discolored from rapid death (local) and decomposition.

Right hind-leg bitten at 1-32 p.m.; less ecchymosed; mark of fang indicated by a point of coagulum of a dark colour.

Bite on right ear also ecchymosed, also snout, in both of which places he was bitten. Blood coagulated in all the veins after being opened for an hour; coagulum firm.

Microscopical examination of blood shows nothing unnatural, excepting perhaps a slowness of the red globules to run into masses like piled coin in rouleaux.

The fact that this pig was twice severely bitten, and that death did not occur for nearly three hours, seems to shew that the animal is not very susceptible. A large dog would probably have died in less than half an hour.

It is true that the first Cobra, though a large and powerful one, was probably somewhat exhausted, but the second was perfectly fresh, and had only that morning been brought in by the snake-catcher, freshly caught.

Experiment No. 4.

At 12-53, a small Dhamin (Ptyas Mucosus) was bitten by a fresh Cobra about 5 feet in length.

12-59.—Dhamin weak and sluggish in his movements.

1-3.—Bitten again by the same snake.

On the floor, moves slowly and with difficulty; growing manifestly weak.

1-12.—Gasping for breath; very low; voluntary muscular power gone. Still, when roused, can move and raise his head, as if he had been roused from a state of overpowering nervous oppression. Breathes slowly and imperfectly; does not half-fill his lungs.

Bitten at 12-53.
Died at 1-14 p.m.
Dead in 21 minutes.

This is further proof of the deadly action of the poison on innocuous snakes.

Experiment No. 5.

At 12-55 p.m., a large Cobra was bitten by a full-grown, freshly-caught Cobra; they were both of one variety, that marked with one ocellus in the hood, the *Keauteah* of the snake-catchers.

The scales were scraped off, and the snake was made to imbed his fangs deeply in two different places about 10 inches from the head. There could be no doubt of the penetration, or of the injection, of a large quantity of poison.

At 12-59 five drops of Cobra-poison, taken from the snake, were injected, by means of the hypodermic syringe, into the muscles of the Cobra's back.

1-30.—No effect produced; the Cobra is as lively as ever.

1-45.—Still unaffected.

4-30.—Still unaffected.

18th August, 5 *p.m.*—The snake is as well as ever.

This experiment goes far to prove the immunity of the Cobra from the noxious effects of the poison of its own species.

Experiment No. 6.

1-20 p.m.—Civet cat (Viverra Malaccensis) bitten by a Daboia. The snake struck in more than one place.

1-25.—Appears paralyzed.

1-26.—Appears almost dead.

1-30.—Still breathing imperfectly; stretches his legs as if from spasms.

1-32.—Got up on his fore-legs and vomited; lying down exhausted.

1-37.—When roused, he seized a stick, but is evidently half paralyzed in the hind-quarter; lies down again on left side.

1-40.—Gets up again when irritated, breathes hurriedly, and lies down at once. Evidently very drowsy and much exhausted.

1-47.—Tries to get up of his own accord; finds he cannot;

rolls over on other side; right hind-leg paralyzed. Continues restless and endeavouring to move, and has again succeeded in changing his position.

1-57.—Lying flat on side with all his legs stretched out. Can be roused, but his hinder extremities still paralyzed, and he does not give fight as before. Is uneasy and restless.

2-12.—Roused; walks about much better, but his right hind-leg is very weak; quite paralyzed. Put into his cage; gave much more fight.

2-30.—Seems reviving, but he is restless and manifestly uncomfortable; lying down, and at full stretch, on side.

4-15.—Purged freely; very low; evidently at the point of death.

4-25.—Convulsive movements for two or three minutes; stretching the limbs, &c.

4-36.—Dead.

Body examined, showed the animal to have been bitten on the nose, on the side of the head (in the temporal muscle), and in the thigh.

The *post-mortem* appearances of the viscera were like those in other animals.

This viper was the same that had been frequently used in other experiments before described, and must have been considerably weakened. The deadly nature of the snake is manifest from this continued power of inflicting mortal wounds, and it is probable that it has the power of rapidly secreting fresh poison. It is regarded with great dread by the snake-catchers, and evidently with good reason.

2 & 5.

EXPERIMENTS ON THE INFLUENCE OF SNAKE-POISON.

By J. Fayrer, M.D.,

Professor of Surgery, Medical College of Bengal.

September 11*th*, 1868.—I am indebted to Messrs. Greenhill and Rutherford, Veterinary Surgeons, for the opportunity of making the following experiments. The horses experimented on had been condemned to be destroyed for the disease, partial paraplegia (gone in the loins), and were placed at my disposal by the above gentlemen, for whose valuable aid in noting the symptoms and recording the pathological conditions I am under much obligation. The disease, though incapacitating the animal for work, is not such as to reduce his strength so much as to vitiate the evidence derived from the effects upon him of the poison; and I believe these experiments may be accepted as fair illustrations of the action of snake-poison on the larger animals. The subjects experimented on were a stud-bred mare about 14-3 high and aged 27 years, suffering from partial paraplegia, and an Australian horse, 15-1, 9 years old, a powerful animal, and in good condition, though also paraplegic. The mare succumbed in an hour and twenty minutes from the effects of the bite of a large Cobra; whilst the stronger and younger horse survived the bite of a poweful, fresh, and full-grown Daboia nearly twelve hours.

The difference in the effects of the poison of the Daboia and Cobra in these two cases is very remarkable, not only as to the duration of life in the animals bitten, but also in the pathological conditions before and after death.

The mare bitten by the Cobra was rapidly affected—staggered, became exhausted, and died in less than an hour and a half. The post-mortem examination shewed distinct rigor mortis, firm coagulation of the blood; the heart and large vessels, aorta as well as venæ cavæ, distended by firm ante and post-mortem coagula. The lungs were very slightly congested, frothy when cut into, and on the anterior surface rather pale and bloodless than the reverse—whilst all the abdominal viscera were equally free from congestion. The horse bitten by the Daboia, on the other hand, was affected very slowly, and seemed to doze his life away until just at the last, when a few unconscious plunges terminated his existence ; the post-mortem in this case shewed less cadaveric rigidity, fluid blood, empty cardiac cavities, and lungs and other viscera congested.

But it is to be noted that the Cobra bit more vigorously, forced his fangs deeper, and had to deal with a more feeble animal than the Daboia, who bit a more powerful and healthy horse, and did not insert his teeth with such vigor as the Cobra. The snakes were both fresh and full-grown, and their terrible power was strikingly illustrated by the death of these two horses.

The difference observed in the pathological appearances, and state of the blood after death, may probably be accounted for by the greater rapidity of death in one case, rather than by any essential difference in the nature of the action of the poisons. The mare bitten by the Cobra died in 80 minutes, and after death the blood coagulated firmly, and was found distending the heart and great vessels with firm coagula. Death was probably caused by the rapid effects of the poison on the nerve-centres, before the blood had time to be thoroughly devitalized. In the other case, where death did not occur for nearly 12 hours, there was no coagulation either in or out of the heart or vessels; sufficient time had elapsed to allow the blood to be thus thoroughly changed. I am inclined to believe that if death were protracted after a Cobra-bite, the condition of the blood would be as it was in the case of the Daboia-bite.

Experiment No. 1.

A bay Australian gelding, 15-1 high, 9 years old, and partially paraplegic, (but otherwise a strong, well-conditioned horse) ; pulse 42, soft ; respiration 48 per minute ; was bitten by a full-grown fresh Daboia Russelli near the lower part of the neck, *over* the track of the right jugular.* The snake struck vigorously and drew blood freely. The time was 12-15.

12-19.—Respiration 58 (gone up 10) : pulse still 42.

12-30.—Respiration 64 ; pulse now 64. The puncture swollen.

* The vein was not penetrated.

12-52.—Lies down ; looks languid ; pulse 80 and weak.

1-1.—Twitching of head to the near side ; horse still down and very dull. Lower lip pendulous ; muzzle resting on the ground ; sight and hearing natural.

1-5.—A spasmodic twitch of the muscles of the neck ; patches of urticaria, about the size of a shilling, making their appearance on the abdominal surface.

1-9.—Pulse 70, intermittent.

1-6.—Pulse 76 ; respiration 52. Can rise from the recumbent posture without much effort.

3.—Pulse 80, tremulous and intermittent ; horse looks dull and sleepy ; yawning, getting up, and lying down again very frequently, as in colic.

4-30.—Pulse 67, weak and intermittent ; breathing hurried ; horse standing, but very dull ; wound swollen, and very painful to the touch ; mucous membrane of mouth pallid ; ears and legs cold ; body moderately warm ; when roused is quite sensible.

6.—Horse lying down, breathing heavily ; pulse almost imperceptible at the jaw, 60 ; fugitive colic pains.

9-30.—Breathing stertorous and very heavy ; body and extremities cold ; pulse imperceptible ; horse drank a little water, but is evidently sinking ; region of wound much swollen and very painful ; purging thin, watery fœces (they were quite natural when the horse was bitten).

11-45.—Down and struggling ; getting up and moving to and fro in the loose box restlessly ; then lying down again and struggling with all four legs ; straining and passing small quantities of watery fœces with flatus.

12.—Dead.

Bitten at 12-15.

Died at 12, midnight—*i.e.*, in eleven hours and three-quarters.

Post-mortem 12 hours after death. Cadaveric rigidity moderate ; abdomen distended, and mucous membrane of rectum partially congested and swollen ; vicinity of wound blackened by infiltrated blood in the cellular tissue. Muscles all discolored, and general venous congestion apparent.

Thorax.—Heart, right auricle empty ; right ventricle contained a little frothy blood ; left auricle and ventricle both empty ; substance of heart firm, but presents numerous small ecchymosed spots. Larger blood vessels as usual. Blood in them fluid.

Lungs congested.

Liver and spleen congested.

Mucous surface of intestines in a highly irritable state, congested and thickened.

Other viscera healthy.

EXPERIMENT No. 2.

A stud-bred mare, about 14-3 high, aged 27, suffering from partial paraplegia and enphysema of lungs, but otherwise strong was bitten at 12-22 in the integument of root of the neck on the right side, and just above the right nostril, by a full-grown, fresh, and vigorous Cobra (Naja Tripudians). The punctures bled freely. Before being bitten the pulse was 57, respiration 36.

12-26.—Pulse 60; restless; moves the head about in an uneasy manner.

12-35.—Looks anxious and restless; leans hind-quarter against the wall; twitchings of nostrils.

Eyes staring; Tapetum lucidum shining brilliantly; ears retracted; tail raised.

12-43.—Staggering; keeps the hind-quarter resting against the wall, as though to prevent falling; staring, anxious eye. Patches of urticaria rapidly breaking out over the body.

12-44.—Pulse 64, weary.

Spasmodic twitching of the pectoral muscles; staggers much in the hind-quarters.

12-53.—Straining, but nothing passed; so restless now that the respiration cannot be counted; the wound is swollen and painful; urticaria profuse; drinks freely of cold water; eats hay.

12-59.—Looks sleepy; staggering; left off eating.

1-12.—Same state; right fore-leg twitching in a spasmodic manner.

1-20.—Intense restlessness; staggering; tremulous action throughout the whole muscular system.

1-27.—Drinks water freely; tries to move about in the loose box, but staggers so much that it keeps on its legs with difficulty. The right side of the upper lip seems paralyzed. Pawing restlessly with right fore-foot.

1-32.—Lies down.

1-36.—Peculiar spasmodic action of paniculus carnosus.

The horse is evidently dying ; convulsive plunging of all four legs. Head drawn towards the chest (This, Mr. R. says, is very unusual).

1-42.—Muscular twitching over the whole body.

1-43.—Dead.

Bitten at 12-22.

Died at 1-42—*i.e.*, in one hour and twenty minutes.

Post-mortem one and a half hour after death.

Thorax.—Lungs, slight hypostatic congestion ; surface, natural color.

Heart.—Cardiac cavities distended with firm coagula. The clots were very firm, and were partially decolorized, probably indicating their ante-mortem origin.

The great venous and arterial trunks, especially the aorta and venæ cavæ, plugged with firm coagula ; blood that was removed from the jugular vein, found after death coagulated firmly.

Blood examined under microscope, with No. 3 eye-piece ¼-inch object glass ; Nachet ; was natural ; no change in the corpuscles.

The liver and spleen were normal, not in the least congested. There was rigor mortis.

I examined the blood of the horse killed by the Daboia about 18 hours after death ; it was dark and perfectly fluid ; no coagulum had formed.

On placing a drop of it under the microscope, the field filled was with rhomboidal tabular and acicular crystals probably of hæmato-crystallin, in great abundance.

The corpuscles appeared to have been dissolved or disorganized, and the few that I could find after repeated examinations were apparently the ordinary blood corpuscles shrivelled and partially broken down. The weather being hot and damp, the blood had probably become somewhat decomposed, and therefore I am unable, beyond describing the crystals, to give a very reliable account of the changes that had occurred. It appears to me it is in a case like this, where death was protracted, that if any structural changes take place in the corpuscles, one should find them.

I was unable to detect any such changes ; but as the examination was necessarily somewhat imperfect, I cannot say certainly, in this case, that they did not really occur. It was remarked just before and after death, that there was a peculiar pallor of the mucous membrane of the mouth.

The relative disproportions between the pulse and respiration is accounted for by a disorded condition of the pulmonary air-cells known in stable language as "broken-winded," which was the case to a certain extent in both these animals.

PRESENT :—Dr. Fayrer, Professor Partridge, and Mr. Seeva.

EXPERIMENT No. 1.

26th September, 1868.—At 12 a Daboia, two-thirds grown, was bitten in three places in the thoracic region, from a foot to six inches from the head, by a full-grown, fresh, and vigorous Cobra. There could be no doubt that this snake was well bitten; the Cobra imbedded his fangs viciously, and kept his hold for some time. There were blood marks after each bite.

12-55.—No effect.

2-2 *p.m.*—No effect.

5.—The Daboia is apparently unaffected.

27th September, 10 *a.m.*—No change.

28th, 2 *p.m.*—No change.

30th.—No change.

2nd October.—Still alive and well.

EXPERIMENT No. 2.

A full-grown Cobra was bitten by another full-grown, fresh, and vigorous Cobra in the body, in two places, about six inches from the head, and also in the mouth. They both bit each other freely in this situation—blood was drawn by the bites—at 12 o'clock.

12-55.—No effect.

2-2 *p.m.*—No effect.

5.—Both perfectly well.

27th September, 10 *a.m.*—No change.

28th, 2 *p.m.*—No change.

30th, *noon.*—No change.

2nd October, *noon.*—No change.

EXPERIMENT No. 3.

A large black Cobra was bitten about 12 o'clock in the body in two places, a foot and six inches from the head, and also on the head, by a large and vicious Daboia; blood was slightly drawn. There could be no doubt that the fangs had penetrated, or that the poison was inoculated.

12-55.—No effect.

2-2 *p.m.*—No effect.

5.—No effect.

27th September, 10 *a.m.*—No change.

28th, 2 *p.m.*—No change.

30th, *noon.*—No change.

2nd October, *noon.*—No change.

Experiment No. 4.

A fowl was bitten in the thigh by a Daboia at 12-15. It was convulsed immediately, and quite dead at 12-16-40. Dead in 100 seconds. The blood coagulated after death.

Experiment No. 5.

A hypodermic syringe filled with about 30 drops of the blood, taken from the above fowl immediately after death, was injected into the thigh of another fowl at 12-20.

It walked about; was soon rather lame in the injected leg; gradually became sluggish; drooped; could walk if roused, but remained quietly crouching. It gradually drooped and died at 4-10 p.m.

Experiment No. 6.

Mr. Sceva injected the blood of the fowl (experiment No. 5) into another fowl's thigh at 4 p.m., 26th September.

27th September, 10 *a.m.*—Fowl still alive.

28th September, 2 *p.m.*—The fowl is alive and apparently well, excepting slight lameness in the injected leg.

30th, *noon.*—It is still alive. There has evidently been no effect produced.

2nd October.—The fowl recovered.

Experiment No. 7.

A fowl was bitten by a large Cobra in the thigh at 12-19-5, and fell into convulsions immediately, and was dead in 50 seconds.

Blood coagulated after death.

Experiment No. 8.

A hypodermic syringeful of the blood of the fowl bitten by the Cobra in experiment No. 7, taken from the heart, was injected into a fowl's thigh at 12-29.

12-32.—Sluggish ; lame in punctured leg.

12-47.—Walks about, but is drowsy.

1-24 *p.m.*—In much the same sluggish state ; another syringeful of the serum that had separated in the clotting of the same blood (that of No. 7) was again injected into the fowl's thigh.

1-52.—Lying down, resting its beak on the ground ; very drowsy and sluggish.

2-2.—Cannot be roused.

Died shortly after, at 3-16 p.m.

Experiment No. 9.

A fowl bitten in the thigh at 12-36 by the Daboia that had bitten the Cobra. It walked abcut immediately after with slight muscular twitching.

12-36-45—Standing with the lame leg drawn up.

12-40.—Pecking at food. Walks, but staggers slightly.

12-41.—Bitten again in the thigh by the same snake, which is evidently much exhausted.

12-43.—No very apparent effect.

12-43-33.—Fell over in convulsions.

12-44-15.—Dead.

This experiment shews that the snake was much exhausted by previous biting.

Experiment No. 10.

A fowl was placed near a fresh Daboia,* free on the ground. The snake, on being irritated, struck the fowl somewhere about the neck at 12-49. It fell into convulsions immediately, and was dead at 12-49-45, that is, it was completely dead in 45 seconds.

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* The Daboia is naturally very sluggish, and not aggressive, unless irritated, when it strikes with great rapidity and deadly precision.

Mr. W. Blanford tells me of an instance where a Daboia was carried home by a gentleman who thought he had got a young Python. It did him no injury, and he only became aware of the danger he had escaped by the snake striking at and killing a dog that approached too near it.

This experiment shews the terribly deadly nature of the Daboia's poison.

Experiment No. 11.

A Cobra was injected at 1 p.m. with fifteen drops of *his own* poison; the syringe was inserted about 8 inches from the head.

Ten minutes after there was no effect.

At 5 p.m. the snake was still unaffected.

September 27th, 10 *a.m.*—No effect.

30*th September, noon.*—No effect.

This experiment seems to shew that the Cobra is not poisoned by his own venom.

2*nd October*.—Seems sluggish, but after so long an interval; it may be from other causes.

Experiment No. 12.

Five drops of Cobra poison, diluted with about ten drops of water, were injected with the hypodermic syringe into the innerside of a cat's thigh at 1-7-45 p.m.

At 1·12 restless; muscular twitchings; mewing loudly.

1-13.—Partially paralyzed; dragging the punctured leg; breathing very much hurried. As the cat crouches on the ground the hind-quarters fall over as though paralyzed.

1-14.—Tries to walk; drags the hind leg.

1-56.—Sluggish; apparently in no pain; does not move, even when roused.

[*Mr. Sceva reports after this.*]

2-20.—Lying on its side, with hind leg extended; profuse flow of saliva from the mouth, and symptoms of nausea. Frequent evacuation of thin fœcal matter.

2-30.—Raised the head and fore part of the body; dragging the hind limbs for a short distance on the floor.

3.—Attempted to get up again, but was unable to do so.

3-5.—Died, slightly convulsed. The blood coagulated firmly after death. It was examined by Professor Partridge and myself, and no change from the normal structure could be made out. The corpuscles, red and white, were unchanged, excepting that some of the red ones were shrivelled.

The quantity of poison used was only 5 drops, and that was mixed with water. It was injected at 1-7-45 p.m.; the cat died at 3-5 p.m., rather less than two hours.

It is evident from this that the poison does not suffer by mixture with water.

Experiment No. 13.

A large Cobra was injected at 1-33 p.m. with five drops of the solution of strychnia, gr. i. to ʒi., near the head.

It was convulsed and powerless at 1-36.

At 1-40 muscular tetanic twitchings.

1-42.—Dead.

This experiment shows that a poison is rapidly effective in the snake when inoculated into the circulation.

Experiment No. 14.

A Cobra was injected with about 15 drops of the poison of another fresh and vigorous Cobra at 1-43 p.m. The poison was carefully injected with the hypodermic syringe about eight inches from the head. The Cobra inoculated was of the pale, yellowish-coloured variety, with a single occellus on the hood. It was very active and vicious, the most so of any I have seen. It was sent to me a short time ago by the Police authorities; having been captured after biting a native lad in a boat, who died, it is said, within an hour after being bitten.

At 2-2 p.m. and 5 p.m. not affected; as vicious and active as ever.

At 10 a.m. of 27th September still unaffected.

30th September, noon.—Still unaffected.

2nd October.—Still quite well.

Present:—Dr. Fayrer and Mr. Sceva.

Experiment No. 15.

28th September.—At 1-17 p.m., a fowl, half-grown, was bitten in the thigh by a Daboia; convulsed immediately, and dead in 35 seconds.

Experiment No. 16.

Blood drawn from the heart of the fowl in experiment No. 15 (two hypodermic syringefuls), about ʒi., injected into the thigh of another half-grown fowl at 1-22 p.m.

7-15.—No effect of the poison perceptible as yet.

29th September, 6 *a.m.*—Crouching; profoundly drowsy. Head resting on beak; falls over as if the bird had gone off into a sound sleep; starts up and falls over again, like a creature that cannot keep awake.

In this state it remained, got more drowsy, and died at 2-40 p.m.

Experiment No. 17.

29th September.—At 2-50 p.m. a half-grown chicken was injected in the thigh with ten drops of the blood of the chicken of experiment No. 16.

30th September, 2 *p.m.*—Appears to be slightly affected; feathers ruffled; tail depressed; not so active as it was.

2nd October.—It recovered, having been only very slightly affected.

Experiment No. 18.

28th September.—A half-grown fowl was bitten in the thigh at 12-15 a.m. by a very vicious and active Cobra (one that had killed a child, and was itself the subject of experiment on the 26th). The fowl became convulsed immediately, and was quite dead in about 34 seconds.

The muscles generally and heart were found to be without any irritability in a few minutes after death. The blood coagulated firmly.

Experiment No. 19.

Two syringefuls of the blood of the fowl in experiment No. 18 were injected into the thigh of a full-grown and strong fowl at 12-25 a.m., 28th September.

12-27.—It seemed much excited; this passed off, and at 1-26 p.m. it seemed very little affected, except that it was purged.

2 *p.m.*—Appears drowsy.

2-30—Effects of the poison are manifest; wings drooping. It crouches, resting the point of the beak on the ground.

3.—Crouching on the ground; body inclined to one side. One leg partly extended, with wing extended over it.

3-30—Lying down, with wings partilly extended; a small quantity of liquid running from the beak. Head lying on the ground; nearly insensible.

3-56—Dead.

Experiment No. 20.

September 28th.—About 25 drops of blood, taken from the heart of the fowl of experiment No. 19, injected into the thigh of a half-grown chicken at 3-56 p.m.

At 7-15 p.m. no change, except slight lameness from the puncture in the leg.

September 29th.—No change; no symptom of being affected by the poison.

September 30th, 2 p.m.—Chicken remains unaffected.

2nd October.—Chicken well.

After September 29th the chicken did not seem to be affected in any way by the injection until October 5th, when it appeared weak, and passed the latter part of the day with its head partly under its wing. It has eaten heartily during the time since September 29th, and appeared as lively as the other chickens that were kept in the room with it It died on the following day, October 6th, and on examining the body it was found to be greatly emaciated. No trace of any other injury or disease, except the poisoning of the blood, could be discovered.

Experiment No. 21.

September 29th.—An Ophiophagus Elaps, about 8 feet long, that had been deprived of its fangs by the snake-men, was made to shed its poison by squeezing the jaws; a drop or two of clear, yellow, viscid fluid exuded.

This, diluted with water, was inoculated into a fowl's thigh, a puncture was first made with a lancet, and the poison was introduced with an ordinary quill pen.

For the first two or three minutes no apparent effect was produced: the bird walked about as usual. It then began to look uncomfortable; stood still; seemed dazed; sat down and soon crouched itself together; began to droop, to nod its head and rest its beak on the ground. This state of drowsiness gradually increased; it seemed to be profoundly sleepy, attempting to rouse itself with a start, and falling off again into a profound state of narcotism.

At 12-30 it was almost unconscious, and could not rise on its legs; when roused, opened its eyes, made an attempt to raise the head, which fell over again. Its condition seemed to be in all respects one of profound narcotism.

12·37.—A few convulsive movements only indicate life.

12·40. Still a few convulsive movements and stretching of the neck.

12·46.—Dead.

The wound much discolored and ecchymosed; emphysema of the areolar tissue about it. The blood clotted firmly after death.

At 1·40 p.m. some of the blood (half a syringeful, 15 drops) was injected into the thigh of another fowl.

30th September, 2 p.m.—More than 24 hours and it is not affected; eats heartily; looks bright and active. The quantity of blood injected was very small.

2nd October.—Quite well.

This, imperfect as it is, is the first opportunity I have had of experimenting with the poison of this snake; it is rare; and the snake-catchers have not been able to procure me a fresh and wild specimen. The snake experimented with has been for some time in the hands of the snake-catcher. The man who brought it had borrowed it from a friend, and he was unable to say how long it had been in captivity, or where it had been caught. This Ophiophagus Elaps is the largest kind of poisonous colubrine snake, and a very formidable and terrible creature it is. In general form it resembles the Cobra, having the head and hood similarly shaped. Its fangs are like those of the Cobra, and its venom is said to be equally deadly in proportion to its size. It is very active and aggressive, has great power of turning itself in a short space on its own body, and when about to attack, assumes the same erect and menacing attitude as the Cobra.

In color it differs from the Cobra, being of an olive-green and marked with triangular bars of white edged with black, which are very conspicuous on the hood and tail. The hood is proportionately not so large as in the Cobra, and there are other unimportant anatomical differences which I need not detail here. It attains to a great size, 12 feet or even more, and is therefore probably one of, if not the largest poisonous snakes known. There is only one species of the genus which has received its name from its habit of feeding on other snakes.

"Supernè olivaceo viridis, striis saggittalibus nigris
Cinctus, abdomine glauco-nigro marmorato."—*Cantor.*

It is said to be very dangerous and aggressive (Dr. Cantor says "it is very fierce, and is always ready not only to attack, but to pursue when opposed"); and stories are told—I know not if truly—that it has chased men for hours when disturbed in its native haunts. It has a variety of synonyms: Ophiophagus Elaps (Bengalee name Sunkr Choar); Naja Bungarus; Naja Elaps; Naja Vittata; Hamadryas Ophiophagus; Trimeresurus Ophiophagus; Hamadryas Elaps.

Such are the synonyms given from different authorities by Gunther. The first is the one by which it is generally recognized by naturalists in the present day. It has a wide geographical distribution, and is found in Bengal, though I have not yet ascertained the localities in this province that it most affects. The snake-catchers say it is to be found in the Soonderbuns and other dense and secluded jungle, and that it is difficult and dangerous to capture. It is certainly found in Burmah and the Tenasserim Provinces and Assam. Gunther speaks of three varieties: the one experimented with, found in the Malayan Peninsula, Bengal, Peninsula of Southern India; another in the Phillipine Islands; a third in Borneo.

These are merely varieties, and are distinguished by some difference in colour. It has, Gunther says, been found in every part of the Indian Continent—in the Andaman Islands, Java, Sumatra, Borneo, and the Phillipine Islands, and, according to Dumeril, in New Guinea. It inhabits hollow trees, and is sometimes found between their branches.

Its food, as its name implies, consists of other snakes.

PRESENT:—Dr. Fayrer and Mr. Sceva.

EXPERIMENT No. 22.

October 2nd, 1868.—The Ophiophagus Elaps, mentioned in experiment No. 21, September 29th, that had been deprived of its fangs, was made to shed its poison by squeezing the poison-glands; a drop or two only could be obtained, so much having been secreted in four days. It had the same appearance as on the first occasion. This, diluted with an equal quantity of water, was injected with the hypodermic syringe into a fowl's thigh at 12-30 A.M. The fowl was not immediately affected, and being carelessly placed near an open door, it made its escape into a drain, in which, as it did not emerge, I presume it died. The opportunity of watching the effects of the poison was lost; but the experiment is interesting, as it shews that the poison is secreted although the poison fangs are removed, and it shews the rate at which it was secreted, about two drops in four days. The snake had not been fed, but on this occasion it was fed with a Passerita Mycterezans, (a green whip-snake) that was poisoned by a Cobra.—*Vide* experiment No. 23. The snake-man put the head of the dead snake into the Ophiophagus' mouth; it seemed delighted to have it, and proceeded to swallow it forthwith, gradually drawing it into its gullet by alternate lateral movements of the lower maxillary bones. The process of swallowing occupied about five minutes, during which the Ophiophagus moved slowly about with the anterior part of his body raised and his hood distended, the Passerita hanging out of its mouth. The last few inches of the tail were swallowed more slowly than the rest.

A second Passerita being offered shortly after, was declined, and its head ejected from its mouth.

Experiment No. 23.

A green whip-snake, more than three feet long (Passerita Mycterezans), was bitten by a Cobra, about ten inches from the head, at 12-37 a.m.

At 12-38, sluggish; moves less actively; gapes, keeping the mouth wide open.

12-39.—Almost paralyzed; mouth now closed; head lying on the side. The body is swollen where bitten.

12-40.—Dead.

Death was very rapid; a peculiarly active and vigorous, though innocuous, snake killed in two minutes by the poison of the Cobra.

Experiment No. 24.

At 12-48 p.m. a Cobra bit a Cobra in three places near the head. They were both vigorous, fresh, and full-grown.

1-10 p.m.—Appears rather sluggish.

At 1-11 this bitten Cobra bit a fowl in the thigh; it died in four minutes.* I should note that it had been partially

* *Vide* experiment No. 28.

exhausted by biting the Passerita, which it killed in two minutes.

1-16.—Appears rather sluggish as it lies on the floor.

At 1-35 it appears in its natural state; raises its head, expands the hood, and strikes when threatened.

At 1-43 it was bitten severely in the body, about a foot from the head, by a Daboia, one of those that have been some time in confinement.

At 1-47 it appeared to be affected; was sluggish, and lay with its hood shrunken and its skin shrivelled. It is possible that in presenting it to the Daboia to be bitten it may have been squeezed, but it did not appear so. It remained in this sluggish state, and was dead at 4-10 p.m.

Experiment No. 25.

A Passerita Mycterezans, (green whip-snake,) rather smaller than the former one, bitten in the body at 1-40 by a Daboia.

At 1-45 p.m. almost powerless. It gradually became more and more exhausted, gaped like the one bitten by the Cobra, and was dead at 2-2 p.m., or in 17 minutes.

The Daboia was one of those long in confinement, and had no doubt become exhausted.

Experiment No. 26.

A large black Cobra bitten in the body by a Daboia at 1-52 p.m., October 2nd, at about a foot from the head.

At 2-20 no change.

October 3rd, 6 a.m.—No change.

Experiment No. 27.

A full-grown Cobra bitten by a Daboia in the body at 2-4 p.m.

At 2-20 no change.

Died at 10-30, October 4th.

Experiment No. 28.

A half-grown fowl was bitten in the thigh by a Cobra at 1-11 p.m.

At 1-11-45 it crouched, drooped its wings, rose, staggered, and dropped down.

At 1-13 drooped its wings; rested on its breast, with the point of its beak on the ground.

1-14.—Convulsed and dying.

1-15.—Dead. Died in four minutes.

The Cobra was not quite fresh; it had bitten the Passerita, and had itself been bitten by another Cobra before biting the fowl.

EXPERIMENT No. 29.

At 1-25 about four drops of the blood of the above fowl (experiment No. 28) were injected into the hind-quarters of a sorex cærulescens (musk-rat.)

At 1-35 eating a portion of the dead fowl, apparently not affected, unless it may be perhaps rather sluggish.

At 5-30 a.m. of 3rd October the musk-rat found dead; appeared to have been dead two or three hours; no sign of any injury, but the syringe puncture in the thigh apparent.

The evidence of experiments Nos. 1, 2, 3, 11, 14, 26, goes to shew that the Cobra and the Daboia are not affected by each other or by their own poison.

The experiments Nos. 24, 27, on the other hand, would prove that the Cobra succumbs to the Daboia. If such really be the case, it is probable that any one poisonous snake will affect another, and that consequently the Cobra would poison the Daboia. The subject is still, therefore, not set at rest, and more experiments only can decide it.

There is abundant evidence to prove that the innocuous are rapidly affected by the venomous snakes, and that such is the case may be considered as decided, though, no doubt, the poison tells less rapidly or fatally on them than on warm-blooded animals.

It will probably prove to be still less active in the invertebrata, but this has yet to be tried. That the venomous snakes themselves are affected by other poisons, is proved by the rapidity with which they succumb to strychnia and carbolic acid. The weight of evidence, so far, would shew that the venomous snakes are, if not proof against, at least not readily affected by each others' poison.

The matter, however, remains still *sub judice.*

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EXPERIMENTS ON THE INFLUENCE OF THE POISON OF THE COBRA, THE DABOIA, AND THE BUNGARUS, AND OF CERTAIN METHODS OF TREATMENT.

By J. Fayrer, M.D., C.S.I.

Present: Dr. Fayrer and Mr. Sceva.—July 10th, 1869.

Experiment No. 1.

A large and powerful pariah dog was bitten in the thigh, by a daboia russelli at 3-22 p.m., the dog shewed signs of pain when the fangs penetrated. 3-25.—Walks, but drags the bitten limb. 3-28.—Is lying down; on rousing the dog he is unable to stand; defecation and micturation occurred; shows no signs of suffering beyond occasionally a suppressed whine; tries to stand, but is unable to do so; contents of bladder dribbling away. 3-32.—Respiration hurried; pupils dilated; rolls his head uneasily, but keeps the neck turned more to one side; twitching of eyeballs; stretches out the fore-legs in a convulsive manner. Lies otherwise quite paralysed. 3-35.—Breathing regularly, but lies motionless. 3-38.—In the same condition; respiration 40 in a minute; slightly raises his head at intervals. 3-45.—Still breathing, but lies perfectly still, giving occasionally a low suppressed whine. 3-53.—In the same condition; has watery purging. 4 p.m.—In the same condition; respiration 45 in a minute. 4-7.—Can just raise its head when roused, the limbs seem quite paralysed. 4-9.—Muco-sanguineous purging: other symptoms the same. 4-18.—Still breathing; more muco-sanguineous purging. 4-20.—In the same condition. 4-40.—In the same position; lying on his side; legs extended; breathing still. 4-45.—Slight twitching of the muscles generally; respiration irregular, and feeble. 4-50.—Dead: a slight tremor, but no convulsive movement preceded death.—Bitten at 3-22 p.m.; dead at 4-50, or in 88 minutes. The body was examined one hour and twenty minutes after death. The lungs were not congested. The liver was darker colored than natural. The blood in the heart and great vessels was perfectly fluid, nor did it coagulate when collected and set apart.

I examined the blood at noon on the 11th July most carefully and deliberately under the microscope, with a high power. There was no change. The red and white corpuscles were in their natural relative quantities ; a very few of the red ones were crenate. But there was not a trace of any new cell or molecular matter in the blood.

The perfect and permanent fluidity in the blood was remarkably illustrated in this experiment.

EXPERIMENT No. 2.

A pariah dog was bitten at 3-28 p.m. in the thigh by a large bungarus fasciatus said to be quite fresh, and about four and a half feet long ; the bites drew blood. Walking about ; drags the leg slightly. 3-34.—Looks depressed and is salivated. 3-36.—Walks about ; looking scared. 3-40.—Bitten again in the thigh by the same bungarus ; the dog evinced no sign of suffering. 3-42.—Looks dejected ; foaming at the mouth ; salivated. 4-7.—The dog is sick and vomited a quantity of frothy mucus ; vomiting repeated frequently. 4-10.—In walking he looks depressed, as though excessively nauseated, and limps on the bitten leg. 4-12.—Vomiting continues ; lies down for the first time ; breathing hurried. 4-17.—The nausea and vomiting continue ; looks scared and depressed. 4-20.—Excessive vomiting of frothy mucus. Lies down ; is convulsed in the hind legs ; looks very ill. 4-29.—Hurried catching respiration ; twitching of the hind legs. 4-32.—Walking slowly and feebly with a dejected look ; vomits frequently, and froths profusely from the mouth. 4-33.—Stands with his head drooping ; still very sick ; leans his body for support against the wall. 4-45.—No change. 5 p.m.—Appears better. 5-15.—Looks better ; no vomiting ; respiration more natural. 5-40.—Lying down ; when raised on his feet, appears weak, but otherwise better. On lying down, arranged his legs in a natural position as if for sleeping. 6-10.—On being again roused, he walked about ; his legs appeared feeble at first, but appeared to recover the use of them. 9-15.—Sleeping comfortably ; on being roused, looks brighter and intelligent.

11th July, 6 a.m.—Remained during the night without changing his position; on being placed on his feet appears weak, particularly in the hind legs, he appears somewhat numb in the legs.

I received the following report on the 13th July :—

"The dog died at about 10-30 p.m., of the 12th. Bitten at 3-28 p.m. of the 10th July; dead at 10-30 p.m. of the 12th, or in about 53 hours. Yesterday morning (the 12th) I observed that he was very weak. During the day, and up to the time of his death, he remained lying on one side, with the legs extended, passing at intervals muco-sanguineous matter. On opening the body this morning, I found the blood coagulated in the heart and great vessels." The blood sent to me on the 13th was firmly coagulated. Under the microscope, it presented innumerable needle-like crystals of hœmato-globulin. The red corpuscles visible were very few in number, and were not, so far as I could judge, changed in any way. But I would speak with reserve about the corpuscles of this blood, as the field was so entirely filled with the crystals that little else could be seen even after careful dilution with water and agitation. It is possible that new cell forms may have been there, and escaped detection. The mass of the red corpuscles seem to have been converted into crystals. In both this and the preceding case, the blood was examined some time after death, but I failed to detect any new cell growths.

Experiment No. 3.

A young cobra, about ten inches long, was bitten at 3-45 p.m., by a fresh full-grown cobra (keauteah) near the tail, so that the viscera might not be injured. The fangs were seen to penetrate, and no doubt could exist that the poison was fairly inserted. Being put on the ground, it crawled away vigorously, seemed unaffected by the bite. 5 p.m.—No change. 11th July, 6 a.m.—No change; it is quite well and active. On the 13th July, I saw it quite well. On the 17th, it was found dead; apparently it had been dead about 12 hours.

Experiment No. 4.

Another young cobra of the same brood as the last (No. 3) was bitten by a fresh daboia near the tail like the last. The fangs penetrated, and the poison was freely inserted. 5-10.—

No change. 6-15.—No change, except that, when moving about, the end of the tail beyond the part bitten appears stiff, and does not move so freely as the rest of the body. This is accounted for by the nature of the wound inflicted by the formidable fangs of the viper. 11th July.—No change. 13th.—The snake is alive and apparently well. On the 17th, it was found dead, and decomposed; it had probably been dead three or four days. These two young cobras were of one brood; they were caught a few days ago, and are said by the snake-men to be about a fortnight or ten days old.

There could be no doubt about their having been fairly bitten by the cobra and the daboia; on the 10th no evil result followed up to the 13th, though they died subsequently. Surely this is strong proof that the cobra is but little, if at all, susceptible, to the poison of its own species. These snakes being so young, may have died from want of food, and partly from the effects of the wound, independent of the poison. They were alive on the 4th day after being bitten.

Experiment No. 5.

A white half-grown kitten was bitten by a bungarus fasciatus, said to be fresh, at 4-9 p.m., in the thigh. It seemed much excited shortly after. 4-25.—Lying in the former position, stretching out the fore-leg in a convulsive manner. 5 p.m.—In much the same condition. 6-10.—It has been very restless; now seems inclined to sleep; appears to be free from pain. 9-15.—Does not appear now to be much affected by the poison.

11th July.—It seems better.

13th July.—The kitten was quite well.

It was evident in this case, that the animal was not mortally, though thoroughly, bitten, for the snake was made to close his jaws on the part and drew blood. This, I believe, is just the sort of case which probably frequently occurs when men or animals are accidentally bitten—enough venom is injected to cause symptoms of poisoning, but not enough to destroy life. And the man or animal recovers chiefly by his or its own inherent power of recovery. Had I administered any of the so-called antidotes, or injected any of the proposed remedies, the recovery might have been attributed to the means used.

That a man or animal so poisoned may be benefited by the use of stimulants, or other therapeutic measures, I do not for a moment deny, but, as I have before said, this is a very different matter to that of administering an antidote that shall neutralize the poison, and by so doing save life.

Experiment No. 6.

Another kitten of the same size and age, as that in experiment 5, was bitten by a cobra in the left thigh, at 4-16 p.m. The bite was very imperfect, and was repeated at 4-20 p.m.

At 4-24.—The kitten very restless, and springing about violently. 4-25.—Hurried breathing; restlessness. 4-45.—Becoming weaker; respiration irregular. 5-5.—Convulsive movements generally. 5-20.—Dead in one hour and four minutes. 6-20.—Body opened one hour after death. Lungs natural; no congestion; the blood, on being removed from the heart and great vessels, soon coagulated firmly.

Experiment No. 7.

A bungarus fasciatus was fairly and deeply bitten by a fresh cobra, at 4-27 p.m., near the tail; no doubt of the penetration of the fangs and inoculation of the poison. No effect was produced. The bungarus was well and active on the 16th, five days after the bite.

Experiment No. 8.

A bungarus fasciatus was thoroughly bitten by a fresh daboia, at 4-32 p.m., near the tail.

No evil result followed; the bungarus remained unaffected; on the 16th July was in its normal condition.

Several facts of importance are proved, or their probability confirmed, by the preceding experiments.

In death by poisoning by the daboia, and therefore, probably by all the viperine order—viperidæ and crotalidæ, the coagulability of the blood is generally destroyed. I say generally, because, though frequently, it is not invariably so. In the experiment on the fowl, it was found that the blood had coagulated. It remains fluid after death on exposure to the air.

The most careful and protracted microscopic examination could detect no structural change in the corpuscular elements of the blood. Death is more protracted, but the deadly effects of the poison are even more quickly manifested than in death from cobra-poisoning.

In point of lethality both appear equally dangerous.

In death by cobra-poisoning, the blood coagulates firmly after and even before death, as *post-mortem* examinations made at all periods, from immediately, to an hour or more after death, have shewn the blood to be coagulated firmly. No changes in the corpuscular elements have been seen in any of the microscopic examinations I have made.

The poison of the bungarus is less deadly than that of the cobra or daboia, but it is very dangerous, though it is slow in producing its worst effects. It also does not destroy the coagulability of the blood. Perhaps, this may prove to be the case with all the poisonous colubrine snakes. No change was observed in the corpuscular elements, *i.e.*, of such as remained. But the red corpuscles had passed, in the case of the blood of the dog that died from a bungarus bite, into a state of excessive crystallization of a needle-like and long tabular form.

It is very doubtful if the cobra and daboia are affected by each other's poison; but the evidence on this point is not yet complete.

The bungarus is also less susceptible to the poison of the daboia and cobra than the *innocuous* snakes, if, indeed, it be affected at all.

Death was not caused by asphyxia in any of these cases. Everything tends to show that it is due to direct exhaustion from paralysis of the nerve-centres.

EXPERIMENTS ON THE USE OF THE LIGATURE AND CARBOLIC ACID IN THE TREATMENT OF SNAKE-BITES.

By J. Fayrer, M.D., C.S.I.

Present :—Dr. Fayrer and Mr. Sceva.—July 17th, 1869.

Experiment No. 1.

A large and powerful pariah dog was bitten in the thigh, at 2-45 p.m., by a fresh cobra (keautiah). The hair had been previously removed from the part in order that the puncture of the snake's fangs might be distinctly seen. The moment the fangs were withdrawn, the punctures were scarified, and carbolic acid at once applied, and well inoculated into the bites. The tissues were whitened, and the blood coagulated by the acid. 2-53 p.m.—The dog looks depressed and dejected; hanging his head. 3-12.—Lying down; looks dejected, but perfectly intelligent. 3-15.—Respiration hurried. 3-23.—Pupils widely dilated. In convulsions, rolled over on the other side; respiration irregular and catching. 3-27.—Violently convulsed. 3-30.—Respiration has ceased, but the heart still beats distinctly. 3-31.—Dead in forty-six minutes. The carbolic acid was evidently of no service in this case.

Post-mortem examination at 5 p.m. Blood coagulated; no crystallization under microscope.

Experiment No. 2.

A fowl had the feathers removed from the thigh, so that the bites might be seen, and was then bitten there at 2-54 p.m. by a daboia. The wounds were immediately scarified, and the carbolic acid thoroughly applied to the bites. The fowl fell over in convulsions when released, and was dead in less than sixty seconds. The body was opened at 3-35, or in about 40 minutes after death, and the blood was found to be coagulated in the heart and great vessels; some fluid blood escaped into the thorax. The lungs were not in the least congested. The condition of the blood was particularly noted, as it has generally been found fluid in the mammals dead from the daboia-bite.

Post-mortem examination of dog, experiment No. 3.

Blood examined at 5 p.m.: fluid when removed, but coagulated on exposure to the air.

Microscopical examination: no crystals; no change.

EXPERIMENT No. 3.

The poison of a fresh cobra (gokurrah) was taken from the snake in my presence, and ten drops of it immediately injected with the hypodermic syringe into a middling-sized dog's thigh, at 3-3 p.m. The tube of the hypodermic syringe was not removed; and the syringe being filled with carbolic acid, about 20 drops were injected exactly in the track of the poison, and in the shortest space of time possible. 3-8.—The dog is depressed; looks scared; hangs his head; twitching of the hind legs when he is raised. 3-15.—Lying on his side almost paralysed; pupils widely dilated. 3-20.—Is convulsed. 3-22.—General twitching of all the muscles of the body; is quite unconscious. Respiration has ceased, but the heart still beats distinctly. 3-25.—Heart still beats. 3-27.—Irregular action of heart. 3-29.—Dead in 26 minutes. In this case there could be no doubt of the perfect inoculation of the carbolic acid, for it followed the poison through the same channel, and in the shortest possible space of time, in which any local remedy could be applied, and yet without producing the slightest benefit. The second of time by which the poison preceded it, was sufficient to cause death; no remedy could have been applied more rapidly, unless it had been mixed with the poison and introduced with it; in which case the venom might have been probably decomposed and rendered inert. It appears to be impossible to overtake the poison, and neutralize it when once in the circulation, however rapid may be the inoculation of the supposed antidote.

EXPERIMENT No. 4.

A fowl was bitten in the thigh by a daboia at 3-19 p.m. The carbolic acid was immediately applied to the wounds which had been at once scarified. 3-19-30.—Fowl in convulsions. 3-20.—Dead in one minute. Body opened. Blood in heart and great vessels had coagulated.

EXPERIMENT No. 5.

A small dog bitten in the thigh, by a bungarus fasciatus, (one used last week) at 3-13 p.m. The bites drew blood. 3-29.—Looks dejected. 5-20.—No further change.

18*th July*, 7 a.m.—No change. At 12, noon, the dog appears very weak; has not altered his position (recumbent) since last report. 6 p.m.—The same; refuses food; gradually drooped throughout the day.

19*th July*.—Died at 1-35 p.m., in about 46 hours and 27 minutes. Blood examined at 7-45 p.m.: blood clotted after death firmly; the serum paler than usual; corpuscles natural; no crystallization.

EXPERIMENT No. 6.

A fowl was bitten by another bungarus, which had also been used last week, at 3-32 p.m. 3-40.—The fowl looks uneasy, but not otherwise affected.

18th, 7 a.m.—Crouching on the floor; wings drooping. *Noon*.—Unable to stand; profuse flow of watery blood from the beak. 3 p.m.—Lying on its side; eyes closed. 5-40 p.m. —Died in 26 hours and 18 minutes. Body opened at 6 p.m.; blood coagulated; under microscope no crystallization had occurred.

EXPERIMENT No. 7.

A fowl was bitten by a cobra in the thigh at 3-45-30. Ran about for a moment when placed on the ground. 3-46.—Crouched; resting its beak on the ground; fell over, and was dead at 3-47.

Body opened at 5-10 p.m.

Blood fluid, but coagulated on exposure to air.

EXPERIMENT No. 8.

A daboia was well bitten by a cobra near the tail, at 4-5 p.m. 18th July, noon.—No change. 18th July, 6 p.m.—No change; no effect was produced. The daboia was alive a week after being bitten.

EXPERIMENT No. 9.

A varanus flavescens was bitten by another daboia, at 4-15 p.m. The daboia had bitten before. He did not strike his fangs readily through the hard skin of the lizard.

18th July, 3 p.m.—No change. 6 p.m.—No change.

The varanus was not affected; it was alive a week after being bitten.

The daboia was not fresh; and it did not bite vigorously, hence the escape of the varanus.

Experiment No. 10.

A cobra was bitten by a daboia, near the tail, at 4·3 p.m., and was bitten again by another daboia, at 4·8 p.m., near the same place.

18th July, 5 p.m.—No change; a week later—no change.

Note.—The bungarus bitten by the daboia, on Saturday, 10th July, was found recently dead on Saturday, 24th. Death may be due to natural causes. The bungarus bitten at the same time by a cobra is alive and well on the 24th July.

Present: Dr. Fayrer and Mr. Sceva.—July 24th, 1869.

Experiment No. 1.

In the experiments hitherto performed, the snake has been made to close the jaws on the part bitten, and not been left to strike in the natural way. With the object of ascertaining whether there be any difference in the effect of the compulsory and voluntary bite, the following experiment was performed; and I observed in this, as on other occasions, that the snake rather attempted to frighten than to bite the dog, and it was not until the cobra was much irritated by repeatedly bringing the dog near him, that he gave the fatal bie. It struck the dog twice in the hind leg, apparently without any effect, but afterwards struck, and for a moment fastened on to the thorax. Two slightly bleeding points marked where the dog was bitten—this was at 3·32 p.m. 3·45.—The dog is affected; vomited and was purged; very restless. 3·50.—Vomiting and staggering as he walks. 3·53.—Convulsed. 3·57.—Heart still beating irregularly; respiratory moments ceased. 3·58.—Dead—in 26 minutes. Another object of this experiment was again to search in the *post-mortem* blood for the corpuscles described by Professor Halford.

The body was opened at 5 p.m., or about an hour after death. The blood coagulated firmly, and was repeatedly examined under the microscope with a high power; but I could detect no change whatever in its corpuscular elements. The lungs, as usual, were free from congestion.

EXPERIMENT No. 2.

Placed a ligature round a fowl's thigh, and tied it very tightly. The fowl was then bitten by a cobra, at 4 p.m., below the ligature. The ligature was tied as tightly as it could be drawn, and appeared to arrest the circulation completely, for the part below became livid, and the limb was paralysed. 4-13.—The fowl lies quiet, and does not seem to be affected by the poison. 4-17.—Is active and lively; hops about in the sound leg. 4-20.—Does not seem to be in the least affected by the poison; at this period, that is, 15 minutes after the bite, the ligature was removed. The limb was turgid and livid from congestion. The bird began to droop almost immediately the ligature was removed. 4-22.—Drooping; does not rise; when raised crouches again. 4-23.—Head falling over; can hardly move. 4-24.—Convulsed. 4-30.—Still alive; faint; convulsive movements continue. 4-33.—Dead. Bitten at 4-5 p.m.; ligature removed at 4-20; no effect of poison being manifested.

Dead at 4-33,—*i.e.*, 13 minutes after the ligature was removed. The poison was slow of entering with the stagnant blood of the congested limb, but it did enter and killed in 13 minutes.

EXPERIMENT No. 3.

A fowl was bitten in the leg by a cobra, and a ligature tightened round the thigh immediately. This was at 4-10 p.m.

4-12.—Runs about; limping on the bitten leg, which is almost paralysed by the ligature, and livid with congestion.

4-17.—Slightly affected; appears to droop a little. 4-27.—No apparent effect of the poison. 4-30.—Scarified the fang punctures deeply, and rubbed the carbolic acid well into the wounds until all the blood coagulated, and the scarified surfaces were whitened by the acid. 4-31.—Removed the ligature; the fowl hops about, dragging the wounded limb, but not affected, apparently, by the poison. 4-35.—Poison now beginning to take effect; the fowl, as it was running, staggered and fell forwards, it then crouched, and its respirations was very rapid. 4-40.—Cannot walk; when raised falls over again. 4-42.—Head drooping; eyes closing,; beak resting on the ground.

It continued alive until 5-35; and during this time it showed distinct reflex action of legs, if the feet were pinched, and of the wings as in flying when raised in the air. It remained lying on its side, and died at 5-35 p.m.

Bitten at 4-10 p.m.

Ligature applied *immediately*.

Ligature removed 4-31, in 21 minutes.

Dead at 5-35, or in 64 minutes after the ligature was removed. These experiments are very interesting. They prove that the poison enters, and proves fatal by way of the blood vessels.

That if a ligature be sufficiently tightly applied (the great difficulty), the entry of the poison may be much, if not altogether prevented; and that probably the application of carbolic acid or other caustic agent to the part poisoned, if thoroughly ligatured, may do good by decomposing the poison in the blood in which it is mingled.

But that too much faith must not be reposed in the acid or cautery is proved by this and former experiments, where the poison was prevented from entering the circulation by means of the ligature, and was subjected to the action of the acid whilst so detained; yet, when the ligature was removed, and the stagnant circulation again restored, death followed from the slow absorption of the poison which, notwithstanding the thorough application of the acid, yet retained enough of its deadly qualities to cause death.

A fowl bitten by a cobra generally dies in a few minutes. It will be seen by these two experiments how long the fatal event was delayed by aid of the ligature and acid.

Experiment.

Monday, 26th July.—The same ophiophagus elaps mentioned in former experiments was brought to me again to-day. No new fangs had been re-produced: and it looked thin and half starved. The snake-men say, that no new fangs have ever re-placed those originally taken out. I obtained by squeezing the glands about four drops of a deep orange-colored viscid looking fluid of the consistence of mucus. I made a slight puncture on a fowl's thigh with a lancet, and with an ordinary pen inoculated some of this yellow fluid into the wound, at

11¼ a.m. For some time the fowl seemed unaffected, but in the afternoon I found it in a lethargic state, crouching with the head drooping, and the point of the beak resting on the ground. It gradually drooped. There appears to have been no convulsions, and at 10 p.m. it was dead.

This experiment shows that the entire loss of the poison fangs, and consequent comparative inactivity of the glands, does not deprive them of the power of secreting poison; though, no doubt, it diminishes the activity, and probably modifies the nature of the secretion. All other snake-poison that I have seen taken from the armed and vigorous snake of whatever family, has been a clear limpid fluid. In this case, it was a deep rich orange-color, and of the consistence of mucus. It proves also, that on the first removal of the poison fangs, the reserve fangs may also be removed, leaving the reptile disarmed for life. This is not always effected by the operation of the snake charmers, for they well know, and occasional fatal accidents have proved, that a new fang takes the place of the old one. I have had the fangs carefully removed from a cobra, and am keeping him to see in what time the new ones come forward. In one instance, I found that, after a fortnight, a pair of new fangs had replaced those removed, but they were not thoroughly anchylosed to the maxillary bones. A daboia, whose large fangs were removed with the same object, died shortly after the removal of the teeth, but whether the death was due to the operation, or to natural causes, I am unable to say. There is at present, a daboia that has not touched food or water for six months in my possession; every effort having been made in vain to make the snake eat or drink, and it is vigorous and vicious as when first caught; but its venomous powers are probably diminished. During this period, the daboia has frequently changed its epidermic covering, and there are occasional deposits of solid urinary excreta passed. It never moves unless roused, when it is very active and vicious. The only conclusion that I can come to, is that it may have obtained moisture from the damp air, and may have swallowed flies or cockroaches or other insects that have found their way into the cage. But it certainly has neither taken food nor water in any other way during this period.

EXPERIMENTS ON THE INFLUENCE OF SNAKE-POISON, AND THE USE OF CERTAIN REPUTED ANTIDOTES; AND THE EFFECTS OF EXCISION, &c.

BY J. FAYRER, M.D., C.S.I.

Present:—DR. FAYRER and MR. SCEVA.—July 31st, 1869.

EXPERIMENT NO. 1.

Mr. R——'s (of Jounpore) antidote, the powdered root or bark of a plant, name and family unknown, was tried to-day on a dog.

The drug had been sent to me for the purpose, and was fresh and potent.

Half of a powder, the quantity directed by Mr. R——, was given, having been first carefully rubbed, and mixed with about an ounce of water.

A pariah dog was bitten in the thigh by a cobra at 3-3 p.m., and was much excited by the bite. At 3-6 p.m., as symptoms of poisoning appeared, the first dose of the antidote was given, and was all swallowed. The dog was led about, and cold water dashed on its face and thorax, when it seemed drowsy. 3-8.—Lies down; very restless. 3-9.—Hurried breathing. 3-10.—Dog lies down; rises again, and runs about in a restless and excited manner. 3-12.—Restless and uneasy; head swings about as though it were giddy; breathing accelerated. 3-17.—It staggers as it is walked about; cold water sprinkled on its head and chest. 3-18.—The second dose given, that is, the other half of the powder, as directed. 3-20.—The dog is worse; cannot stand, staggers and reels when walked about, and falls over; convulsive movements of head and neck. 3-22.—Convulsed; pupils widely dilated. 3-24.—Dead—in 21 minutes.

The dog was not a large one, but it was healthy and vigorous: the instructions sent with the drug were carefully followed.

The result is not favourable to the drug as an antidote in the canine race.

EXPERIMENT No. 2.

A dog had a ligature made of stout cord, *soaped* to make it knot tightly, thrown loosely round the fore-arm. It was then bitten by a cobra below the ligature, which was tightened as firmly as a man's strength could draw it. Immediately after the bite, a red hot iron was then introduced into the fang wounds, and the bitten part thoroughly cauterized, strong carbolic acid having first been well rubbed in.

Bitten at 3-31 p.m.

Ligature tightened within five seconds.

Carbolic acid and actual cautery applied at 3-33, that is, in two minutes after the bite, and one minute and fifty-five seconds after the ligature was tightened. The limb seemed to be completely strangulated, it became livid; blood oozed from the fang wounds, and the limb was all but paralysed. There could be no doubt that the limb was thoroughly strangulated, or that the bitten parts were well cauterized. 3-36.—Notwithstanding all the above precautions, the dog is already much affected by the poison; is lying prone, unable to rise or to walk; the breathing hurried; and convulsive movements occurring occasionally. 3-40.—Convulsed. 3-41.—Dying. 3-42.—Dead—in 21 minutes.

There was at the most an interval of five seconds between the cobra's bite and the tightening of the ligature, which was not afterwards relaxed. This experiment clearly proves that the poison is taken into the circulation very rapidly; certainly five seconds did not elapse between the bite and the application of the ligature, which had been previously thrown loosely round the limb, in order that no time might be lost in tightening it after the bite, and yet the dog (it was a small one), died of the poison in 21 minutes.

During that very brief interval sufficient poison entered the circulation to destroy life. It is possible that more may have entered after the ligature was tightened, but the quantity must have been very minute, as the ligature was very tight. In an ordinary snake-bite it is difficult to conceive that a ligature could be applied more speedily than in the case of this dog. So that, even this method of treatment, rational as it certainly is, can only be regarded as of doubtful benefit.

I should note, and it is a subject, I believe, that I have not alluded to before in other experiments, that the rigor mortis took place in about 1½ hour after death, in these two dogs. The blood coagulated after death.

Experiment No. 3.

A fowl had a ligature placed on the thigh loosely: it was bitten by a cobra at 3-47. The ligature was tightened at the same time that the snake bit; before its fangs were withdrawn, the ligature was thoroughly tied, so tight that the limb seemed completely strangulated, the part becoming livid and disabled. 3-50.—No sign of the poison taking effect; the fowl hops about on the sound leg. 3-52.—Actual cautery applied to the fang punctures, which were bleeding freely venous blood from the conjested limb, and the wounded parts surrounding were thoroughly disorganized.

The ligature was then divided; the fowl being placed on the ground ran about; the ligatured limb still paralysed.

3-54.—Fowl crouching, but rises and runs about when disturbed. 3-55.—Looks drowsy; is crouching, and begins to hang its head, closing the eyes. 3-57.—Head drooping, beak resting on the ground. 3-58.—Fallen over on its side, rises with a convulsive movement, and falls again. 4 p.m.—Is unable to stand or walk. 4-4.—Convulsive movements. 4-11.—Dead—in 24 minutes. Blood coagulated after death, when removed from the great vessels.

This experiment, more than ever, proves the subtle and deadly nature of the poison. The ligature in this case prevented the entry of the poison into the circulation, which was evidently retained in the congested part of the limb below the ligature. Carbolic acid and the actual cautery applied to the wounds, most thoroughly, failed to destroy it. Yet no sooner was the ligature relaxed than the poison entered the circulation, weak and altered as it must have been after the severe pressure of the ligature, and rapidly killed the bird. This proves that there is danger after removal of the ligature when it has been most effectually applied. The poison spreads itself by diffusion throughout the juice of the strangulated part; so that nothing short of destruction or removal of the whole of that part seems to offer a hope of subsequent escape from toxic absorption.

With reference to the application of a ligature above the bitten part, I would here remark that it is almost physically impossible with the power of one pair of hands so to tighten a cord round a dog's leg, as thoroughly to strangulate the limb. The experiments seem to prove this, but also to shew that it is possible completely to arrest the circulation through a fowl's leg in this manner.

With tourniquets it might be done no doubt, and a man's arm or leg, certainly his toe or finger, might be so strangulated, but, as ordinary snake-bites, do not occur where any tourniquets other than sticks and cords, or the like, are forthcoming. The desideratum is to obtain the most perfect compression of the limb, in the simplest way possible, sufficient at all events to prevent immediate entry of the poison, through the circulation; and this may be done with an ordinary cord or strip of cloth, twisted with the common stick tourniquet, and the fullest extent that the strength of the hands is able to twist it. But it must be borne in mind that this compression only extends to a certain depth, and that deeper, the circulation still goes on; with this, the poison retained by the ligature in the partially strangulated portion will soon communicate by diffusion, and symptoms of poisoning will supervene. In such a case we may fairly hope that the amount of poison entering the blood has been so far limited as not to be fatal, and that we may, therefore, be able to help the sufferer, though the troubles caused by the reduced dose of the poison. But it is obvious that the urgent necessity is for the application of some agent that will equally diffuse itself, and neutralize or destroy the poison whilst yet retained, and only partially diffused through the strangulated part.

In this, as far I can understand it, lies the only hope of safety in a real cobra-bite.

Carbolic acid or other allied substances would probably be useful. But it is obvious that the success of this, or, indeed, of any mode of treatment, lies in the promptitude and tension with which the ligature is tied, and the decomposing agent applied.

EXPERIMENT NO. 4.

DR. W. J. PALMER, Professor of Chemistry, was present also.

A fowl had a ligature thoroughly tightened round the thigh, and was then bitten below it, by a cobra at 4-7 p.m.

4-19.—No effect of the poison visible. 4-22.—Breathing rather hurried, but otherwise seems unaffected. 4-30.—Begins to shew signs of the effects of the poison, nods its head drowsily, rests its beak on the ground; it is evidently affected. 4-35.—Much the same; 30 drops of the liquor ammoniæ injected in three doses with the hypodermic syringe. 4-37.—Fowl is drooping fast, cannot move. 4-41.—Convulsed. 4-44.—Lies unconscious, but convulsed. 4-50.—Dead.

In this case the ligature, which consisted of a cord soaped to make it run easily and knot firmly, was tied round a fowl's thigh, from which the feathers had been stripped, with the greatest amount of tension that a man's hands could exert. The part below the ligature became livid, and the limb paralysed. In this condition it was bitten at 4-7 p.m. The ligature was never relaxed, and certainly did not slip, yet at 4-30, perhaps earlier, that is, in 23 minutes, it began to shew that the poison had, notwithstanding the ligature, found entry into the circulation. Its death, 21 minutes later, proved that sufficient poison had entered to destroy life, and also proves, I think, that it is almost beyond our power to keep it out. The question is, supposing the strangulation of the limbs to have been complete, how did the poison enter? It must have passed the barrier of the ligature, how did it do so? I can only explain it by supposing that tense as it was, it was not sufficiently constricted to prevent some diffusion of the poisonous fluids through the compressed tissues, and, that in the space of 23 minutes, enough found its way in to destroy life.

From this experiment, I think, we may fairly deduce the amount of safety that may be expected from the ligature. That it retards the entry of the poison is abundantly proved, and that it gives time, therefore, to operate on the retarded venom is also obvious. But it is equally evident, so subtle is this poison, and such is the power of diffusion, that nothing short of the most rapid and effective application of the ligature, and the immediately subsequent application of some decomposing agent, can, in a *bonâ fide* cobra-bite, offer any hope of safety.

Experiment No. 5.

A fowl was deeply bitten in the thigh by a daboia at 4-31. The snake had been in confinement for some time, but it was vigorous and vicious, and plunged its fangs deeply into the bird's thigh, drawing blood. 4-36.—Not affected. 5 p.m.—Not affected.

No symptoms of poisoning occurred, and the fowl was alive and well on the 2nd of August.

This experiment is a most instructive one, and proves that a poisonous snake may bite without poisoning. It is not in the least probable that this daboia was altogether exhausted, for although in captivity it had been at rest for many days, and had not exhausted its poison by biting; another daboia that had been six months in captivity, and had eaten nothing during that period, killed a fowl rapidly by one bite. It furnishes an explanation of some of the so-called recoveries from snake-bite, in which, when the snake has been seen and the punctures of its fangs are visible, the patient recovers from the mental alarm and prostration after the administration of one of the supposed antidotes. That such alarm does cause temporary, physical as well as mental, prostration I have had proof in the following case :—Some time ago, on visiting the hospital one morning, I was told that a man had been admitted during the night suffering from a snake-bite, and that he was very low.

I found him in a state of great prostration, he was hardly able to speak, and seemed to be in a state of great depression. He and his friends said that during the night in going into his hut, a snake bit him in the foot; that he was much alarmed, and rapidly passed into a state of insensibility when they brought him to the hospital. They and he considered that he was dying, and evidently regarded his condition as hopeless. He was in fact in that condition not unfrequently described, from which the sufferer has been snatched by the timely administration of an antidote. On asking for a description of the snake, they said they had caught it and had brought it with them in a bottle. The bottle was produced, and the snake turned out to be a small innocent Lycodon. It was alive, though somewhat injured by the treatment it had received. On explaining to the man and his friends that it was harmless, and with some difficulty making them believe it, the symptoms of poisoning rapidly disappeared, and he left the hospital as well as ever he was in his life in a few hours. Had no snake been found, and had an antidote been given, who would have been prepared to dispute its efficacy? I am sorry to destroy popular and favorite illusions, when they are harmless, but in a matter of this kind, it is well that the truth should be known.

Experiment No. 6.

A fowl was bitten by a daboia in the thigh at 4-49 p.m. The snake has been over six months in captivity, during which time it has steadily refused to take food or water. It was active, vigorous, and vicious; it plunged its fangs deeply into the fowl's thigh and drew blood.

In 20 seconds the bird was violently convulsed; in 60 more seconds it was dead.

Contrast this experiment with the preceding one, and I think it confirms what I said as to the occasional uncertainty of a snake-bite. These two daboias were both old, that is to say, old in captivity. They were both, notwithstanding, vigorous, and bit fiercely. In one case no evil resulted from the bite; in the other, rapid death.

The blood of the fowl was examined after death. Dark colored coagulated blood was found in one of the great vessels near the heart. In others, and in the cavities of the heart it was fluid, and remained so after death.

It is worthy of notice that in the mammals poisoned by the daboia, the blood was found to be fluid, and to continue so after death. In birds it was sometimes coagulated. Could this be due to the rapidity with which life was extinguished in the bird?

Present :—Dr. Fayrer, Dr. W. Palmer, Professor of Chemistry, and Mr. Sceva.—August 7th, 1869.

Experiment No. 1.

A pariah dog was bitten by a cobra (*Teturiah Keautiah*, of the snake-men) in the hind leg at 3-5 p.m. At 3-8 p.m., thirty drops of liquor ammoniæ sp. gr. ·959, diluted with three parts of water, were administered. 3-12.—Dog lying down, licking the wound; when walked about, limped on the bitten leg; breathing hurried. 3-15.—Thirty more drops given as before. 3-22.—Lying down; limbs twitching. 3-23.—Thirty more drops given. 3-24.—Convulsed; lying down; unable to rise. 3-25.—Dying; limbs convulsed; pupils widely dilated; *tapetum lucidum* very brilliant. Heart still beating, no respiratory movements. 3-26.—Pupils contracted again (this is a phenomenon I have not before observed.) 3-28.—Another thirty drops of liquor ammoniæ administered. 3-29.—Heart still beating irregularly. 3-30.—Dead—in 25 minutes.

Ammonia has long been considered one of the most potent of all remedies in snake-bites. The object of this experiment was to test its value. The result is not encouraging.

Experiment No. 2.

Mr. R——'s "antidote" was again put to the test. The powder was rubbed into a pulp mixed with water in the proportion directed; it was then administered to a dog at 3-31 p.m. The dog was then bitten by a cobra in the thigh. 3-35.—The dog is affected by the poison, looks scared, and limps in the bitten limb. 3-37.—Staggers, lies down; breathing hurried. 3-39.—Another dose administered. 3-43.—Limbs convulsed. 3-45.—Paralysed; heart beating irregularly. 3-59.—Heart still beats; no respiratory movements. 4 p.m.—Dead—in 28 minutes.

I am afraid the antidote must be regarded as inapplicable to the canine race.

Experiment No. 3.

Jugular vein of a pariah dog exposed at 3-42, and a diluted solution of liquor ammoniæ sp. gr. ·959—one part to water two parts—to the extent of 30 drops, injected. No apparent inconvenience caused to the dog by the injection. At 3-43, the dog was bitten in the thigh by a cobra. 3-48.—Dog showing signs of the poison; 30 more drops, diluted in the same way with 6 of water, again injected into the jugular vein. Shortly after this, the dog began to turn round and round in the most restless manner; 30 more drops injected similarly diluted in the other external jugular, as a large thrombus had formed in that part exposed. 4-10.—Dog convulsed. 4-12.—Cannot stand, limbs paralysed. 4-13.—Violently convulsed all over. 4-20.—Dead—in 37 minutes.

The cobra was not fresh in this case, and yet it killed in 37 minutes. The injection of the diluted ammonia was not more satisfactory than that of the undiluted, as far as its immediate antidotal effects were concerned; but it would appear that the injection of diluted liquor ammoniæ into the jugular vein is not followed necessarily by convulsions, or other violent constitutional disturbance.

Experiment No. 4.

Some of the blood of the dog killed by the cobra in the first experiment, where the ammonia was given, was removed from the body about three-quarters of an hour after death. It was found to be firmly coagulated, but some of the serum and part of the clot mixed with water, to the extent altogether of 40 drops, were injected with the hypodermic syringe into a fowl's thigh, the actual quantity of blood thus used could not have been more than a few drops. The injection was made at 4-20 p.m. 4-35.—Slightly affected by the poison. 5 p.m.—Crouching, head drooping, appears giddy. 5-30.—Lying on one side; convulsive movements. 5-35.—Dead—in 75 minutes.

What can more forcibly illustrate the extraordinary virulence and potency of the poison than this experiment? A few drops of the blood of a dog poisoned by a cobra, diluted with water, injected into a fowl's thigh, killed the bird in 75 minutes. The quantity must have been excessively minute, but it proves how it retains its power, although diluted and mixed with the blood.

Present :—Drs. Fayrer, W. Palmer, and Mr. Sceva.—
August 14th, 1869.

Experiment No. 1.

A gentleman residing in Rohtuck having forwarded to me the powdered root or some other part of a plant, name and family unknown, which he had found useful in the treatment of snake-bites, and having requested me to test its efficacy, the following experiment was made :—

ʒi of the powder was rubbed with six peppers into a pulp and mixed with water.

A pariah dog was then bitten by a cobra (variety *Kurris Keautiah*) of the snake-men, in the thigh at 3-13 p.m. ; part of the antidote was then, according to Mr. F.'s direction, rubbed into the punctures, and the remainder administered internally, immediately after the outward application. 3-18.—The dog is affected by the poison, he is restless, nauseated, making efforts to vomit ; walks with a staggering gait. 3-22.—Limbs partially paralysed. 3-23.—Convulsed, unable to rise. 3-25.—Lies perfectly motionless, muscles generally twitching. 3-26.—Dead—in 13 minutes.

The drug had evidently no effect in retarding the action of the poison. The dog, which was a medium-sized animal, died even sooner than usual.

Experiment No. 2.

A Mahomedan hakeem, Mahomed Khan, presented himself with some medicine with which, he said, he had succesfully treated several cases of snake-bite in men. It was a strong aromatic smelling powder, dissolved in water, but he could tell me no more than that it was a jungle root. He asked to be allowed to try it, and appeared quite confident of success. A very large and powerful pariah dog was then placed at his disposal, also a cobra, which was not fresh, having been in captivity for some time, and had bitten before. He had the dog bitten in the thigh by the cobra at 3-35 p.m. He was allowed to do, or direct to be done, whatever he liked. At 3-36 he administered a quantity of the drug, which was swallowed by the dog. 3-37.—The bitten leg is partially paralysed. 3-45.—The dog is sluggish and lying down. 3-46.—A second dose administered. 3-48.—Hurried breathing. 3-50.—The dog is nauseated and rejected some half-digested meat. 3-55.—Uneasy; hurried breathing. 4-2.—Lying down, panting, frothing at the mouth. 4-5.—Retching. 4-7.—Lying down; looks depressed, but quite intelligent. 4-15.—When roused staggers as he walks. 4-18.—Lies prone, with the legs outstretched. Has very little control over the hind legs when roused. 4-20.—Another large dose of the drug administered by the hakeem. 4-21.—Limbs convulsed, unable to rise. 4-24.—Tries to rise, falls over. 4-26.—Convulsed. 4-32.—Is quite paralysed; pupils widely dilated. 4-35.—Heart still beats, no respiratory movements. 4-40.—Pupils contracted again (I have observed this symptom in another dog just before death.) 4-42.—Dead; pupils again dilated. Bitten at 3-35, dead at 4-42—in 67 minutes.

The dog was a remarkably powerful and vigorous animal. The snake was not fresh, and yet the dog succumbed in one hour and seven minutes.

The hakeem expressed much astonishment at the results; he evidently *believed* that his drug would prove an antidote. He said, in a somewhat depresed tone of voice, that he had other remedies. He was invited to put them to a similar test.

Experiment No. 3.

A very large and vigorous pariah dog was bitten in the marginal fold of integument between the thigh and abdomen by a cobra at 3-55 p.m. The part was immediately cut out with a bistoury, the places where the fangs had penetrated being completely removed. The instrument was at hand, and the operation was done at once. Two seconds, not more, might have intervened between the bites and the excision.

At 4 p.m., some brandy was poured down the dog's throat. 4-6.—Another dose of brandy administered. 4-16.—He is excited, and the respiration is hurried, perhaps from the brandy. 4-25.—The dog is not yet affected by the poison. 4-33.—Much the same, the breathing rather hurried. 4-42.—No symptoms of poisoning except the hurried breathing, and that may be from excitement. 4-47.—More brandy given. 4-50.—No symptom of poisoning as yet. 5-10.—Vomited; shews symptoms of being poisoned. 5-15.—Vomited again. 5-30.—Restless, breathing hurriedly; abundant flow of saliva. 6 p.m.—Slight convulsions; breathing hurried. 6-30.—Dead. Bitten at 3-55, dead at 6-30—in 2 hours and 35 minutes.

Here again the extraordinary virulence of the poison is shewn. The snake bit in a fold of skin which was immediately excised. Yet in the slight interval, it could not have been more than two seconds, enough of the poison had entered the circulation to cause death in two hours and thirty-five minutes, notwithstanding the free administration of brandy. The dog, too, was an unusually large and vigorous animal.

Experiment No. 4.

A fowl was bitten in the thigh by a cobra at 4-13 p.m. The part in which the fangs had lodged was immediately excised with a sharp scalpel. 4-17.—Fowl lying down, shewing no signs of poisoning. 4-20.—Fowl rather drowsy, eyes closing, head drooping. 4-25.—Breathing hurried; drowsy. 4-28.—When roused can stand, but cannot walk, and falls over; gasping. 4-31.—Convulsed. 4-33.—Dead—in 21 minutes.

This again shows the extraordinary virulence of the poison. The entire mass of muscle into which the fangs were impressed was clearly cut away within three seconds after the bite, and yet poison sufficient had found entry to cause death. That death was much retarded there can be no doubt, for the fowl lived twenty-one minutes, instead of three or four, after being bitten. Slight as the encouragement is to be derived from such experiments as this, it yet points in the right direction in which we are to look for any rational treatment.

Experiment No. 5.

A fowl was bitten in the carpal extremity of one wing, in a thoroughly vascular part, by a cobra at 4-40 p.m. This was amputated at the carpal joint immediately the fangs were withdrawn. The scalpel was ready, and it was removed within three seconds of the completion of the bite. The amputation was about half an inch above the highest fang's mark. 4-48.—No symptom of poisoning, no bleeding from the wing. The fowl is running about quite indifferent to either poison or amputation so far. 4-55.—No symptom of poisoning as yet.

August 15*th*, *Noon*.—The fowl is alive and well; in this case, the poison has evidently not entered the circulation, the excision having been in time to prevent it. These experiments all prove that the poison takes effect chiefly through the venous circulation, and that if excision be practised immediately and thoroughly, either the whole or part of it *may be* prevented from entering the circulation. No doubt some of the poison finds way into the circulation by diffusion from the centre of inoculation, and thus all may not be removed by even very free and very early excision. The natural deduction is, that the part should be cut out as rapidly and extensively as possible; otherwise, as in the cases of these animals, delay of a few seconds may prove fatal.

16th Series

EXPERIMENTS ON THE INFLUENCE OF SNAKE-POISON, AND ON THE EFFECTS OF CERTAIN METHODS OF TREATMENT.

By J. Fayrer, M.D., C.S.I.

Present :—Drs. Fayrer, Cutcliffe, and Mr. Sceva.—
August 21st, 1869.

Experiment No. 1.

A large pariah dog was bitten at 3-24 p.m. in the thigh by a cobra that had been in confinement for some weeks, and had bitten before. Strong carbolic acid was immediately rubbed in, the punctures having been scarified. 3-30.—The Hakeem who administered the "antidote" last Saturday again presented himself with another, and he was allowed to administer as much of it, a fluid resembling the former one, as he pleased. 3-37.—The dog staggers as he walks; another dose of the antidote administered by the Hakeem. 3-40.—The dog is slightly convulsed, pupils dilated, and limbs partially paralysed. 3-42.—Unable to stand when raised; is convulsed. 3-45.—Quite paralysed. 3-48.—Dead—in 24 minutes.

A gentleman who had believed, from some experiments performed under his own supervision, in the efficacy of carbolic acid, witnessed this experiment, and was satisfied that the acid is powerless to counteract the deadly effects of the poison. The Hakeem also expressed his conviction that the cobra-bite is inevitably mortal. Neither of these agents, indeed, had the slightest effect, and the dog died very rapidly, considering its size and strength, and that the snake was not fresh.

Experiment No. 2.

A small dog was bitten at 3-48 p.m. in the thigh by another cobra, also not fresh like the first. A solution of the powdered leaves of aristolochia indica, for which I am indebted nature of the excreta during the night, that the cat has been slightly under the influence of the poison. August 22nd, 1 p.m.—Looks well; appears free from pain; no symptom of the poison beyond slight weakness. 7 p.m.—The same.

This animal has also escaped; the experiment is not thoroughly satisfactory or conclusive, as the cobra was not fresh, and the tail is not a very vascular part. Still it is suggestive of the benefit to be hoped for from early excision, and seems to show that, although the operation may not altogether preclude the entry of the poison into the circulation, yet that it may limit it to a degree in which it is not fatal.

EXPERIMENT No. 7.

Two drops of carbolic acid put into a large cobra's mouth at 4-50 p.m. 4-52.—Twitching in convulsive movements. 4-53.—Faint. 4-54.—Dead.

This acid is very poisonous to all snakes.

Present:—Dr. FAYRER and Mr. SCEVA.—August 28th, 1869.

EXPERIMENT No. 1.

I have just received from Mr. H. B. Simson, C.S., from Monghyr, some leaves and stalks of a wild plant growing in that vicinity, named by the natives "Norbish," and reputed to be efficacious in the treatment of the bites of snakes or stings of other venomous animals, such as the scorpion, centipide and wasp. The plant was brought to Mr. Simson's notice by Baboo Hurrish Chunder. I have been as yet unable to find out its botanical name. The juice of the fresh plant was extracted and mingled with that of the green ginger, according to instructions.

A medium-sized, but strong and active dog was then bitten in the thigh, at 3-37 p.m., by a cobra (teturiah keauteah), that had been in confinement for some weeks. One ounce of the juice was administered at 3-39, and some of the juice, with the bruised leaves, rubbed into the fang punctures. The leg was partially paralysed almost immediately after the bite. 3-40.—Staggers in his hind leg as he walks. A second dose of the juice administered. 3-50.—The dog is lethargic, and breathes rapidly. 4 p.m.—Looks sluggish, and sick; walks feebly, dragging the hind legs. 4·2 p.m.—Another dose of the juice administered. 4·10.—Is sick; rejected a quantity of frothy mucus, tinged with the juice of the plant. 4·12.—Another dose given. 4·15.—Sick again. 4·18.—Constant retching. 4·21.—Staggering; very restless; keeps his nose on the ground. 4·27.—Again retching; rises and staggers as he walks. 4·30.—Fallen over on his side; convulsed. 4·32.—Violently convulsed. 4·35.—Slight convulsive movements in neck. Respiration has ceased. Heart still beats. 4·37.—Dead—in 1 hour.

This dog, though small, was full grown and vigorous. The snake was not fresh, hence, perhaps, the reason that death did not occur for one hour, instead of 30 to 40 minutes, as is usual.

Experiment No. 2.

A small pariah dog was bitten in three places in the thigh, by a full grown bungarus fasciatus, that was brought from Soorie, in Beerbhoom, about three weeks ago. The snake seemed vigorous, and was just completing the exfoliation of its epidermis. The snake bit at 3·48 p.m. At 5 p.m. there were no symptoms of poisoning, the dog, perhaps, looked a little depressed, but that might have been from fear. The bungarus would not strike, even when the dog trod on it; it did its best to get out of the way, as I have so frequently seen with other snakes. It was only when its jaws were closed by the snake-man on the dog's thigh that it bit. 6 p.m.—No change. 8 p.m.—Vomited. 9·15.—Lying down; on being raised on his feet appears weak; steps irregularly. August 29th, 7 a.m.—Vomited again. 9 p.m.—Lying on his side, in which position he has remained all day; refuses food. 30th, 7 a.m.—Appears to have recovered partially. Noon.—No further change. 6 p.m.—Looks better. 31st, 8 a.m.—Still improving; takes food and water. September 1st, 8 a.m.—Appears to be again suffering from the poison. 2nd.—Worse; unable to stand, or walk steadily. 3rd.—Unable to stand. 4th.—Unable to stand; tries to eat, but takes very little. 5th.—

Very weak ; has diarrhœa. 6th.—The same. 7th, 4-55 p.m.—Died.

This experiment remarkably illustrates the slow action of the poison of the bungarus, as compared with that of the cobra, or viper.

Experiment No. 3.

The same bungarus (Experiment No. 2) was bitten severely in three places near the tail, so as to avoid injuring the viscera, by a cobra (keauteah) at 3-54 p.m. At 5 p.m. there was no change, the bungarus was unaffected. 29th, 7 a.m.—Sluggish ; appears to have received some injury about the head and neck.

Mr. Sceva reports that the bungarus died on Sunday morning, beforenoon. He expresses a doubt as to its death being the result of the poison.

Experiment No. 4.

A fowl was bitten in the posterior part of the thigh, by a cobra (kalla keauteah) at 4-6 p.m. Immediately the snake's fangs were withdrawn the part was cut out ; the mass of muscle, including the two fang punctures, was completely excised ; certainly, not two seconds of time intervened between the bite and the removal of the part bitten. A ligature was placed tightly drawn around the thigh above the part bitten, and was relaxed just before the part was excised. The object of the ligature was to prevent entry of the poison by the circulation, during the short time that the fangs were actually imbedded in the flesh.

4-12.—Fowl crouching ; head beginning to droop. 4-13.—Head nodding; beak resting on the ground, but still easily roused, as though from sleep. 4-16.—Very drowsy ; head fallen over on the ground. Cannot stand or walk, but can still be roused. 4-25.—Can still be roused, but is very much depressed. 4-35.—In convulsions. 4-40.—Convulsive movements ; weaker. 4-56.—Slow respiration ; occasional convulsive movements. 5-10.—Dead—in 64 minutes.

It is evident that, although excision in this case did not save life, it mitigated the effect of the poison, and prolonged life.

Had the part not been excised, it is probable that death would have occurred in a few minutes, instead of an hour and four minutes. The inference is, that when the poison is injected into a muscular part, before excision can be practised, a certain amount has already entered the venous circulation, and some of it has, by diffusion, passed beyond the reach of the knife, and so more slowly enters the circulation, and kills. In cases where amputation of the whole part can be practised, the latter danger is obviated; and if done very rapidly, as in the case of the fowl, in which the carpus was amputated, it may save life. The blood coagulated firmly after death.

Experiment No. 5.

A large fowl was bitten in the thigh by the cobra (kalla keauteah), that bit in Experiment No. 4, at 4-55 p.m. In this case the part was not cut out. The fowl was left to its fate, the object of the experiment being to contrast the effects with those where the part had been excised, the bite being inflicted by the same snake.

5-1.—The fowl is crouching, but is easily roused; has hurried breathing. 5-4.—Drooping rapidly, beak resting on the ground; starts; raises itself, as out of sleep; falls back into a profound state of lethargy. 5-8.—Springs from the ground with convulsive movements. 5-12.—Violently convulsed, and lies on the ground. 5-15.—Dead—in 18 minutes.

This fowl was a more powerful bird than the one previously bitten by the same snake, and yet it lived only 18 minutes, whilst the first that had the earlier, and consequently more vigorous bite, lived 64 minutes. The prolongation of life is evidently due to the excision of the bitten part in the first fowl; and though it shows only mitigation, and not annihilation of the effects of the poison, it is so far encouraging, for it gives time, during which other juvantia may be had recourse to. But it plainly proves, when contrasted with the experiments in which amputation was performed, that in excision, diffusion of the poison takes place throughout the tissues beyond the limits of the fang punctures, and that from this diffusion, fatal absorption may take place.

EXPERIMENT No. 6.

A fowl was bitten in the fore-arm, between the ulna and radius, by a cobra, at 4-30 p.m. The part was *immediately* amputated at the elbow joint; a ligature was applied to prevent bleeding. 4-40.—The fowl seems unaffected. 5-6.—Seems quite well.

7th September.—The fowl is still alive and well; it also has been saved by the immediate amputation, as in the case of the cat and the other fowl. The cases in which excision was practised all proved ultimately fatal, though death was delayed. Why is this? The reason, I believe, is, that when excision only is practised, although it may extend beyond the limits of the cobra-bite, yet does not remove so much of the poison as has already so rapidly been diffused throughout the tissues.

The inference from this seems to me very clear, that in case of a bite in the finger or toe in a human being, amputation, if performed without delay, would offer the best chance of life. It is a terrible alternative; but as it is, perhaps, the only chance of saving life, it should be done.

All the snake-men that I have seen admit that they have all little or no belief in any medicines; but that they know of instances where men have been bitten by cobras, and have recovered, by binding ligature in several places tightly round the limb above the punctures, and then by burning the bitten part thoroughly either with a hot iron, a live coal, or exploding gunpowder.

I hope on a future occasion to consider the whole question of "what may be done in snake-bite," and to summarize the results of such observations as I have been able to make myself, or to gather in a reliable form from others.

Present:—Dr. FAYRER and Mr. SCEVA.—September 4th, 1869.

EXPERIMENT No. 1.

A pariah dog was bitten by a cobra (bansbuniah keauteah, of the snake-men), in the fore-arm at 3-42 p.m. Carbolic acid was immediately rubbed into the bites, and within two seconds, a strong ligature was tied as tightly as it could be drawn round the limb above the wounds.

3-44.—The dog is restless; the bitten and ligatured limb is almost paralysed from the tension of the ligature; below the ligature it is intensely congested, and dark blood is dropping freely from the fang wounds. 3-52.—Ten drops of carbolic acid, diluted with an ounce of water, were administered internally. 4 p.m.—The dog is lying down, and is very sluggish; but when he is roused he walks about. 4-5.—Lying on his side; restless; half convulsive movements of the limbs; breathing accelerated. 4-10.—Is now in the sitting posture, with fore-legs stretched out in a rigid convulsive manner. 4-11.—Rises; staggers as he walks. 4-14.—Rises; falls over again. 4-19.—Hind legs twitch convulsively. 4-24.—Convulsive twitchings; is sick. 4-26.—Cannot stand; is convulsed. 4-30.—Sick and convulsed. 4-32.—Heart still beats; no respiratory movements. 4-33.—Dead—in 51 minutes.

This experiment shews how futile the carbolic acid and the ligature are, even when thoroughly and rapidly applied. The ligature was tightened to the extremest strangulation of the limb, within two seconds of the cobra's bite. The carbolic acid was applied even sooner, and yet the symptoms of poison set in rapidly, and death occurred within the hour. The snake, it is to be observed, too, was not a fresh one, and had been some time in captivity.

Experiment No. 2.

A pariah dog was bitten by a cobra (keauteah), in the inguinal fold, which was raised and stretched for the purpose. The fangs penetrated deeply, and the part was immediately excised by a clean sweep with a sharp scalpel, the part wounded being completely removed. The cobra was not fresh, but it was active and vigorous, and bit fiercely.

4-12.—The dog is restless. 4-27.—Breathing accelerated. 4-35.—No further change. 4-40.—Looks sluggish; eyes blinking; breathing rather rapid. 4-46.—No change. 6 p.m.—No change. 9 p.m.—No change. 5th September, 8 a.m.—Looks well; takes food. 6th September.—Quite well; not affected by the poison.

This dog escaped. The excision in this case proved successful; it was done very rapidly, and extended considerably beyond the marks of the snake's fangs.

Experiment No. 3.

The poison of a cobra (teturiah keauteah), was removed, and two drops inserted between the eye-lids of a healthy and vigorous young puppy, at 4-12 p.m. The dog was examined again at 4-37 p.m., and the eye was found to have been most seriously affected. There was intense chemosis of the conjunctiva, so much so, that the eye could not be seen, and the lids well puffed out like a ball. The chemosis was very pallid.

4-46.—Dog again examined, and found to be deeply under the influence of the poison. Convulsed in the limbs; unable to stand, and salivated; starting and whining with a short, snapping, snarling sound; chemosis intense; eye-lids swollen like a ball; the eye cannot be seen. 4-54.—Paralysed and convulsed. 4-56.—Dead—in 44 minutes.

The result of these experiments surprised me much, for it proves that absorption of the poison can take place through a membrane, and prove fatal. I am certain there was no wound or abrasion of the conjunctiva, and yet the influence of the poison was rapid and deadly. Previous experiments have not illustrated this effect of snake-poison; according to most observers, it has been thought that the poison could be applied with impunity to any surface, even of mucous membrane, provided there were no wound.

Experiment No. 4.

Having exposed the surface of the pectoral muscle of a fowl, and having raised a few of the superficial fibres, without causing the effusion of more than a few drops of blood, two or three drops of the poison, just taken from a cobra (keauteah), were rubbed into the exposed surface at 4-12 p.m.

4-23.—Apparently not affected. 4-26.—The bird is drooping; head declining; rises suddenly with a start, as if awakened suddenly from a sound sleep; head falls over again, and the point of the beak rests on the ground. 4-32.—Rises and staggers; falls over in convulsions. 4·37.—Violently convulsed. 4·45.—Violently convulsed. 4·48.—Dead—in 36 minutes.

This experiment also proves that absorption of the poison takes place through the walls of the vessels; for, although the muscular fibre was exposed, there was scarcely a bleeding point. It shows the danger of allowing the poison to come in contact with any raw or abraded surface.

Experiment No. 5.

A very large bungarus fasciatus, five feet long, was bitten by a fresh and vigorous cobra at 4·46 p.m. The bite was inflicted near the tail. 6 p.m.—Very sluggish. 7·20.—Dead.

Mr. Sceva notes that he thinks that death may have been caused by injuries inflicted from compression during handling; the head being very small, compared with the cobra and viper, the snake-man grasps the neck more firmly for fear of slipping, and hence may have caused the injury. But the results of more than one experiment incline me to believe that the bungarus is, though in a much less degree than the innocuous snakes, susceptible, and that it succumbs to the cobra or viper-poison. At the same time, I quite recognise the justice of the doubt which is thrown on the subject by Mr. Sceva.

16 series (continued)

ON THE INFLUENCE OF SNAKE-POISON WHEN APPLIED TO UNWOUNDED SURFACES.

Present :—Drs. FAYRER, CUNNINGHAM, and Mr. SCEVA.—September 11th, 1869.

EXPERIMENT No. 1.

Some poison was taken from a cobra (teturiah keauteah), and about a drop inserted between the eyelids of a pariah dog at 2-58 p.m.

3 p.m.—The eye is already much irritated ; lachymation profuse. The dog keeps rubbing it with his paw, and resting the side of the head against the wall ; he is very restless and uneasy ; chemosis rapidly increasing. 3-5.—Lying down ; rubbing the eye, which is much chemosed ; whining and restless. 3-16.—Dog very restless ; lies with his head resting against the wall. 3-28.—Eye intensely swollen ; the animal is very restless, and whines. 3-35.—He is evidently under the influence of the poison ; breathing deeply. 4-4.—Lying quiet ; breathing very deep. 4-11.—Lies curled up. 4-16.—Gets up ; is quite intelligent ; is very weak, and cannot stand long ; the eye is intensely swollen, with a pale chemosis. 5-15 p.m.—On being roused from a lethargic state, appears stupid and confused ; eye intensely swollen ; lies down again, and sleeps soundly. 5-31.—Breathing slowly and heavily. 6. p.m —Sleeping comfortably. 9-30.—Walks without difficulty ; looks more natural ; rubs the swollen eye with his fore-paw. The constitutional effects of the poison are evidently passing off.

12th September, 3 a.m.—Sleeping confortably ; breathing natural. 8 a.m.—Swelling of eyelids diminishing ; appears lively. 5 p.m.—Still improving. 13th.—Improving ; opens the eyelids ; the cornea is quite opaque, and there is a muco-purulent discharge from the eye. 14th.—The dog is recovering. 15th.—Except that the cornea is opaque, and some conjunctivitis remains, the dog is well; he is cheerful; takes his food well.

It was evident in this case that the dog was poisoned by absorption from the conjunctiva. The constitutional effects were not severe as in the former dog, but the local mischief was very serious, and for a time, at all events, have destroyed the sight of that eye. The intense chemosis, no doubt, caused the corneal mischief. The results of these experiments show how careful we should be to protect the eyes when handling and approaching the cobra or viper in an excited state, when it is possible that, some of the poison scattered, as the snake attempts to strike, might accidently be injected into the eye. In another experiment, a very minute portion of the poison was thus thrown into the eye of one of the gentlemen assisting in the experiments. The poison had been applied to a dog's nostril, and in the sneeze that resulted, the accident happened. The eye was immediately washed and fomented, care being taken not to rub it, and no evil result, beyond lachymation, irritation, and transitory redness, followed.

Experiment No. 2.

Some poison was taken from a spectacled cobra (gokurah), and a drop or two inserted into a pariah dog's nostril at 3 p.m. Violent sneezing and profuse watery discharge from the nostril resulted almost immediately.

3-30.—The sneezing and watery discharge continue, and seem to irritate the dog considerably. 3-45.—No constitutional effects of the poison manifested, but the local symptoms continue unabated. Two drops more of the same poison were well rubbed into the palate. 4-15.—No change. Two more drops rubbed into the mucous surface of the cheek. 4-25.—Not affected. The last applications appear to have caused no irritation. 5 p.m.—No change. 12th September, 3 a.m.—Does not appear to be affected in any way by the poison. The catarrhal symptoms have passed away. 13th.—The dog is well.

In this case, beyond the local irritation, no effect was produced.

Experiment No. 3.

A drop of cobra-poison was inserted into a fowl's eye at 3-15 p.m.

3-18.—Eye already much swollen; membrana nictitans deeply chemosed. 3-30.—Eyelids quite closed; no constitutional sign of poisoning. 3-37.—No change. 4-10.—Another drop inserted into the same eye. Much irritation immediately followed; the fowl is constantly trying to scratch the eyelid with its foot. 4-20.—Beginning to droop; nodding its head; sleeping as fowls do when they begin to feel the influence of the poison. 4-30.—Head more drooping. 5.—No further change; no worse. 5-30. Eyelids greatly swollen, but no appearance of any constitutional action of the poison. 9 p.m.—The same. The fowl continued to improve. The eyelids and conjunctiva became less swollen, and gradually recovered; and on the 16th, the bird was perfectly well, and its eye quite right again.

In this case also, as in that of the dog, the local symptoms were very severe, whilst the constitutional symptoms were mild and transient. They equally showed that the poison can be absorbed through the unbroken surface of a membrane, and that the conjunctiva especially is apt to permit of the endosmosis.

Experiment No. 4.

A few drops of cobra-poison were rubbed into the mucous lining of a fowl's mouth at 3-42 p.m. 4-15.—No effect; no sign of either local or constitutional disturbance. 12th, 8 a.m.—Not affected. 13th.—The fowl is perfectly well, and does not appear to have been in the least affected by the poison.

In this case, as in the experiments on fowl and other animals, no evil resulted from the contact of the poison with the tongue and mucous surface of the mouth.

The evidence of these four experiments is not absolutely conclusive as to the extent to which the poison may operate by absorption, through a mucous membrane. They prove that absorption in the case of the conjunctiva, and the schneiderian membrane really does occur, whilst in the mouth absolutely no effect was produced. But the poison was not taken from fresh or vigorous snakes, that is, they had been some time in confinement, and its action may have been impaired. Sufficient, however, is shewn to prove how dangerous the contact of the poison with the delicate mucous surface may really prove.

1755 Lewis

EXPERIMENTS ON THE INFLUENCE OF SNAKE-POISON ON THE BLOOD OF ANIMALS.

Present:—Drs. FAYRER, CUNNINGHAM, and Mr. SCEVA.—September 18th, 1869.

EXPERIMENT No. 1.—A dog was bitten in the fore-foot by a spectacled cobra. The snake struck the dog in the foot, and held on for a moment, at 3-27 p.m. The snake had been some weeks in captivity and had bitten before. 3-30.—The dog wildly excited, whining and licking the bitten part, which is bleeding and swollen; keeps turning round and round; sitting down and rising again in an excited manner; breathing very much accelerated. 3-40.—Licking the wound in sitting posture, and is trembling all over. 3-47.—Staggering. 3-50.—In convulsions. 3-55.—Dead—in 28 minutes.

Body examined at 4. p.m.—Lungs not congested; cavities of the heart filled with dark blood, which reddened and coagulated firmly, directly it was removed: part was already coagulated. At 4-15, no rigor mortis.

Mr. Sceva reports that a little stiffness of the limbs had taken place at ten minutes to five, or in about an hour after death.

EXPERIMENT No. 2.—A pariah dog was bitten by the daboia that had been in confinement since December, 1868, and during that period had never taken food or water. It had been some weeks unused, and when taken out of the box was very active and vicious; it seemed in good health and condition. Its jaws were closed on the dog's thigh at 3-27 p.m. At 3-28, the dog was partially paralysed; it made no noise, seemed to feel no pain; tried to move away a few paces with a staggering gait; the bitten limb almost useless; head drooping to the ground. 3-40.—Is unable to stand; limbs extended, perfectly paralysed; breathing deeply. 3-41.—Convulsive rigidity of the limbs.—3-44.—Dead—in 7 minutes.

The poison appears to have been very active in this instance, notwithstanding the condition of the snake. Paralysis of the nerve centres seemed to follow immediately after the bite; there was no sign of pain, and the dog was unconscious almost immediately.

Body examined at 3-55.—Lungs not congested. Cardiac cavities filled with fluid blood. The blood was perfectly fluid, both in the heart and great vessels, and remained so; no attempt at coagulation occurred. The contrast with the blood of the dog killed by the cobra was very remarkable, it formed at once a firm clot. At 4-15 p.m., there was no rigor mortis.

Mr. Sceva reports that at ten minutes to five, or in rather more than an hour after death, no rigor mortis had taken place.

EXPERIMENT No. 3.—A fowl was bitten by the same daboia in the thigh at 3-49. When placed on the ground it ran a few steps, limping on the bitten leg. In 30 seconds it fell over in violent convulsions; in 20 seconds more—50 altogether—it was dead.

The blood of this fowl remained perfectly fluid after death.

EXPERIMENT No. 4.—A fowl was bitten by a small cobra (teturiah keauteah), not fresh, in the thigh at 4-8 p.m. When placed on the ground it ran about, limping on the bitten leg. 4-9.—Feathers drooping; crouching; rises and tries to run; its wings droop to the ground. 4-10.—Head falling over, beak resting on the ground, comb and wattles becoming livid. 4-11.—Nearly paralysed, point of beak resting on the ground to support the head; cannot rise. 4-18.—Violently convulsed. This continued at intervals until the fowl died at 4-23. Dead—in 15 minutes. On opening the body, the blood was found to form a firm coagulum.

The object of these experiments was to compare again the effects of the daboia and cobra-poison on the blood. They clearly prove that after death from the viper's poison, however quickly it may be caused, the blood remains permanently fluid; whereas, that the cobra-poison does not destroy its coagulability. The nature of the change thus wrought on the blood, I know not at present in its chemical bearings, but I believe it to be effected through the nerve centres affecting the vitality of the blood, not by a direct chemical action. There certainly are differences in the symptoms caused in the bitten animals, but they equally point to direct action on the nerve centres, as the cause of death. I have seen as much difference between the effects produced by different daboias, or by the same daboia on different animals of the same species, as in those that had been bitten by the cobra; and, on the other hand, similar differences in the effects of the bite of different cobras, or of the same cobra on different animals of the same species, as in those bitten by the daboia. In point of deadliness, they are, when fresh and vigorous, about equal; but I think that the first effects of the poison are most rapidly shewn in the daboia-bite.

Dr. Cunningham, of the Bengal Medical Service, who is on special duty investigating the subject of cholera, and who has a microscope with high powers, has very kindly undertaken to make a most careful microscopical examination of the blood of these animals; I append his report.

General Hospital; Friday, 24th September, 1869.

My Dear Dr. Fayrer,—Along with this I send you the drawings of the dog's and fowl's blood, which I got last Saturday. The specimens were examined, and the drawings (of which these are copies), were made on Sunday morning. In no case were any bodies seen corresponding with Halford's cells.

The blood of the cobra-bitten dog was, at the time of examination, in a firm dark clot.

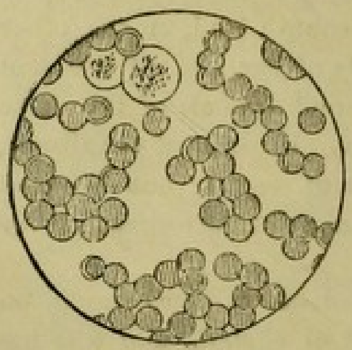
Beyond the ordinary constituents of the blood nothing could be seen, even under a power of nearly 1,100 diameters.

The blood of the dog bitten by the viper differed from the other. 1st.—In being entirely fluid. 2nd.—In being of a much lighter red colour. 3rd.—In containing numerous blood crystals. 4th.—In containing a good many large and active specimens of Bacteria.

The fowl's blood was in both cases very much broken up and decomposed, few entire red corpuscles remaining. This state of decomposition was most marked in the blood of that which was bitten by the viper. In both specimens were a few of the circular cells, which occur in fowl's blood under ordinary circumstances.

With many thanks for the opportunity which you have given me of examining the blood.—I am, &c.,

D. DOUGLAS CUNNINGHAM.



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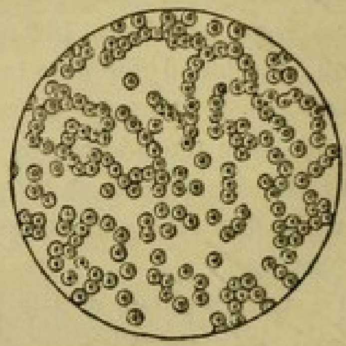

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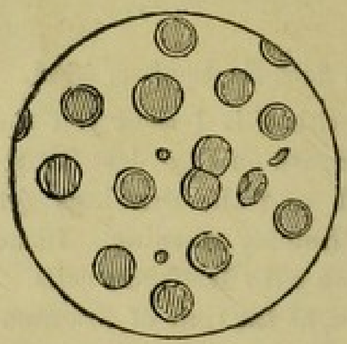

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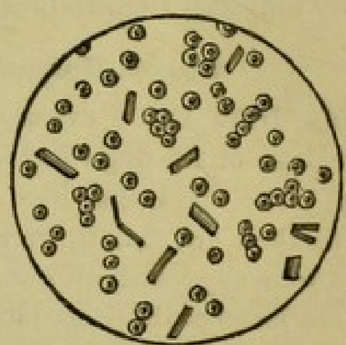

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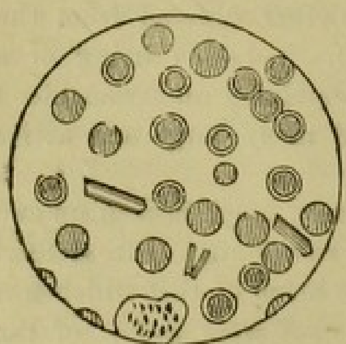

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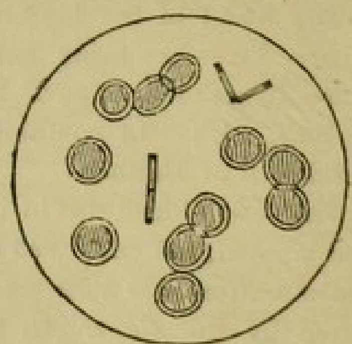

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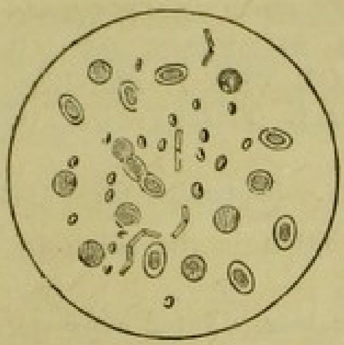
1 2 3 Cobra—Dog.

4 5 6 Daboia—Dog.



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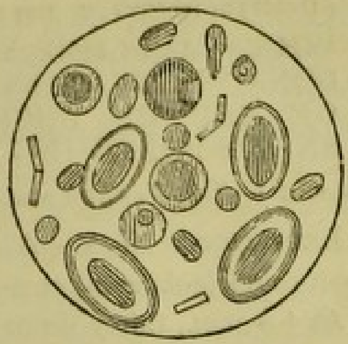

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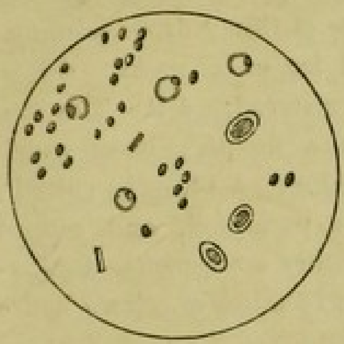

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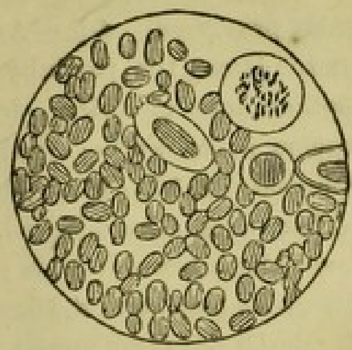

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7 8 Cobra—Fowl.

9 10 Daboia—Fowl.

17th series (cont)

EXPERIMENT ON THE ACTION OF SNAKE POISON WHEN APPLIED TO THE SURFACE OF THE CONJUNCTIVA, AND ALSO ON THE INFLUENCE OF EAU DE LUCE IN THE TREATMENT OF SNAKE-POISONING.

Present :—Dr. Fayrer and Mr. Sceva.—September 25th, 1869.

Experiment No. 1.—A dog was bitten in the thigh by a fresh cobra (gokurrah) at 4-3 p.m.

At 4-4 p.m., thirty drops of eau de luce, diluted with water, were poured down the dog's throat. The dog was much excited, and ran about limping on the bitten leg, which was already nearly paralysed. 4-5.—Another dose of thirty drops administered. Drags the partially-paralysed leg as he walks. 4-8.—Another dose of thirty drops administered. 4-9.—The dog staggers as he walks; frothing at the mouth; looks much depressed. 4-12.—Lies down; retching. 4-13.—Convulsed; another dose administered. He lies paralysed, and cannot move; the heart still beats; no respiratory movements. 4-14.—Convulsive gasping. 4-15.—Dead—in 13 minutes. Two hours after death the rigor mortis was complete.

I fear the eau de luce must be classed with other " antidotes."

Experiment No. 2.—Poison taken from a fresh cobra (gokurrah), and a drop inserted between the lids of a fowl's left eye, at 4-20 p.m. The eye closed immediately.

4-25.—The eyelids already much swollen. 4-37.—So much swollen, that the eye cannot be seen. 4-38.—No constitutional indication of the poison. Another drop inserted; conjunctiva deeply injected and chemosed. 5 p.m.—The fowl crouches, but is easily roused; it seems slightly affected by the poison. 5-10.—Crouching. 9 p.m.—Is drowsy; crouching, with wings drooping, and the point of the beak resting on the ground.

26th September, 7 a.m.—Lying on the ground with one wing extended; unable to walk. 1-30 p.m.—Lying down on one side; gasping; on being roused staggers and falls down. Has spasmodic movements; shivering; feathers ruffled. 6-9 p.m.—In the same state. 6 a.m.—Lying on one side, with the legs extended; frequent defecation. 9 a.m.—Appears to be improving; able to crouch on its feet. 4 p.m.—Is much better; takes food and water. 9 p.m.—Still improving.

28th September, 6 a.m.—Sits naturally on its feet; eats well; the swelling of the eye much reduced; is able to stand, but cannot walk much; the legs appear to be benumbed, or to have locomotor ataxy; steps in an awkward manner. 7 p.m.—The bird seems to have recovered.

The fowl had a very narrow escape; it clearly proves that the poison acts by absorption through the conjunctiva.

Experiment No. 3.—A drop of fresh cobra-poison was put into a dog's eye at 4-27 p.m. The lachrymation was immediately profuse; rubbed the eye with his fore-paw.

4-30.—Conjunctiva much injected; he is very uneasy, rubbing the eye with his foot. 4-38.—Lies curled up with his head between his fore-legs. Another drop inserted into the same eye. 4-40.—Appears sluggish, but is not constitutionally affected beyond this. 5 p.m.—The dog is lethargic; lies with his head between the legs; eyelids and conjunctiva intensely swollen. 5-10.—No change. 9 p.m.—Eyelids closed, and greatly swollen.

26th September, 7 a.m.—Appears lively and free from pain; swelling of the eyelids much reduced.

27th, 9 a.m.—Eats well, and does not appear to suffer any pain. 9 p.m.—The same.

28th, 6 a.m.—Eyelids slightly swollen. 7 p.m.—Nearly recovered.

It is to be noted, that although most flagrant inflammation was excited in the eye, it had not, as in the ordinary form of conjunctivitis, a tendency to suppurate. The eye, although temporarily damaged, the cornea being rendered opaque, was not destroyed, as is so frequently the case in the specific form of *ophthalmiæ*.

This experiment, like the last, proves that the poison is not only absorbed through the conjunctiva, but that it is a local irritant. The inflammation is intense, but it subsides without treatment; and although the cornea is rendered opaque with cloudy opacity, it would evidently soon recover. It seems quite clear from these experiments, that the notion that the poison is not operative, unless introduced directly into the blood, is not tenable, and that it is capable of endosmosis.

The following incident is interesting, as it shews how one may be mistaken about a snake-bite, although the evidence of its infliction seems complete :—

A short time ago, my friend Dr.—— wrote to me, saying that a person had been to him, to inform him that he had been bitten by a cobra, and that he had prevented any evil effects by the timely use of measures known to himself. He offered to bring the sufferer, with the snake, for inspection. Accordingly, my friend, accompanied by the patient, who brought with him a gurrah containing a full grown and vigorous cobra (keauteah), made their appearance the following morning, and I had the fullest opportunity of enquiring into the case. He informed me that he was fond of snakes, and was in the habit of handling them, having no fear of their bites. The cobra that had bitten him the day before, had been only recently caught in his presence, by a professional snake-catcher. He had purchased, and had been playing with it, when it bit him, through some inadvertence on his own part, on the back of the middle finger of the right hand. He immediately knocked the snake off; the punctures bled freely, and he vigorously sucked the wounds for some time, having also, I think he said, tied a ligature tightly about the wound. He felt no ill effects from the bites. There were two recent marks on the finger which just corresponded to the position of a cobra's fangs. They looked healthy, and free from any irritation or mischief.

He took the snake out of the *gurrah*, putting his hand in among its coils fearlessly, although it hissed and tried to strike. He placed it on the ground, where it deported itself after the fashion of cobras, erecting its head and hood, and striking at whatever came near it. He sat on the ground and allowed it to crawl under his legs, caressing it at the same time. This, I confess, aroused my suspicions, but I warned him of the extreme danger he was probably incurring, and I asked him if he was sure the snake had its fangs ; he said he had no reason to doubt it, for it had been caught wild in his presence, and he had never lost sight of it since. As there was not the slightest reason to doubt his statement, I was, I confess, somewhat astonished at his power of handling, thus fearlessly, so deadly an animal, and I again warned him of the great risk he incurred. He said he had often done the same with other snakes, and nothing had happened to him until on this occasion.

I have no doubt whatever that he fully believed all he said, and that he imagined he had prevented mischief by his treatment of the bite. To attest it, he had put himself to some inconvenience to shew me the bites and the snake that inflicted them, and there was no apparent reason for mistrusting his account of the matter.

He was about to take his leave, when, being still sceptical, I asked to be allowed to examine the cobra's fangs. He made no objection, but seemed rather to dislike opening the snake's mouth. We, however, effected this between us, and it proved that there were no fangs at all. They had long been removed, and the partially exposed roots of the broken teeth were barely visible above the sheath, leaving just rough surface enough to scratch whatever they came in contact with. He seemed more astonished than I was, and assured me, what I did not doubt in the least, that he had fully believed in the existence of the fangs, for, as he said, the snake had been freshly caught in his presence, and he had had it ever since.

I advised him to be more careful in his future dealings with the ophidia, as the next pet cobra might prove to have fangs, and the disposition to use them.

Had this gentleman gone away without examination of the snake's mouth, what other conclusion could have been drawn from his evidence than the most dangerous one, that the bite of a large and vigorous cobra may be inflicted, and yet that the simplest means are sufficient to obviate the evil results. It is probable, that if the details of similar stories, and they are not unfrequent, could be analysed, they would receive an equally simple and satisfactory explanation. It is not necessary, in investigating the real truth of such accounts, which are often so largely tinctured by ignorance and credulity, to impugn the veracity of those who relate them, and who are so prone to believe in the marvellous, and to deal with the improbable, simply because it is so.

I do not for a moment doubt that this gentleman, who so kindly volunteered to demonstrate the successful treatment of the bite of a deadly snake, believed in the whole story, and had not the faintest notion that he had been deceived either by accident, or by the snake-man, who captured what was probably already a capture, in his presence. But the direct evidence of the snake's edentate upper jaw was more conclusive to him, as well as to us, than any amount of circumstantial testimony to the contrary.

I may here mention, shortly, another case which was related to me a few days ago by a gentleman holding an important post in one of the Bengal Railways, who was an eye-witness to what he described. He told me that he sent his servant to bring a bottle of soda water. The man went to do so, and in reaching out his hand, in what was probably an obscure or dark part of a room or godown, he must have actually placed his finger in, or close to, the snake's mouth. He came back to his master and said he had been bitten by a snake, and pointed to the two punctures on the finger as attestation of it. Further proof was not long in making its appearance, and within forty-five minutes the wretched man was dead. I hope to receive the details of the case more at length, and to learn something of the unfortunate man's condition during the operation of the deadly poison. Had the finger, in this case, been removed at once, or had a ligature been very tightly tied above the bite, the result might have been different. I say "might have been," because, in the experiments made on the lower animals, I have found that unless amputation or excision is made, with the greatest promptitude, the poison has already entered the circulation, and is rapidly running its course to the nerve centres, where it proves fatal.*

I would take this opportunity of requesting medical men, or others who have the opportunity of seeing cases of snake-bite in

* This occurred near Calcutta, and the snake was one of the varieties of cobra.

men, or even in animals, when well authenticated, to be so kind as to take the trouble of sending a brief account of the circumstances, the symptoms and the results, as they may have leisure or inclination to record; in all cases, especially noting the kind of snake that inflicted the bite.

'18 the series

EXPERIMENTS ON SNAKE POISON.

By J. Fayrer, M.D., C.S.I.

(Re-published from the Indian Medical Gazette.)

Present: Drs. Fayrer and Ewart, and Mr. Sceva.—
April 23rd, 1870.

Experiment No. 1.—The external jugular vein of a dog was exposed, and Liquor Potas: ʒss. water ʒiii. injected with the hypodermic syringe at 3-14 p.m.

At 3-28, the dog seemingly unaffected by the alkaline injections, two drops of poison, squeezed out of the poison glands of a cobra (Bansbunniah Keautiah,) sickly and casting it skin, were diluted with water and injected hypodermically into the dog's thigh. This snake had been deprived of its fangs, and could not bite. The dose of poison was very mild. 3-35.—The dog seems restless and uneasy—is whining. 3-36.—Apparently very slightly affected. 4-10.—Is restless; sits down, looks listless and tired. 4-15.—Liquor Potas: ʒss. Aq. ʒi injected into jugular vein; no effect produced, the dog did not seem to feel it in any way. 4-20.—Liquor Potas: ʒss. Aq. ℥ii. poured down its throat. 4-26.— Restless and uneasy; is sick, slightly convulsed; respiration hurried; sardonic grin. 4-30.—Cannot walk; profusely salivated, defecated; more solution of Liquor Potas: administered. 4-35.—Tries to rise; falls over, staggers; all the symptoms of snake-poisoning now rapidly increasing; spasmodic action of diaphragm. 4-37.—Much convulsed. 4-40.—Still much convulsed and profusely salivated; gasping respiration. 4-42.—Respiration ceased. 4-45.—Dead—in an hour and a half.

The body was opened at 5 p.m. Blood in the cavities of the heart fluid, but coagulated firmly on being removed.

Experiment No. 2.—About half a grain of cobra-poison kept in a glass tube since December, 1869, was diluted with water, and a hypodermic syringeful of the solution (about 20 drops) injected into a fowl's thigh at 3-53 p.m. The poison had coagulated into a white paste; was very fœtid, and not readily soluble in water, as the solution, after being well rubbed, was turbid and floculent. 4 p.m.—The fowl is lethargic, and crouches; but easily roused, and runs about looking as bright as ever.

Twenty drops of a solution of Liquor Potas: one part to two of water, injected into the fowl's thigh. The legs were soon observed to be weak. 4-5.—Cannot stand, the legs are extended and seem almost paralysed. 4-7.—Legs powerless, but its eye is bright, and its head does not droop, as is usual in snake poisoning. 4-14.—Another syringeful of the Liquor Potas: solution injected into the thigh. 4-20.—Lies on its side, legs quite powerless, but eyes still brighter; head raised; it seems perfectly conscious. 4-30.—In the same condition. 4-40.—Another syringeful of the solution of Liquor Potas: injected—no apparent change. 4-50.—Eyes still bright; head does not droop, cannot move. 5 p.m.—In the same condition. 6-15.—Unable to walk. 7-11.—Attempted to walk, but was unable to do so; fell with legs extended in opposite direction; remained in this state till 7-41 p.m. 9 p.m.—Lying on its side with only wings extended, and legs out stretched.

24th, 5-30 a.m.—Lying much as it was at 9 p.m., yesterday. 9-15—Convulsive movement. It did not die till 1-35 p.m., or about 22½ hours.

Experiment No. 3.—A syringeful of the same Liquor Potas: solution was injected into a fowl's thigh at 4 p.m. of 23rd April. 4-10 p.m.—No apparent effect produced on the fowl by the injection, it is as lively as ever. A syringeful of diluted cobra-poison, the same as in last experiment, injected into a fowl's thigh. 4-17.—Legs seem paralysed as in the last case, but the eyes are bright, and the head not drooping, as in experiment 2. 4-30.—In the same state, legs quite paralysed. 4-40.—Another dose of Liquor Potas: solution of same strength injected into the thigh. 4-42—The fowl was slightly convulsed after the last injection, crouching, with its head resting on its beak; there were jerking convulsive movements of the tail. 4-50.—Lethargic, but eye bright, breathing slow and steady. Closes the eyes, but when roused opens them again. 5 p.m.—Head slightly drooping in addition to other symptoms. 6-15 p.m.—Unable to walk. 6-15.—Lying on floor, with legs and wings extended. 7-30.—

Convulsive movements of wings and body. 7-41 p.m.—Dead —in three hours and forty minutes.

Experiment No. 4.—About half a grain of the same cobra-poison as that used in experiments 2 and 3, injected into a full-grown, but rather sickly-looking, dog's thigh, at 3-6 p.m. 9-10.—Is not apparently in any way affected. 4-25.—Does not appear in any way affected. 4-35.—Not in the least affected by the poison. Another syringeful, twenty drops of the poison solution, injected. 4-45.—The dog appears sluggish, but it may be fright; not otherwise affected. The jugular vein was now exposed, and Liquor Potas: ʒi + Aq. ʒii was injected. No apparent effect produced by this injection into the jugular vein. The dog on being released moved about in the usual way.

4-50.—Liquor Potas: ʒss + Aq. ℥ii poured down the throat. 5 p.m.—The dose was repeated. The dog seemed inclined to vomit, but did not do so; not otherwise in the least affected. 6-15 p.m.—No change. 9 p.m.—Appears restless, changing position frequently. 9-30 p.m.—The same. 24th April, 9 a.m.—Looks well, not lethargic. 24th April, 1 p.m.—The same. Midnight, the same. 24th April, 8 a.m.—Seems well and unaffected. 24th April, 1 p.m.—No change, 46 hours after the experiment.

The poison used in these experiments was necessarily weak. In the first it was taken from a cobra that had lost its fangs, and when squeezed out in a small quantity, it was probably mingled with mucus. It produced the usual effects, however, in a dog, and death occurred in an hour and a half.

The Liquor Potas: was administered by injection into the jugular vein, and into the stomach; no apparent result followed, and the dog died in ninety minutes, with the usual symptoms of cobra poisoning: the blood coagulated firmly when removed from the heart and large vessels after death.

In the three other experiments, old and decomposed poison, removed from the snake four months previously, and which had coagulated into an exceedingly offensive white paste, very insoluble in water, was used, and in small quantities. In the case of the full-grown dog no symptom was produced by the second day. To test the effect of the Liquor Potas: it was injected into the jugular vein, and administered by the mouth. No change occurred, and 40 hours after the experiment the animal was unaffected. In the cases of the two fowls, one died in 3 hours 40 minutes, the other in 22 hours; and in them the symptoms were somewhat different from those usually produced on fowls by the cobra-poison.

One of the earliest symptoms in ordinary cases of cobra poisoning of fowls is drooping of the head, which is supported by the point of the beak resting on the ground. The bird frequently raising its head with a sudden start, until at last, overwhelmed by the action of the poison, it falls over and dies, frequently in convulsions. This drooping of the head was not observed; the eye was bright, and the head erect almost to the last, whilst the legs were quickly paralysed.

In those cases the Liquor Potas: was also given by hypodermic injection, but with no apparent result, except in one case, slight convulsions occurred, though I am not at all sure they were caused by it. Death in both cases was protracted, in one excessively so; but this I attributed to the weakened and diluted state of the poison. Is it possible that the difference in its action may have been due to the changes that had taken place during decomposition? At all events, though much weakened, and probably altered in its action, it still preserved, to some extent, its lethal properties: for, although the strong and full-grown dog was not apparently affected, the smaller and more sensitive birds were.

The conclusions I draw from these experiments are :—

1*st.*—That the poison of the cobra retains its activity even when the fangs have been destroyed, and the gland perhaps for a time inactive.

2*nd.*—That keeping and decomposition of the poison does not destroy, though it weakens or alters, its poisonous properties.

3*rd.*—That the injection of diluted Liquor Potas: is not necessarily attended with any danger, or even bad symptoms when injected into the jugular vein or hypodermically; and that the result of these four experiments, which are not by any means conclusive, does not show that it has any antidotal effect on the action of the poison; but on this subject further evidence is needed.

April 25*th.*—Two young fowls were injected in the thigh with the same old cobra poison as in the last experiments, 23*rd*

April; the poison was inserted with the hypodermic syringe, at 3-55 p.m. 5-10 p.m.—No change. 7 p.m.—No change. 9-15 p.m. —The legs which were injected are lame and stiff in both fowls.

26th, 5 a.m.—No symptoms of poisoning. 1-20 p.m.—One fowl walking about quite well. The other appears dull and drooping.

27th, 6 a.m.—No change. 1 p.m.—Both fowls walking about in the cage. *29th.*—They are quite well.

The effects of the poison on both were most feebly manifested. The Liquor Potas: was not used.

Present: Drs. Fayrer and Ewart, and Mr. Sceva.—
April 30th, 1870.

Experiment No. 1.—A solution of Liquor Potas: one part, water three parts, was prepared.

2-55 a.m.—One drachm of the above solution was injected into the external jugular vein of a small dog.

The dog seemed rather sluggish after the injection, but at 3-7 p.m. was as usual, and seemed quite well at 3-9 p.m. He was bitten on the fold of the thigh by a young cobra about one-third grown.

It was made to close its jaws very reluctantly, and its bite was very doubtful, no marks of blood were visible.

3-15 p.m.—It seemed rather sluggish, apparently frightened; 20 drops of the Liquor Potas: solution were hypodermically injected into the thigh. This seemed to cause sharp pain; the place where the cobra was supposed to have bitten was washed with Liquor Potas. 3-24.—Sluggish; lies down again when it has been made to stand. Twenty drops more of the Liquor Potas: solution injected into the thigh. 3-27.—Stretching out the hind legs. 3-29.—Rises and sits down again. Thoracic muscles seem contracted. 3-34.—Seems to walk with difficulty when roused; abdomen seems distended. 3-43.—Lies quite quiet. 4-6.—In the same conditions. Hind legs seem weak. Lies with the limbs extended. 4-15.—Walks about, when roused sits up, but seems giddy, head moves from side to side. 4-21.—Twenty-nine drops of the solution injected seems to give as before considerable pain; it licks the puncture. 4-50.—Another twenty drops injected. 8-30.—No change. 9-30.—Lying down, breathing naturally; no symptoms of poisoning now present.

May 1st.—The dog is living, is not in any way affected.

May 3rd.—The dog remained quite well.

Experiment No. 2.—A large dog had the jugular exposed, and Liquor Potas : ʒi. water ʒiii. was injected at once into the vein.

3-10.—The same young cobra was made to close its jaws in the dog's thigh, but there was no evidence of its biting. 3-30.—Twenty drops of the solution were injected into the thigh. The dog was not in any way affected, and remains, on the 2nd May, quite well.

These two experiments are very instructive, for they show in the first experiment that the dog was, though bitten, so slightly poisoned that no evil results followed. In the second no effect was produced at all. The cobra was very young and small, its fangs were small, and the poison small in quantity, and not active. This no doubt is the way in which recoveries take place when there is no doubt as to the person having been bitten, as the snake has been seen. That the snake had more poison was proved by its effect on a fowl, which is much more sensitive to the poison than the dog.

The evidence as to the value of the Liquor Potas : is not of much significance; for, if it appears in its favor in the case of the dog, it is the reverse in that of the fowl.

I propose to give it further trial in the case of an animal bitten by a full-grown and vigorous cobra, and also by injecting the poison mixed with the Liquor Potas : as I did with the Liquor Ammonia.

Experiment No. 3.—A fowl was bitten in the left thigh by the same young cobra; it was made to close its jaws, and the fangs compressed in the part at 3-27 p.m. 3-32.—Not in any way affected. 3-52.—Not the least affected 25 minutes after being bitten. 4-5.—Feathers of back slightly ruffled; purged, otherwise seems bright. 4-11.—Apparently beginning to droop a little, but when roused seems all right, and runs about vigorously. The wattles look less bright than they did. 4-15.—Crouching, but rises and runs about when roused. 4-16.—Twenty drops of the Liquor Potas : solution injected into the thigh. 4-20.—Drooping, rests its beak on the ground. 4-22.—It droops more. 4-50.—Restless; changes its position frequently. Wings drooping. 8-13.—It gradually drooped, and died. The extreme weakness of the poison was proved in this case by the fact that it was 25 minutes before the faintest indication of poisoning appeared. It generally, with the ordinary cobra, begins within a minute.

Death occurred in four hours and forty-six minutes.

May 5th, 1870.—Poison removed from a large Gokurrah (spectacled cobra,) and mixed with Liquor Potas: two parts of each: of this solution, about ten drops were injected into a dog's thigh at 11-58 a.m. 12-10.—Restless. 12-11.—Quite lively, but staggers on the hind legs. 12-13.—Does not seem more affected. 12-21.—Sluggish. Another injection of one drop of poison mixed with three of Liquor Potas: injected into the thigh. Is sluggish, staggers in his gait. 12-29.—Thirty drops of a solution of equal parts of water and Liquor Potas: injected into the thigh. 12-30.—Convulsed. 12-34.—Purged, unable to move, is paralysed. 2-37.—Convulsed. 12-40—Dead—in—42 minutes.

The body was opened about half an hour after death. The blood was fluid, but coagulated after removal; not as rapidly though, I think, as usual.

A syringeful of the blood was injected into a fowl's thigh; the result of this experiment will be noted.*

Experiment No. 2.—Equal parts of poison from the same cobra, and water were mixed, and about 10 drops injected into a full-grown dog's thigh at 11-54 a.m. 12-1.—Not affected. 12-10.—Very sluggish, deep and hurried breathing. 12-13.—Can hardly stand; gradually became paralysed. 12-18.—In convulsions. 12-20.—Purged, dying. 12-22.—Dead—in 28 minutes.

This experiment proved that the cobra poison was active, and not injured by dilution with water. The other experiment proves that it is not neutralised when mixed with Liquor Potas.

Experiment No. 3.—A solution of the same cobra poison with equal parts of water. Two drops of this solution injected into a fowl's thigh at 11-55. 11-58.—Fowl drooping, point of beak resting on the ground. 12-2.—Nearly dead. 12-7—Dead—in 12 minutes.

Experiment No. 4.—One drop of poison from the same cobra, 3 drops of Liquor Potas: injected into a fowl's thigh at 12-18. In less than thirty seconds the fowl fell over in convulsions; it remained in a perfectly unconscious condition, with occasional convulsive movements of the wings until 12-24. Death occurred in six minutes.

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* The fowl did not die.

In this case the fowl was of the same size as in Experiment No. 3, about two-thirds grown. Death occurred more rapidly after inoculation of the poison mixed with Liquor Potas : than after that of poison mixed with water.

The blood of the bird was examined at 12-40, 16 minutes after death; it coagulated firmly when removed from the body.

EXPERIMENT No. 5.—One-half drop of cobra poison and two drops of Liquor Potas : injected at 12-20 into a fowl's thigh. 12-24.—Crouching. 12-26.—Drooping, the usual sign of the beak resting on ground. 12-30.—Dying apparently. 12-31.—Convulsed. 12-38.—Dead—in 18 minutes. Body examined : blood formed a firm coagulum.

The dose of poison was very small, it was barely half a drop, with two full drops of Liquor Potas.

EXPERIMENT No. 6.—A fowl had about 40 drops of the solution of Liquor Potas : one part, water two parts, injected into the thigh at 12-45. The legs almost immediately became paralysed, or rather rigidly extended. It lay on the ground with a scared look ; breathing very much hurried ; beak open, feathers ruffled. It remained in this state for several hours, and gradually recovered on the 5th May at 8 a.m. It was alive and well, and nearly regained the use of its legs.

EXPERIMENT No. 7.—The same quantity of the Liquor Potas : solution injected into a fowl's pectoral muscles at 12-47. The bird immediately assumed the same scared aspect, the feathers staring, the eye wild, and the beak wide open, with very hurried respiration. It remained in this way for some time, and in about 20 minutes 20 drops of the blood of the dog that died from the mixture of cobra poison and Liquor Potas : were injected into its thigh.

It remained in the same condition for some time, but gradually recovered, and on the morning of the 5th May was quite well.

The object of these two experiments was to test the effect of the Liquor Potas : when injected. The symptoms were very well marked, and seemed to cause great distress, though no fatal consequence resulted.

So far the results of the trial of Liquor Potas : have been unfavourable ; the fact of the poison mingled with the Liquor Potas : before inoculation proving fatal, seems all but conclusive against it as an antidote.

Present: Drs. FAYRER and EWART, and Mr. SCEVA.—
14th May, 1870.

Through the kindness of a friend, I have received a phial of dark-colored, strongly ammoniacal smelling fluid, sent by Dr. Gunston of H.M.S., who says:—"I send the Cape antidote for snake bites; it may have deteriorated* in quality, as I bought it in the Cape in 1864. I never had occasion to use it, but the rule is, I believe, to scarify the wound and rub some of the mixture into it, and also to swallow two or three drops. I am not certain of the quantity in either cases, but experiment would easily decide that. I know for certain that bites from the Cape black cobras have been cured by it, and there, every one carries it about when out shooting; it is firmly believed in."

One object of the following experiments was to test this "antidote. The fluid was in a small phial carefully covered with thick leather; it was hermetically sealed, and when the stopper was removed a dark-colored, clear, and very strongly ammoniacal fluid was found.

EXPERIMENT 1.—A fowl had the feathers removed from its thigh, and was bitten by a Gokurrah (spectacled cobra) with only one fang, in the right thigh at 3·25 p. m. The single puncture was immediately deeply scarified, and some drops of the fluid well rubbed into the wound. A drop of the fluid diluted with a few drops of water was then poured down the bird's throat. But at 3-26 the fowl was already paralysed. At 3-28, it was quite dead. The blood of this fowl, on being removed from the heart a few minutes after death, coagulated firmly.

EXPERIMENT No. 2.—A half-grown pariah dog was bitten in the thigh by the same cobra at 3-30 p.m. In this case the Eau de Luce was again tried. Half a drachm sufficiently diluted with water given at 3-33 p.m. 3-34.—The dog shows symptoms of poisoning, he is restless and uneasy. Lies down; rises again; breathing hurried. Tries to walk; staggers; hangs his head; frothing at the mouth. 3-38.—Another half drachm

* The bottle was so carefully stoppered and sealed, and the ammoniacal odour was so strong when opened, that I should think it could not have deteriorated by keeping.

of the Eau de Luce administered. 3-40.—Has lain down, and is unable to move, evidently dying. 3-42.—Heart still beats, but has ceased to breathe. 3-43.—Dead—in nine minutes. The blood of this dog coagulated firmly after death. The so-called antidote obviously had not the least effect.

Experiment No. 3.—A fowl was bitten in the thigh by the same cobra at 3-46 p.m. The wound was immediately scarified, and some drops of the Cape remedy well rubbed in. Two drops well diluted were immediately administered by the mouth. The fowl was convulsed almost immediately, and was dead, in less than two minutes. The blood of the fowl exposed in a watch glass, after death, became of a very florid color, and coagulated very imperfectly, after 15 or 20 minutes. There was some doubt about the watch glass having had ammonia in it, but the attendant declares it was thoroughly washed.

Experiment No. 4.—A fowl was bitten by a cobra, with one fang, in the thigh, at 4-5 p.m. 4-5-30.—Legs paralysed; feathers ruffled. 4-7.—Dying, convulsed. 4-8.—Dead.

Blood drawn into three vessels: one a watch glass, the second an ounce measure glass, the third a flat glass vessel (top of a jar); two or three drops of the Cape antidote (ammoniacal) put into the watch glass. Two or three drops of Eau de Luce put into the measure glass. Into the third nothing. At 4-49, the unmixed blood was firmly coagulated. The blood mingled with Eau de Luce coagulated much sooner, and became very dark. The blood mixed with the Cape antidote remained bright red, and did not coagulate.

Experiment No. 5.—A fowl was bitten in the thigh by the same cobra, now somewhat exhausted, at 4-44 p.m. 4-45.—Dead, with the usual symptoms. At 4-52 p.m., blood drawn into three watch glasses, a few drops in each. No. 1. Three drops of the Cape antidote × blood. No. 2. Four drops of Eau de Luce × blood. No. 3. Nothing × blood. These were placed aside and watched for some hours. Nos. 1 and 2 remained fluid. No. 3. Coagulated imperfectly.

There are some apparent contradictions in these two experiments; in the first the blood coagulated firmly when mixed with Eau de Luce. In the second it remained fluid. Has the shape of the vessel anything to say to it? In the first it was deep and narrow; in the second flat and shallow. I do not know that the results of experiments on the coagulability of the blood after death, under any circumstances, is of much import, but I record those as they were made.

Present: Drs. FAYRER, CHEVERS, and EWART, and Mr. SCEVA.—
4th June, 1870.

EXPERIMENT No. 1.—A small Pariah dog was brought fully under the influence of alcohol; several ounces of brandy had been given, diluted with water, in divided doses, during the morning. He was bitten in the thigh by a young, one-third grown Gokurrah, at 3 p.m. The snake was with difficulty made to close its jaws, and the bite was doubtful. At 3-10.—No symptoms of poisoning. The dog was bitten in the thigh by a Keautiah full grown, and was very rapidly affected by the poison, began to stagger; more brandy was administered. 3-15.—Dog convulsed. 3-16.—Dead.

It has been suggested that persons in a state of intoxication from alcohol are less susceptible to snake poison, and that brandy administered to those bitten is useful. I have no doubt it is so to a certain extent; but this experiment seems to show that it can do but little in preventing the fatal effects of the poison in an animal at all events.

EXPERIMENT No. 2.—At 3-20 p.m. three drops of poison recently taken from the same Keauteah mentioned in the last experiment, were put into a fowl's mouth, being brought in contact with the lining membrane. 3-28.—Not affected. 3-40.—Not affected. 3-56.—Fowl is drowsy, eyes closed, crouching, cannot stand, resting the point of the beak on the ground. 4-12.—More drowsy. 4-20.—Convulsed. 4-24.—Peculiar convulsion of neck. 4-40.—Lies on its side, appears dying. 5.—Still alive, but completely paralysed. 5-20.—Violently convulsed. 5-43.—Dead.

EXPERIMENT No. 3.—Half a drop of poison from the same Keautiah put into a dog's eye at 3-25 p.m. Immediate excitement resulted, the dog began to rub the eye with his fore-foot with excessive lachrymation. The eyelids began to swell, and the conjunctivæ to be chemosed. 3-28.—Eyelids much swollen. The dog is evidently affected constitutionally, he is drowsy.

4 p.m.—Eyelids swollen with great tension. The conjunctivæ in a state of intense chemosis, very drowsy. 4-12.—Lies quiet. 4-40.—Dog was drowsy and partially paralysed; when raised on his legs he cannot stand, falls over. 4-45.—Convulsed. 5-5.—Convulsed. 5-30.—Respiration ceased, heart's action continuing, but irregularly. 5-34.—Dead—in two hours and nine minutes.

This dog had been taking Liquor Arsenicalis for some time, before the poison was introduced: he was in excellent health and spirits at the time. The arsenic does not seem to have been in any way prophylactic.

Experiment No. 4.—About four drops of poison from the same Keautiah were diluted with four parts of water, and introduced into a dog's stomach at 3-50 p. m. No effect was manifested by 3-58, when about 8 or 10 drops of poison taken from a large Gokurrah (spectacled cobra) were put into the dog's mouth, being dropped on to the tongue and roof of the mouth. 4-2.—The dog runs about uneasily and is restless, is evidently nauseated, tries to be sick. 4-8.—Retching violently. 4-11.—Vomited the contents of his stomach, followed by a quantity of frothy mucus. Mouth examined, no change apparent in the mucous membrane. 4-15.—Involuntary defecation and micturation commencing; is very restless; staggers; head rolling from side to side. 4-26.—In convulsions. 4-28.—Dead—in 31 minutes. The body was examined soon after death. The blood flowed freely from the heart and great vessels, and formed into a peculiarly firm coagulum rapidly. The stomach and œsophagus laid open, rugæ of stomach deep pink, mucous surface of gullet quite blanched, tenacious and frothy mucus adhering to surface of stomach.

The three last experiments quite settle the question of poisoning by absorption of the poison through a mucous surface. In all three animals death resulted rapidly, and with all the symptoms of snake poisoning well marked. There could be no doubt of the absorption. The greatest care was taken not to abrade the surface, indeed nothing was done that could have abraded the surface ; and it was carefully noted at the time that no lesion had taken place. It must, therefore, be admitted that snake-poison may be absorbed through a mucous membrane, and that it is dangerous to apply it to the surface, and that the sucking of a cobra bite might be followed by symptoms of poisoning. This is quite contrary to hitherto expressed opinion, and confirms what I have observed and noted in previous experiments.

Experiment No. 5.—The peritoneal cavity of a fowl exposed by a small carefully made incision, no blood lost; a drop or two of Gokurrah poison then applied to the peritoneal surface at 3-53 p.m. The wound was closed, and the fowl released; it ran about for a moment or two, and then began to droop. 3-58.—Drooping, crouching, nodding its head, resting the beak on the ground. 4 p.m.—Symptoms increasing rapidly. Fowl convulsed and fallen over. 4-1.—Dead—in 8 minutes. This experiment proves that the peritoneum also absorbs the poison; care was taken that the poison should not touch the slight wound; it was spread on the peritoneal surface. Symptoms of poisoning came on rapidly, and death occurred in 8 minutes. This also tends to confirm the absorption of the poison through an unbroken membrane.

Experiment No. 6.—A full grown Pariah dog was bitten in the thigh by the same Keautiah from which the poison had shortly before been extracted, at 4-43 p.m. Immediately after being bitten the external jugular vein was exposed and Liq. Potas. ʒi, Aq. ʒii injected into the vein. No effect produced by the injection. 5 p.m.—Hind legs weak; staggers; restless; lies down, and rises again; defecations; falls over, and is almost paralysed; tries to use legs, fails, and he falls over. Twenty drops of Liquor Potäs: injected hypodermically into the thigh; thirty drops of Eau de Luce with water given by the mouth. Convulsed. 4-5.—Dead—in 22 minutes.

In this case the Liquor Potas: seemed to accelerate the action of the poison. The snake must have been all but exhausted when he bit, for all the poison that could be got, had been squeezed out of his glands not two hours before. There were no indications of poisoning for 10 or 12 minutes after the bite, and it generally begins sooner than that; but the poison's action having commenced, its progress was fearfully rapid, death taking place in about 12 minutes after the first indication of poisoning presented itself. The Liquor Potas: may not have done any harm, but it certainly did no good.

Present: Drs. Fayrer, J. Ewart, and J. Anderson, and Mr. Sceva,—June 8th, 1870.

An Ophiophagus Elaps, nine feet six inches long, and seven inches in circumference, arrived from Rangoon yesterday. It seemed in good health, but sluggish, and indisposed to bite even when roused; is just about to cast its epidermis.

Experiment No. 1.—At 11-50, a pariah pup one-fourth grown, was bitten in the thigh, the snake being made to close its jaws on the part. 11-51.—The dog much excited, but apparently not in any pain. 11-52.—In a state of general tremor; defecation. 11-55.—Fallen over paralysed. 11-56.—Convulsed. 11-58.—Dead—in eight minutes. The body was examined soon after death. The blood coagulated in a minute and a half after removal from the great vessels, into a peculiarly firm clot. The dog never gave the slightest indication of suffering; its death was very quiet and free from pain.

Experiment No. 2.—A full-grown pariah dog bitten on the thigh by the same Ophiophagus at 12. The snake was made to close its jaws as before on the part. 12-2.—Staggers, being weak in the hind leg. 12-4.—Standing up, but seems lethargic; head drooping; no expression or sign of pain; when made to walk, does so with difficulty: limbs seem weak, or to be in a state of ataxy. 12-9.—In the same condition: breathing deep; head drooping to the ground; seems unconscious of anything; complete locomotor ataxy. 12-20.—Limbs now seem paralysed; singular freedom from any expression or look of suffering. 12-26.—Slight convulsive movement of muscular system generally. 12-30.—Lies quite motionless; expression of eye natural. 12-31.—Slight convulsions of muscular system generally. 12-34.—Involuntary discharges; heart still beats, no respiration, convulsive waves over the whole body. 12-37.—Appears dead, but the heart still acts irregularly. 12-38.—Dead—in thirty-eight minutes.

There was no salivation in either of these dogs. The symptoms were like those of cobra poisoning; if any difference, death was quieter, and free from suffering. Body examined after death: blood coagulated very firmly on removal from the body. The snake is about to shed its epidermis; it is sluggish, and may be sickly, but yet the poison was very active; however, so far as these two experiments show, it is not more active or fatal than that of a full-grown, vigorous cobra.

Present: Dr. Fayrer and Mr. Sceva.

June 13th.—This morning the same Ophiophagus Elaps was made to shed its poison into a shell, by biting through a leaf stretched across the shell. The poison is a clear golden orange-colored fluid, and the quantity must have been nearly half a drachm. The snake has just shed its epidermis; it has not eaten for several days—but seemed tolerably well, though somewhat thin. It was handled by two men, one seizing it round the neck, the other by the body near the tail. It is very powerful, but they seemed to have no difficulty in controlling it.

At noon I made the following experiments with the poison:—

Experiment No. 1.—Five drops of the poison were injected with the hypodermic syringe into a dog's thigh at 12-14 noon. 12-17.—The leg seems weak, partially paralysed; he walks with difficulty. 12-22.—Sluggish, very weak in that hind leg. 12-25.—Deep breathing, seems lethargic, lying down; no salivation, no appearance of distress; can walk when roused, but staggers and seems drowsy. 12-32.—Very lethargic, lying down; head fallen over. 12-34.—When roused, can still walk with a tottering gait; lies down; head falls over. 12-42.—Lying down; limbs convulsed. 12-43.—Involuntary micturation and defecation. 12-48.—Heart beats still irregularly, but respiration has ceased. 12-50.—Heart's action still felt, but it is very slow and irregular. 12-51.—Dead—in thirty-seven minutes.

There was in this, as in the other dogs, no sign of suffering; a lethargy seemed to gradually steal over the animal, until it becomes unconscious, and then a few convulsive moments precede death. There was no salivation, as so generally occurs in cobra poisoning.

Experiment No. 2.—Two or three drops of Ophiophagus poison were injected into a fowl's thigh at 12-16. 12-17.—Leg weak. 12-20.—Crouching. 12-22.—Head falls over, beak resting on the ground; wings drooping. 12-24.—Paralysed; attempts to rise, falls over. 12-25.—Springs from the ground in convulsions; comb and wattles have become livid. The brilliant red color is gone. 12-28.—Convulsed. 12-30.—Dead—in fourteen minutes.

Experiment No. 3.—Three drops of the same poison injected into a fowl's wing at 12-20. 12-22.—Crouching. 12-25.—Runs about, but is weak. 12-26.—Drooping, beak resting on the ground. 12-28.—Almost paralyzed. 12-30.—Fallen over. 12-32.—Slightly convulsed; sprang from the ground once or twice. 12-33.—Dead—in thirteen minutes.

Experiment No. 4.—Two drops of Ophiophagus poison diluted with 20 of water, were injected into a fowl's thigh at 12-38. 12-42.—Drooping; falls over, beak resting on the ground. 1245.—Springs from the ground, falls as though dead. 12-47.—Dead—in nine minutes.

In this case, diluting the poison with water made it more active, for it killed in 9 minutes; whereas a larger quantity of poison undiluted, killed in 13 to 14 minutes.

Experiment No. 5.—One drop of Ophiophagus poison, four drops of Liquor Potas: and eighteen drops of water, were mixed, and then injected at 12-42 into a fowl's thigh. 12-45.—Limps on injected leg; falls over. 12-47.—Convulsed. 12-50.—Convulsed. 12-54.—Dead—in twelve minutes. Convulsive springs from the ground less violent than in the last case.

The Liquor Potas: had no antidotal effect. It seems to me almost conclusive that Liquor Potas: does not destroy the activity of the poison. In this case, there was only a single drop of poison to four drops of Liquor Potas:, and this was diluted with eighteen drops of water. The fowl died in 12 minutes, that is, 2 minutes sooner than one of equal size, that had been injected with three times as much of the poison undiluted. So far, death from the poison of this snake seems quieter, and attended with less suffering than from that of the cobra, though with very much the same symptoms, generally.

Experiments on the effects of the Poison of the Hydrophidæ, by W. D. Stewart, Esq., *Civil Surgeon, Pooree, communicated by*

Dr. J. Fayrer.

Experiment No. 1.

9th May, 1870, at 5-45 p. m.—The thigh of a half-grown fowl, cleaned of feathers, was presented to the Sea snake. It bit rapidly two or three times, and drew blood. After being bitten, the fowl crouched on its bent legs and never stood again.

5-49.—Pupils dilated; shook its head as if excited; then began to droop; eye-lids closing; beak resting on the ground.

5-50.—Raising its beak up and down; head rotating from side to side; sitting all the time; no convulsions.

5-55.—Lying on its side quite powerless.

5-59.—Dead in 14 minutes.

With a lens no punctures could be made out, even scratches could hardly be seen at seat of bite; blood dark, coagulated firmly.

From Mr. Stewart's description, I imagine the snake was H. Cyanocincta. In speaking of its fangs, he says, "Fangs about two-thirds of a line long, with a double curve, first bent forwards at base, then backwards, before terminating in its point. Poison groove extends only from the four-fifth on anterior aspect.

Experiment No. 2.

10th June, 1870.—Present: Mr. Thomson, C. S., and Mr. Stewart.

A long thin-necked snake, with white pea-sized spots on side of neck; unable to bite. Poison gland removed, and inserted at 11 a. m. into a wound made in the thigh of a half-grown fowl.

11-12 p. m.—No apparent result.

3 p. m.—It was observed to be drooping and unable to move.

6 p. m.—Dead.

This snake was most probably H. Chloris.

Experiment No. 3.

July 1st.—A similar snake was obtained on 1st July. It was torpid, but the trial was made by pressing the jaws firmly over the thigh of a fowl.

No result.

Experiment No. 4.

June 20th.—A Pelamis Bicolor, torpid and unable to bite. Mouth opened, and jaws made to close firmly over fleshy part of a fowl's thigh.

No result.

Experiment No. 5.

June 29th.—A Sea snake (probably H. Cyanocincta) was made to close its jaws on a chicken's thigh at 6 A. M., with firm pressure, as it could not bite voluntarily

9 A. M.—Lame, crouched.

3 P. M.—Eye-lids half closed; head drooping; respiration gasping, during which beak opens, and a crowing sound occurs; feathers ruffled; purged frequently.

June 30th.—Lying half-dead; refuses food; mark of bite bluish colour.

July 1st.—Recovered and able to move about; it remained well.

Experiment No. 6.

June 30th.—A Pelamis Bicolor, caught fresh in a hand net. It was quite lively, and able to bite.

A small fowl was bitten by it at 6-26 A. M.; the wound scarcely a scratch.

7 A. M.—Crouching, drooping.

8 A. M.—Beak rising and falling.

9 A. M.—Insensible.

9-50 A. M.—Quite dead.

Blood fluid after death.

EXPERIMENT No. 7.

July 5th, 1870.—A Sea snake, a new species allied to H. Hardwickii, bit a full-sized fowl in the thigh, at 8-30 A. M. The marks of the bite were distinct.

8-34.—Fowl seated.

8-35.—Drooping; eyes closing; rotating the head on the beak in a sitting posture.

8-38.—Convulsed; head resting on ground.

8-42.—Continued convulsions.

8-47.—Legs thrown backwards in final spasm; tail spread out, quite dead in 17 minutes.

Blood coagulated after death.

EXPERIMENT No. 8.

July 22nd.—The same snake was tried on a dog, but it was too feeble to bite: its jaws were pressed firmly on the inner part of the thigh. No evil result to the dog.

EXPERIMENT No. 9.

Hydrophis Cyanocincta, 4 feet long, bit a half-grown fowl voluntarily in the thigh, twice or thrice drawing blood, and leaving slight ecchymosis at 9-37.

9-40.—Fowl drooping; eyes closing; head resting on beak.

9-41.—Fell over on its side.

9-42.—Convulsed.

9-46.—Dead in 9 minutes.

EXPERIMENT No. 10.

The same snake bit a pariah dog, twice on the thigh, at 4-40 P. M.

5-20.—Dog restive, salivated, burrowing its muzzle in the sand.

5-25.—Seated, body thrown forwards, head down, partially convulsed, salivation increasing.

5-30.—Spasms; defecated.

5-35.—Involuntary evacuations; respiration slow; tongue hanging out of mouth; salivation very profuse.

5-40.—Dead in one hour.

Experiment No. 11.

July 23rd.—The same snake kept alive in a hole in the wet sand, bit a full-grown fowl at 7-35 A. M. This was not a fair bite, and took no effect. Bit again at 7-45, effectively. Fowl sat down after the bite.

8-11.—Lay down; head resting on beak; became convulsed.

8-25.—Convulsions.

8-35.—Dead.

The Hydrophis of four feet in length is evidently a very dangerous creature.

Experiments with Snake Poison, by Dr. Fayrer.

I am indebted to Mr. Galiffe, Collector and Supervisor of Calcutta Canals, for fine specimens of Hydrophis Coronata and Enhydrina Bengalensis from Dhappa.

Experiment No. 1.

A fowl was bitten in the thigh by Enhydrina Bengalensis, about 43 inches long, at 5-48 P. M. of 11th August.

The snake was sluggish; and could only be made to bite by forcibly closing the jaws in the fowl's thigh. The fangs were small, and barely drew blood.

5-51.—Crouched, and became convulsed almost immediately.

Died at 5-55, or in 7 minutes.

The blood formed a firm coagulum when removed from the body after death.

Experiment No. 2.

August 12th.—The above snake died at 10 P. M. yesterday. Its jaws were closed with pressure on a fowl's thigh this morning at 7-34 A. M.

8-5.—The fowl limps.

8-12.—Crouching; feathers staring; wings expanded.

8-20.—Head drooping, resting point of the beak on the ground.

9-5.—Remains in the same condition.

9-50.—Convulsed.

11-35.—Remained in much the same condition until death after four hours.

The poison of this snake when vigorous and fresh in its own element, the salt water, must be very deadly.

Experiment No. 3.

On the 9th August, a Hydrophis Coronata was made, with much difficulty, and only by pressure, to close its very small jaws on the comb, and then on the thigh of a half-grown chicken. At 3-30 P. M., the chicken was excited, but apparently not in pain after the bite.

4 P. M.—Pecked some grains of rice.

4-11.—Crouching.

4-16—Head falls over; starts when its beak touches the ground.

4-30.—Drowsy; beak resting on the ground; wings drooping.

4-53.—Eyes closed, beak resting on the ground; starts at intervals, any noise makes it rise with a jerk.

5-15.—Cannot be roused by noise, but starts when touched; falls over on its side.

5-33.—Apparently dead, lying on its side; slight convulsions when raised by the wings.

5-55.—Dead in 2 hours and 25 minutes.

The poison of this snake is also very virulent; it was weak, had been many days in captivity, living in fresh water, but without food. The head is exceedingly small, and the fangs almost imperceptible. In its native element, I should imagine it is, notwithstanding its small jaws, very dangerous. I have never met with a case of bite of the Hydrophis in the human being, but I think there can be no doubt that if a man were bitten by a well-grown snake, and in the water, where the snake would be active and vigorous, the danger would be as great as though he were bitten by a Cobra on the land. Few accidents occur, the boatmen know the danger and avoid them.

Mr. Galiffe in his note to me also speaks of a fatal case in $1\frac{1}{2}$ hours, which occurred somewhere in the vicinity of the Salt Water Lake.

In the returns for 1869, I find a notice of a fatal case of a master of a ship who was bitten when bathing at Moulmein. I append a very interesting case, taken from the naval records, in which a seaman of H M. S. *Algerine* was bitten mortally by a sea snake caught at Madras.

The case is in the transactions of the Zoological Society of London, vol. 2, p. 303.

"The other death in this vessel (H. M. S. *Algerine*) requires a more lengthened notice. On the 9th October, while the ship lay at anchor in the Madras Roads, a water snake was caught measuring seven feet six inches long, and six inches and-a-half in girth at the thickest part. After the patient had handled the reptile for some time, it suddenly bit him on the inside of the index finger of the right hand, inflicting a wound resembling that caused by the point of a pin. He declined having the wound fomented, having been bitten by reptiles of the same kind, as he supposed, in the Straits of Malacca, without any bad consequences. At 8 A. M., half an hour after the infliction of the wound, he made a good breakfast, dressed, and about 10 o'clock, went on deck. After taking a few turns, he was suddenly seized with vomiting, the matter ejected being of a dark-brown colour, resembling coffee ground, and of a very offensive odour. After a short time his pulse became small, variable, and intermitting, and the pupils were dilated, but contracted steadily by the stimulus of light. The left side of the face was slightly paralysed; there was subsultus tendinum, and the skin was covered with a cold, clammy perspiration; the countenance was anxious and indicative of much distress. In consequence of the spasmodic action of the muscles of the glottis, he breathed with great difficulty. The integuments from the wound to the wrist were slightly swollen, and on the right side of the neck and face they presented a mottled appearance of dark purple and livid colour. A ligature having been placed above the wrist, and fomentations applied to the hand, a liniment composed of Turpentine, Liq. Ammoniæ, and Olive Oil, was rubbed on the throat and neck. He made frequent attempts to swallow a mixture containing Liq: Ammoniæ and Tinct. Opii, but failed. At 10-20, in consequence of the spasms of the muscles of the glottis, he was put into a warm-bath, which apparently relieved the symptoms, and enabled him to take a dose of the mixture, which caused him to vomit a dark ropy fluid. About 20 minutes, after coming out of the bath (in which he remained 10 minutes), the spasmodic actions of the muscles of the neck and throat became more severe, and the whole body assumed a purple colour. The breathing became very difficult from the obstructions caused by a dark-brown substance, which came away in a stringy form from the air-passages. By 11 o'clock, he was in a state of coma, the pupils were contracted, and the pulse imperceptible at the wrist. At 11-20, not quite four hours from the time he was bitten, he died. It does not appear that any post-mortem examination of the body took place. It will be remarked that the symptoms in this case very much resembled those produced by the bite of a rabid animal, although they were much more violent and more speedily fatal."

Taken from the Statistical Report on the health of the Navy on the East Indian Station, in the years 1837, '38, '39, '40, '41, '42, and '43.

Remarks on certain of the Hydrophidæ, and Extracts from Notes on them by Mr. Stewart, *Civil Surgeon of Pooree.*

"I have been fortunate in getting a number of both these specimens (H. Cyanocincta) lately, but unfortunate again, in that they perished very soon after I got them; some in fact were brought nearly dead. Whether it is that the violent surf threw them on the shore, or that they are with difficulty kept alive when once removed from the sea, I am not sure. The fact, however, is the same, that though kept in a gurrah of sea-water and exposed to the air, the animals are very feeble after 10 or 12 hours.

"I intend to have readier arrangements in future, so as to get the snakes to bite as soon after they are caught as possible. I am sorry that my attempts to get them to bite lately have been a failure from the above cause; but I hope to be able to supply you with a few facts as soon as I can.

"The Pelamis Bicolor is called by the Telinga fishermen Kullunder Samp, and is looked on as a very deadly snake by them; but I hope to satisfy myself about the truth of this.

"I got a female Hydrophis Cyanocincta brought to me dead. It had 16 eggs in it, each as large as a full-sized hen's egg. The young snakes in each egg were perfectly formed, and about six inches long.

"I still experience the same difficulty in getting the snakes active enough to bite. When they are freshly thrown upon the shore, they are ready to bite; but by the time I get them they are exhausted.

"I have tried dissecting out the poison gland, and inserting it under the skin of the thigh of a fowl. The first was from a thin-necked small-headed snake. The fowl did not appear to be affected at the time, but was found all but dead 3 hours after; and by six hours was quite dead. I tried Pelamis Bicolor this way, but

The continuation of this will be found at page 132 of Thanatophidia

EXPERIMENTS ON SNAKE POISON.

BY J. FAYRER, M.D., C.S.I.

(Re-published from the Indian Medical Gazette.)

Present: DRS. J. FAYRER, W. B. BEATSON, and J. EWART, Professor of Physiology.—July 23rd, 1870.

EXPERIMENT No. 1.—A full-grown pariah dog was bitten in the thigh by a full-grown and vigorous cobra, of the variety called by the snakemen, Kurees Keautiah. Two table-spoonsful of Mr. Otho Alexander's fluid antidote were poured down the dog's throat immediately after the bite, which was inflicted at 12-18 p.m., and the vegetable extract or paste made into the consistence of honey with Liquor Ammonia, was well rubbed into the wound, and over a large surface round it.

This so-called antidote was sent to India by Mr. Otho Alexander of Cephalonia, and the samples experimented with, were sent to me for experiment by His Excellency the Viceroy. The following are Mr. O. Alexander's instructions, which were carefully followed:—

" The antidotes are to be used in the following manner:—As soon as possible after the infliction of the bite two table-spoonfuls of the liquid should be administered. The ointment, said to be Venetian treacle, having been reduced with Liquor Ammonia to the consistence of thick honey, should then be rubbed forcibly into the wound over a large surface, and from the bite downwards, and this should be repeated several times until a quantity of the ointment is absorbed. After the lapse of three or four hours the fluid should be again given, and the friction repeated, but with less force."

The fluid is a clear liquid like water, the paste has very much the appearance of extract of Conium or Hyoscyamus, with a somewhat resinous smell.

12-19 p.m.—The dog limped on the bitten leg, and seemed restless and uneasy. 12-26.—Retching. 12-30.—Very restless; breathing hurried. 12-31.—Vomiting. 12-33.—Staggering; profuse defecation. 12-34.—Convulsed; diarrhœa; rises, staggers, and falls over in convulsions. 12-35.—Violent convulsions. 12-37.—Perfectly paralysed; heart still beats; no respiration. 12-38.—Dead—in twenty minutes after the bite. The blood on removal from the great vessels coagulated firmly a few minutes after death.

Experiment No. 2.—A full-grown pariah dog was bitten in the thigh by a large spectacled cobra (Koyah Gokurrah of the snakemen) at 12-37 p.m. Two table-spoonsful of the fluid were poured down the dog's throat immediately after the bite. 12-40. —Breathing hurriedly; restless. 12-50.—Restless and uneasy; the paste well rubbed into the wounds and neighbouring parts, according to the instructions. 12-52.—Convulsed; rises, walks with a staggering gait, and falls. Another dose of the fluid administered. 12-54.—Violently convulsed. 12-55.—Paralysed, cannot rise. 12-57.—Heart still beats, respiration has ceased. 12-58.—Dead—in twenty-one minutes. Blood coagulated firmly soon after death.

Experiment No. 3.—A young spectacled cobra, three feet in length, was bitten fiercely in three places in the body by a full-grown, powerful, fresh and vigorous cobra of the variety, called by the snakemen, Bansbunniah Keauteah, at 12-27 p.m. The fangs were deeply imbedded, and the poison must have been thoroughly inoculated.

At 2-20 p.m. on the following day, the young cobra was as active as ever, evidently not in the least affected by the poison. I selected a small cobra to be bitten by a large one in order that the effects of the poison might be felt with the greatest force, should it have any at all.

Experiment No. 4.—A Bungarus Fasciatus, five feet in length, was bitten deeply in two places by a very large, fresh, and vigorous cobra (Tentuliah Keauteah), five feet six inches in length, at 12-30 p.m. There could be no doubt of the severity of the bite, for it was disengaged with difficulty.

At 2-20 p.m. on the following day, nearly twenty-six hours, the Bungarus was perfectly well, and not in the least affected by the poison.*

Experiment No. 5.—A fowl had twenty drops of the blood of the dog poisoned by a cobra in Experiment No. 1, injected with the hypodermic syringe into each thigh, at 12-42 p.m. 12-50.—Crouching. 12-55.—Crouching; feathers ruffled. 1-5.—Sluggish, eyes closed; is drowsy. 1-30.—Stands with head depressed; feathers staring; eyes closed; very drowsy. 2.—Very drowsy; head drooping. After this the fowl slowly recovered; and on Monday, 24th, was quite well. The poison in this experiment must have been infinitesimal in quantity; only 40 drops of the blood of a full-grown dog poisoned by a cobra, were injected. The symptoms of poison were well marked, though the bird ultimately recovered.

Experiment No. 6.—A solution of one part of cobra poison to eight parts of Liquor Potas. was prepared by Dr. Ewart, and of this nine drops were injected into a fowl's thigh at 12-57 p.m. There was a floculent looking deposit caused by the mixture of the fluids. 1 a.m.—Drooping. 1-2.—Crouching; head falling over; nearly paralysed. 1-4.—Convulsed. 1-7.—Dead—in seven minutes, with all the symptoms of cobra poisoning.

This experiment appears conclusive: eight parts of Liquor Potas. did not neutralize the effects of one part of the poison.

Experiment No. 7.—A fowl was bitten by a fresh cobra in the thigh at 1-2 p.m. 1-3.—No convulsions. 1-4.—Dead—in two minutes.

* This snake died on the third day. The cobra bite had become a putrid wound which had exposed the ribs. It is doubtful whether death was not caused by the wound independently of the poison.

Experiment No. 8.—Twenty drops of the blood of the above-mentioned fowl, removed immediately after death, injected into either thigh of a fowl at 1-10 p.m. 1-30.—Sluggish. 2-15.—Sluggish. 4-10.—Drowsy; head falls over. 4-20.—No convulsions. 7-15.—Dead—in six hours and fifteen minutes. Blood removed from the body, coagulated firmly after death. This quite settles the question of the blood of an animal killed by snake poison being itself poisonous. In this case it proved fatal in six hours and ten minutes.

In the case where the blood of a dog poisoned by a cobra was injected, the bird also showed marked evidences of poisoning; though the dilution of the poison must have been very great in the blood of so large an animal as a dog; only 40 drops of the blood was used in each experiment.

Experiment No. 9.—A full-grown cobra (Bansbunniah Keautiah) was bitten twice, very strongly, by a full-grown and vigorous cobra (Tentuliah Keautiah), at 1-15 p.m. No evil consequences followed. The snake was perfectly well next day.*

Experiment No. 10.—A fowl was bitten in the thigh by a Bungarus Cœruleus (krait), at 1-22 p.m. 1-24.—Feathers staring; eyes have a fixed glaring stare. 1-25.—Stretches out the neck; falls over; point of beak resting on the ground. 1-26.—Convulsed; puncture in thigh ecchymosed and œdematous. 1-29.—Dead—in seven minutes. Blood coagulated firmly in four minutes after death.

This experiment shows the deadly nature of this little snake, which is apparently more so than its large congener, the Bungarus Fasciatus. This experiment also proves that the coagulation of the blood is not prevented after death.

Experiment No. 11.—A cat was bitten in the thigh by a cobra (Tentuliah Keautiah), at 1-46 p.m. Mr. O. Alexander's antidote and extract were administered, according to his instruc-

* But was found dead 5 days later.

tions, immediately. 1-47 p.m.—Pupils widely dilated; cat lies stretched out; hurried breathing. 1-41.—Convulsed. 1-52.—Paralysed; heart still beats, no respiration. 1-55.—Dead—in nine minutes. This cat was on a former occasion bitten by a large Bungarus Fasciatus, and showed no sign of poisoning. The blood on removal from the body a few minutes after death, coagulated firmly.

Experiment No. 12.—A fowl was bitten in the thigh by a large Bungarus Fasciatus, at 1-44 p.m. 1-54.—Drooping; head falling forwards. 1-58.—Convulsed, cannot stand. 2 p.m.—Convulsive movements; there is a peculiar vocal sound as though the thorax were compressed. 2-5.—Convulsed. 2-10.—Dead—in twenty-six minutes. Blood removed from the body coagulated firmly in a few minutes after death.

Experiment No. 13.—A young rat was bitten in the thigh by a Bungarus Cœruleus, at 2 p.m. Insensible immediately. Dead—in thirty seconds. Blood coagulated firmly in four minutes.

EXPERIMENTS ON SNAKE-POISON.

By J. Fayrer, M.D., C.S.I.

(Re-published from the "Indian Medical Gazette.")

July 28th, 1870.—Present: Drs. Fayrer, Murray, (Inspector-General of Hospitals) Ross, Beatson, and Ewart.

Experiment No. 1.—A full-grown and powerful pariah dog was bitten in the thigh by an Ophiophagus Elaps, 9 feet 9 inches in length, at 12-15. The snake, it is to be observed, had been some months in captivity, and was sluggish and apparently disinclined to bite. It had been fed on fish, which was pushed down its throat, as it refused to eat. The bite in this case was very slight, and it was doubtful if the fangs had penetrated.

12-19.—The dog micturated very freely. 12-24.—Restless. 12-25.—Lying down. 12-35.—Apparently not affected. 12-38.—Defecation and micturition again very profuse. 12-44. —The snake was again made to bite the dog in the thigh. This time there was no doubt about its fangs being imbedded, for blood was drawn. 12-50.—Restless; turns round; lies down; gets up again. Breathing accelerated. 12-55.—Very restless; convulsive twitchings of the muscles generally. 12-58.—Breathing much accelerated; cannot stand; staggers and falls over; convulsive movements. 1-2 p.m.—Convulsed. 1-7.—Convulsions; bowels acted again. 1-9.—Dead.

First bite, doubtful, 12-15. Second, certain, 12-44. Dead 1-9; 54 minutes from the first doubtful bite; or 25 minutes from the second certain bite. The skin was removed from the wounded part. The cellular tissue around the puncture was dark, ecchymosed, and œdematous. The blood, when removed from the body after death, coagulated firmly into a red clot.

Experiment No. 2.—A fowl was bitten in the thigh by the same Ophiophagus at 12-49. It limped immediately on the bitten leg. 12·54.—Fowl drooping, head falling over. 12·55. —Convulsed. 12·56.—Purged; convulsed. 1 p.m.—Dead—in 11 minutes. Areolar tissue about the wound ecchymosed: blood coagulated firmly on being removed from the body after death. The snake is apparently not so virulent as a cobra, for the fowl lived 11 minutes after being bitten. But this may be due to its weak condition for it has been long in confinement; it looks sickly, and has been fed on fish, instead of its natural food, snakes, which it declines to eat. They have been put into its case, but it refuses to touch them.

EXPERIMENT No. 3.—I append an extract from the *European Mail* on the subject of an antidote for cobra poison :—

SNAKE POISON AND ITS ANTIDOTE.

To the Editor of the "European Mail."

SIR,—Having noticed of late the publication in both European and American journals of articles upon the subject, and particularly one under date March 2, 1870, under the heading "The Cobra Question in India," I trust you will give publicity to this communication, on account of its importance; and am induced to ask for it a place in the columns of your journal, in the hope that it will afford to your readers, in India more particularly, a knowledge of an antidote for snake-poisons, which may claim to be specific, insomuch as it has never been unknown to fail in a single instance during the past three years in different districts in this country in which I have been able to induce its general adoption, and particularly by the *Curanderos*, or curers (snake-charmers.) I have devoted no little time during the past twenty years to a study of the habits, peculiarities, &c., of poisonous snakes, and have made many experiments with their poisons, with a view to discover, if possible, specific antidotes to them, and have been so far successful as to be able to announce the law in therapeutics that "all animal poisons have their specific antidotes in the gall of the animal or the reptile in which these poisons exist."

The bite of the cobra, or of any other poisonous snake or reptile, can be cured by administering a few drops of a preparation of the gall of the cobra, which should be prepared as follows:—Pure spirits of wine, or 95 per cent. alcohol, or the best high wines that can be procured, 200 drops; of the pure gall, 20 drops; in a clean two-ounce phial, corked with a new cork; give the phial 150 or 200 shakes, so that the gall may be thoroughly mixed with the spirits, and the preparation is ready for use. In case of a bite put five drops (no more) of the preparation into half a tumblerful of pure water; pour the water from one tumbler into another backwards and forwards several times, that the preparation may be thoroughly mixed with the water, and administer a large tablespoonful of the mixture every three or five minutes until the whole has been given. In case the violence of the pain and hæmorrhage or swelling of the bitten part should be but slightly alleviated after the whole has been taken, repeat the dose, prepared with the same quantity of the preparation in the same way, and administer as before. In curing upwards of fifty cases of snake-bites I have never been obliged to repeat the dose except in two instances, and have never lost a case. The cobra-poison is no more deadly than that of a great variety of snakes found in South America, of which may be named the *Cascabel*, or *Rattle-snake*; *Boqui-dorada*, or gilded mouth; *Mapana-Sapo*, or frog-headed Mapana; *Mapana-fina*, or *Lachesis*, *Niger*, *Birri*, and *Verrugosa*, or wart-snake. The poison of all these varieties produces death (under certain conditions—atmospherical, physical, climaterical, and electrical) in from fifteen minutes to two or three hours; but it is found that the gall of each variety (administered as previously indicated) is the perfect antidote for its own poison. The gall of the most deadly kind may be used in cases of bites of those less virulent, and is also applicable in cases of bites of the centipede, scorpion, sting-ray, star-lizard, or *Lacerta stella*, and is also very effective in dog-bites.* * * * * * * * *

State of Magdalena, April 10, 1870. S. B. Higgins.

The instructions therein contained have been most carefully followed. The alcoholic solution of the bile of the cobra was prepared with the greatest accuracy by Dr. D. Cunningham; it was taken from a large and vigorous cobra killed on purpose, and the tincture prepared without delay.

The following experiment was made on the 28th of July :—

A full-grown pariah dog was bitten by a cobra (Bansbuniah Keautiah) on the thigh at 12-30. The bite was very slight, as the snake seemed indisposed to close its jaws. However, a very slight wound was inflicted, and it was not repeated, as it was more probable that the antidote would be beneficial, the dose of poison being slight. At 12-32 the antidote was administered exactly according to the instructions. 12-35.—Another dose given. 12-38.—Ditto ditto. 12-41.—Ditto ditto. The dog is sluggish and depressed. 12-42.—Staggers in his gait; micturates and defecates profusely. 12-44.—Another dose given. 12-47.—Ditto ditto. 12-51.—Ditto ditto. 12-53.—Ditto ditto. The dog is sluggish. 12-56.—Another dose given. 12-59.—Ditto ditto. 1-2 p.m.—Ditto ditto. 1-5.—He is very sluggish and depressed. 1-8.—Convulsed; another dose given. 1-12—Ditto ditto. 1-17.—Very drowsy; convulsive twitchings; another dose given. 1-25.—Ditto ditto ditto. 1-30.—Convulsed ; another dose given. 1-34.—Ditto ditto ditto. 1-41.—Feeble respirations, almost paralysed. 1-45.—Still breathes ; 1-52.—Still breathes ; cannot move ; has occasional convulsive twitchings. 1-57.—Dead—in eighty-seven minutes. Blood coagulated firmly on being removed from the body. Skin raised over the bite ; areolar tissue echymosed and œdematous. The symptoms were simply those caused by a smaller dose of the poison than usual ; death resulting in 87 minutes.

Experiment No. 4.—A pariah dog was bitten in the thigh by a cobra at 12-58. The bile antidote administered at 12-55. 12-58.—Another dose given. 1-1 p.m.—Another dose given. It was repeated at intervals of three minutes. 1-6.—The dog is sluggish and staggering. 1-10.—Convulsed. 1-12.—Dying. 1-13.—Dead—in twenty minutes. The antidote was administered regularly at intervals of three minutes. Blood coagulated firmly after death ; areolar tissue under the integument ecchymosed and œdematous.

Experiment No. 5.—A young dog was bitten in the thigh by a spectacled cobra (Kurees Gokurrah,) at 1-25 p.m. Mr. Otho Alexander's fluid antidote administered, and paste diluted with ammonia, applied according to Mr. A.'s instructions. 1-27.—The dog staggers, drags the bitten leg. 1-28.—Bitten leg paralysed. 1-29.—The dog has fallen over ; paralysed. 1-30.—Convulsed. 1-32.—Dead—in seven minutes. The dog was about half-grown ; the cobra was fresh and vigorous. The drugs did not appear in any way to modify the action of the poison. Blood coagulated firmly after death.

Experiment No. 6.—The same Ophiophagus Elaps used in Experiments Nos. 1 and 2, was made to shed its poison into a shell ; and on this occasion I observed that the fluid was more limpid, and not of so deep a yellow color as in former experiments. Six drops of this poison were injected into the external jugular vein, which was laid bare on purpose, of a very large and powerful dog, at 1-42 p.m. For a minute the dog did not seem affected in any way. 1-43.—Staggered suddenly when walking, and micturated profusely ; in a few seconds more it was convulsed with opisthotonos. 1-44.—Fell over, apparently insensible ; there was neither cry nor indication of pain. 1-45.—Lying with the limbs extended, and breathing deeply. It remained in this position, apparently dead, but for the deep breathing, until 1-59, when it was convulsed. At 2-4 it was quite dead—in 22 minutes. It seemed perfectly unconscious after the first two minutes. Blood coagulated firmly after death.

EXPERIMENT No. 7.—A cobra was made to shed its poison into a shell, and five drops were injected into the external jugular vein of a full-grown pariah dog, not quite so powerful as that in Experiment No. 6, at 1-55. In thirty seconds it was affected, the bowels acted, muco-sanguinolent motions, and it fell into convulsions ; its legs failed, and it remained resting on its belly. Vomited ; gave a few convulsive movements, and was dead—in 2½ minutes.

These two experiments, 6 and 7, shew the terrible activity of snake-poison when it directly enters the venous circulation. In contrasting the two, the cobra-poison appears more rapid and deadly in its action than that of the ophiophagus. Death occurred from the cobra-poison in 2½ minutes, and from the ophiophagus-poison in 22 minutes. But it is to be remarked that the dog was somewhat more powerful in the case of the ophiophagus than in that of the cobra ; and that the ophiophagus was probably weak and sickly from confinement, whilst the cobra was comparatively fresh and vigorous.

From the opportunities I have had so far of testing the relative virulence of the poisons of these snakes, I should say that, quantity for quantity, the poison of the ophiophagus is not more deadly than that of the cobra, if, indeed, it be not less so. The Rev. Mr. Vinton, of Rangoon, to whom I am indebted for the ophiophagus, and who has much knowledge of those snakes, writes to me as follows :—"In all my experiments I have always found that, quantity for quantity, the poison of the Hamadryad was not so dangerous as either Cobra or Daboia. The danger with the Hamadryad is, however, in the very large quantities of poison. When very much enraged it clings to its bite, and seems determined to inject a very large quantity of poison into the wound."

From what I have seen of the Hamadryad (Ophiophagus) I am inclined to form the same opinion as Mr Vinton. The snake, when it did bite, held on with much pertinacity, and in earlier experiments, when it was made to shed its poison by biting a leaf stretched across a shell, at least half a drachm was obtained of a bright orange-coloured viscid fluid, which I have already described.

But nothing that I have seen of it in captivity, confirms the account of its aggressive nature. Indeed, it seems rather sluggish and difficult to rouse, not assuming readily the menacing and angry look of the cobra when roused. But when much irritated, the Ophiophagus raises its head, expands the hood, hisses, and strikes, though not so fiercely as the cobra. It is probably different in the wild state, where it is said, when roused, to take the initiative, and not only attack but chase its enemy, even man.

EXPERIMENT No. 8 —About five drops of fresh cobra-poison, just taken from the snake, were put into a fowl's mouth at 2-5 p.m., and were apparently immediately swallowed. The fowl was evidently affected, its feathers rather ruffled ; it drooped, and was purged. It kept constantly shaking its head, and trying to sneeze, if we may so describe the action in a fowl. It drooped for a time, but the following day had quite recovered. The crop was full of grain, and hence the poison probably was diffused throughout the contents, and was not brought into contact sufficiently with the mucous membrane to produce fatal poisoning. Former experiments have abundantly proved the danger of applying the poison to a mucous surface.

NOTE.—The Bungarus Fasciatus, bitten by the cobra on the 23rd of July, died on the 28th July. It was found that the cobra-bite had ulcerated, and a putrid opening in the tissues exposed the ribs. It evidently did not die of the direct effects of the poison. The cobras bitten by other cobras are alive and well. As these snakes were all severely bitten by fresh and vigorous cobras, I think it may be fairly said that they cannot poison each other or themselves.

I am indebted to Dr. Richards, Civil Medical Officer of Bancoorah, for the following experiments which he was kind enough to make at my request with the Krait or Bungarus Cœruleus. The snake is said to be common in that part of Bengal, and is known there to the natives as the Dhomun Chitee :—

Experiment No. 1.—*August 1st*, 1870.—A "Krait" (Bungarus Cœruleus), after being irritated for five or six minutes, was made to bite the comb of a fowl at 6-55 p. m.; it died, with the usual symptoms preceding, at 7-27, or 32 minutes. The body was opened at once, and the blood taken from the heart coagulated immediately.

Experiment No. 2.—*August 2nd*.—The same Krait was made to bite a fowl's fore-arm at 1-28 p.m. The snake held on for some time. The bitten part, which bled very much, was at once burnt with a piece of iron made red hot. 1-40 p.m.—Tail drooping slightly; looks rather sluggish. 2 p.m.—Apparently much better, and is eating some rice. 2-15 p.m.—Rests the beak upon the ground, and is crouching. 2-25 p.m.—Crouched in a corner; endeavours to keep its beak resting on the ground, but the head falls on one side; presently became convulsed. 3-20.—Dead—in 1 hour and 52 minutes. Body opened 30 minutes after death. The heart contained fluid blood, which, however, coagulated immediately on being drawn from it, except a portion that was mixed with Liq. Potas., which did not coagulate, and became very dark.

Experiment No. 3.—The same Krait was made to bite a fowl's fore-arm at 2-12 p.m. 3 p.m.—Drooping, and drowsiness began in 17 minutes; now staggers, and then squats down. Liquor Potas. mxv, with water, administered. 3-14 p.m.—Endeavours to keep the head straight on the ground, but the head constantly drops on to one side or the other. 3-28.—Dead—in 1 hour and 16 minutes. The body was opened 7 minutes after death. The blood was fluid, but coagulated immediately on being drawn from the body.

This last fowl died much quicker than the second, although bitten after, and with less severity. Either the excessive bleeding, or the actual cautery in the case of the second fowl prolonged life. I am inclined to believe it was the former. The experiment with Liq. Potas. was not satisfactory, as it was given much too late.

Experiment No. 4.—*August 5th.*—A full-grown country goat was bitten by the same Krait, in one of the teats, at 4-30 p.m. At 8 p.m. appears tolerably well, but the tail is drooping. 10-12 p.m. —Staggers about, or lies on its side; defecation, micturition, and salivation. 10-24 p.m.—Convulsed; pupils dilated, and insensible to light; gasping; twitching of the ears; eyes fixed. 10-28 p.m. —Dead—in 5 hours and 58 minutes. Body opened at 11 p.m. The blood, which was fluid when taken from body, was put into three separate glasses.

No. 1 contained blood only, and this coagulated firmly immediately; color bright red.

No. 2 contained blood and Liq. Potas.; did not coagulate immediately; it became gradually thicker; and for five minutes coagulated less firmly than No. 1; color brownish.

No. 3 contained blood mixed with Liq. Ammonia; did not coagulate until the morning of the 6th, and then not at all firmly; color dark red.

I could find no fang marks in the teat, *either before or after death.* The Krait died before the evening, owing to my having handled it too roughly in making it bite the goat.

EXPERIMENTS ON SNAKE POISON.

By J. Fayrer, M.D., C.S.I.

(Re-published from the Indian Medical Gazette.)

August 5th, 1870.

Experiment No. 1.—Some poison was taken from an ophiophagus on the 4th, yesterday; it had dried into a gum-like paste by noon to-day and was of the usual clear orange color. This was diluted with water into its natural consistency.

The snake was sickly and died this morning, so that it is probable that the poison was less active than if it had been taken from a vigorous snake. A drop of this poison was injected with a hypodermic syringe, at 12-27 p.m., into a pigeon's thigh.

The bird for the first three or four minutes did not seem to be affected, it then began to droop and erect its feathers. 12-35.—Fell over, cannot stand. 12-36.—Convulsive movements. 12-38.—Appears to be dying. 12-40.—Dead—in 13 minutes.

Blood coagulated firmly after death.

Experiment No. 2.—About one-fourth of a drop of clear transparent poison extracted from a Bungarus Cœruleus. It was with the greatest difficulty that even this small quantity could be collected, owing to the smallness of the krait's fangs. This was diluted with sufficient water to form a good sized drop, and was injected at 12-35 into a pigeon's thigh.

No change for the first three or six minutes. 12-43.—Crouching, wings spread out. 12-45.—Convulsed. 12-47.—Paralysed completely, occasional convulsions. 12-51.—Dead—in 16 minutes.

Blood coagulated firmly after death. The quantity of poison was extremely small, and even part of that was lost in collecting it: the whole amount must have been considerably less than $\frac{1}{4}$ of a drop, but it proved fatal in 16 minutes.

Experiment No. 3.—Poison taken from a fresh keautiah (cobra). Half a drop was diluted with water and injected into a pigeon's thigh at 12-39. 12-40.—Staggering. 12-41.—Fallen over. 12-42.—Convulsed. 12-43.—Dead—in 4 minutes.

Blood coagulated firmly after death. The snake in this experiment was fresh and healthy, poison was shed in considerable quantity, but only half a drop was used: it killed in 4 minutes.

Experiment No. 4.—A similar quantity of the same cobra poison diluted with four parts of water was injected into a pigeon's thigh at 12-47. 12-49.—Staggering; head fallen over. 12-50.—Convulsed. 12-51.—Dead—in 4 minutes.

Blood coagulated firmly after death. The result was the same as in the last experiment.

Experiment No. 5.—A drop of the ophiophagus poison, the same as used in experiment No. 1, was injected into a pigeon's thigh at 12-52.—Not affected for the first few minutes. 12-58. —Staggers and is convulsed. 12-59.—Fallen over, convulsed. 1-4.—Gasping. 1-5.—Dead—in 13 minutes.

Blood coagulated firmly after death.

Experiment No. 6.—A pigeon bitten in the thigh by the krait from which the poison was taken for the 2nd experiment, at 12-55. 12-56.—Purged, staggers. 12-58.—Crouching, purged. 1 p.m.—Cannot stand. 1-4.—Gasping; convulsive movements. 1-5 —Dead—in 10 minutes.

Blood coagulated firmly after death. The snake was exhausted, and hence the comparatively slow action of the poison.

The object of these experiments on animals of the same size and strength, pigeons, was to test the relative virulence of the poison of the cobra, the krait, and the ophiophagus.

The results are not conclusive, as the conditions were not equal. The ophiophagus was sickly, and the poison had dried up before being used. The krait was small, and had been frequently used lately; the quantity of poison obtained was very small. The cobra was fresh and vigorous.

The results were :—

The cobra killed in	4	minutes.
The ophiophagus in	13	„
The krait in	16	„

Further experiments are needed to test the certain relative activity of the poison of these snakes.

Present: Drs. Fayrer and J. Anderson, Curator of Indian Museum.—8th August, 1870.

I am indebted to Major McMahon, Deputy Commissioner of Delhi, for a very fine specimen of Echis Carinata, and three of Bungarus Cœruleus, which all arrived safely from Delhi yesterday. The Echis is $22\frac{1}{2}$ inches in length. One Bungarus Cœruleus 48 inches, and the two others 27 inches, one being much larger in girth than the other, though of the same length.

The Echis is a beautiful little viper, and apparently very fierce; he hissed* loudly when disturbed, and drew back his head in the attitude as if to strike. The fangs are very long and moveable, and in general character he closely resembles the Daboia Russelli, though differently marked and much smaller.

Major McMahon says, the local name of this small viper is Afâe vulgarized into Hafâe. Speaking of this individual, he says: "I have never seen one larger than the specimen I now send. They have the reputation of being very deadly, and certainly my old snake-man died from the bite of one of his specimens."

The Echis Carinata appears to be common about Delhi.

Experiment No. 1.—A full-grown pariah dog was bitten in the thigh by the Echis Carinata at 12-30. The snake bit savagely,

* I subsequently discovered that this sound is not hissing, but is caused by friction of the lateral scales.

and embedded his fangs thoroughly. The dog howled as though in pain. As the snake closed his jaw and before one fang penetrated, a small drop of clear fluid, the poison, was seen on the part.

12-22.—The dog is restless, and drags the bitten leg. 12-26. —The hind quarters seem very weak, he walks with difficulty. 12-34.—Lying down, rises but with difficulty, and drags the hind limbs. 12-42.—Lying down; breathing hurried. The muscles generally in a state of tremor. 12-59.—The dog can stand. but when he moves he drags the hind legs. 1-6.—Standing in a dejected attitude, head resting aginst a box. 1-18. —He seems rather better. Tries to walk about, but drags the legs. Refuses water when offered. 1-30.—Some blood drawn from a nerve in the thigh; it became a bright, red fluid immediately, and slowly formed into a poor and rather imperfect clot. 1-45.—Very sluggish, but better than he was; limb swollen and discolored about the bite. 2-2.—Lying down, apparently asleep. 2-5.—The breathing is still hurried, and he is very sluggish, but takes notice when spoken to. There is no salivation or frothing at the mouth.

I saw him again at 5-45 p.m. He was lying down, quite conscious, but very much indisposed to move; the bitten limb swollen; this was partly due to the puncture whence the blood was abstracted, and the hind legs very weak.

The dog died at 10 p.m., in nine and a half hours. The blood remained fluid after death. There was no coagulation.

It is worthy of note, that blood taken from the dog whilst living, one hour after being bitten, and when well under the influence of the poison, formed a rather imperfect clot.

The rigor mortis was complete when I saw the dog at 8 a.m. of the 9th. The bitten limb was swollen and infiltrated with black blood. This was partly due to the puncture made to withdraw blood before death.

Experiment No. 2 —A fowl was bitten in the thigh by the same Echis Carinata at 12-24. 12-25.—Restless and uneasy. 12-26.—Falls over, wings outspread. 12-27.—Convulsed. 12-

27-30.—Violently convulsed. 12-28.—Dead—in four minutes. Just before death the fowl vomited a quantity of fluid.

The blood was removed from the body five minutes after death: it was thin and red, became bright red when exposed to the air, but did not coagulate. It remained perfectly fluid, never coagulated.

In this it resembles the blood of animals poisoned by Daboia, which behaved in the same manner. I think it is quite certain that the poison of these two vipers so affects the blood that it will not coagulate after death.

The bitten limb was intensely swelled and discolored with black ecchymosis.

Experiment No. 3.—Another fowl bitten by the same Echis in the thigh at 1-38 p.m. One fang has been broken in the last experiments, and the other it would not insert; at least the bite was doubtful.

No effect produced by 2 p.m. So it was again tried, and this time it bit, but reluctantly; it is evidently exhausted.

The fowl was very slightly affected, being rather sluggish at 2-15. I saw it again at 5-45 p.m., and it had just died, in 47 minutes. Bitten at 1-38.—Died at 5-45.

The snake had evidently been nearly exhausted when it bit this fowl.

The blood was removed from the body, and it was exactly like that in experiment No. 2.—It remained fluid. The first fowl died in four minutes. Gunther says of the Echis Carinata, "No case is known of its bite having proved fatal." I think its powers are under-estimated. A snake that can kill a fowl in four minutes, and a dog in 10 hours must be very dangerous, and its bite might well prove fatal to weak or young persons. This fowl died in 4 hours and 7 minutes; the blood was the same in both.

Experiment No. 4.—A full-grown pariah dog was bitten in the thigh by the Bungarus Cœruleus, from Delhi, four feet in length, at 12-31.—For the first few minutes no apparent effect. 12-44.—The dog is looking sluggish, stands with his head stretched, and in a vacant look. 12-50.—Vomited very freely. 12-59.—Lying down, apparently affected with ataxy; cannot co-ordinate his muscles of locomotion; frothing at the mouth; when made to stand, shakes about in a state of obvious helplessness. 1-2.—Lying down; very restless, making efforts to move the limbs in every direction. 1-5.—Tried to get up, fell over, with convulsive movements. 1-10.—Convulsed generally. 1-15.—Sardonic grin; convulsive twitchings of diaphragm and abdominal muscles; convulsions. 1-23.—Dead—in 52 minutes.

The thorax opened at 1-30. The blood in the great vessels and heart very dark and treackly looking; but it reddened somewhat on exposure to the air, and soon formed into a tolerably firm and complete clot. The quantity was considerable, but there was no separation of clots and serum whilst I saw it until 2-30. The integument was raised over the bite: the punctures were not perceptible below the skin; the areolar tissue was discolored and œdematous, but not to any great extent.

Experiment No. 5.—A fowl was bitten by a Bungarus Cœruleus, 28 inches long (also from Delhi) in the neck at 12-50. 12-50-30.—Crouching. 12-56.—Drooping, head fallen over. 12-59.—Convulsed. 1-7.—Dead—in seventeen minutes.

The blood was removed from the fowl's body after death, and it coagulated firmly at once. This krait was very thin and sluggish.

Experiment No. 6.—A fowl was bitten in the thigh by another Bungarus Cœruleus, about 28 inches long, but much thicker than that of experiment No. 5, at 12-40. 12-58.—No effect. Bitten again by same krait. 1-7.—No effect. 1-14.—Not affected. The fowl remained unaffected.

Experiment No. 7.—Another fowl bitten by the same krait as in experiment No. 6 in the thigh, at 1-13.—It bit well and drew blood. No effects followed. The fowl remained quite well.

The krait was active and vigorous; its fangs were uninjured, and it had not been used before,—it was one of the three from Delhi. The other two were poisonous, but it from some reason or other was not venomous.

Such cases explain some of the recoveries from snake bites, and the supposed effect of antidotes.

Experiment No. 8.—A Bansbunniah Keautiah (cobra) 52 inches in length, was severely bitten on the body by a Bungarus, Cœruleus, 48 inches in length, at 1-22 p.m. Up to 8 a.m. of the next day the cobra was unaffected.

On the 10th August at 1 p.m. it was found dead. It was bitten on the 8th. This may have been due to natural causes, but the snake was well when it was bitten.

Experiment No. 9.—A Bungarus Cœruleus, 28 inches long, the one that bit the fowl on the neck (*vide* experiment No. 5), was bitten at 12-55 by a very powerful cobra, (Tentuliah Keautiah) in the body. The fangs of the cobra were heard to strike the krait's spine. 1-8.—Very sluggish, can hardly move. 1-32.—Gradually becoming paralysed. 1-35.—Dead.

I think there can be no doubt that the krait died of the poison; even if the fangs had penetrated to the spinal cord, death would not have been so rapid, and though there had been paralysis of the part posterior to the bite, it would not have involved the entire body. The symptoms were precisely like that seen in innocent snakes when they die from the cobra bite.

Experiment No. 10.—A fowl bitten by a cobra in the thigh at 1-47. 1-48.—Fell over. 1-49.—Convulsed. 1-50.—Dead. The blood of the above was taken immediately after death, and about twenty drops injected into another fowl's thigh. At 5-45 p.m., it was sluggish, but not otherwise apparently affected. At 8 a.m. of the 9th August it was drowsy, crouching, head nodding; evidently deeply under the influence of the poison. 1 p.m.—The fowl very drowsy and cannot stand. 10th August, 1 p.m.—The fowl can now stand and eat, it is nearly well. It has evidently got over the effects of the poison.

Experiment No. 11.—About twenty drops of the blood of the fowl killed by the Echis Carinata, in 4 minutes, injected into a fowl's thigh at 2 p.m. 5-45 p.m.—Fowl seems unaffected. 9th August, 8 a.m.—Fowl seems unaffected. 1 p.m.—The fowl is not affected. 10th August, 1 p.m.—The fowl is well.

The following important facts seem to be proved or confirmed by the foregoing experiments. The Echis Carinata is a dangerous and deadly snake: it killed a fowl in four minutes, and a dog in nine and a half hours. Like the Daboia, its poison destroys the coagulability of the blood after death.

The Bungarus Cœruleus is also very dangerous: it killed a dog in fifty-five minutes. The blood after death from this poison coagulates firmly.

It, like other snakes, may, when apparently in vigor, bite without producing any evil effect. It may in fact be exhausted.

The krait (B. Cœruleus) succumbs to the poison of the cobra. Doubtful whether the cobra will succumb to that of the krait. The blood of an animal poisoned by a cobra injected into another animal, poisons it, though slowly. In the case of the Echis poisoned blood, the effect was not produced in the second animal.

Experiment No. 12.—About thirty drops of the blood of the dog poisoned by Echis Carinata injected into a fowl's thigh, at 1 p m. of 9th August. It was drowsy in the afternoon. 10th August, 1 p. m.—The fowl is quite well, it has not suffered.

EXPERIMENTS ON SNAKE POISON.

By J. Fayrer, M.D., C.S.I.

(Re-published from The Indian Medical Gazette.)

August 13th, 1870.

Experiment No. 1.—A cobra (bansburriah keautiah) was bitten by a large krait, 4 feet long, at 12-20. The bite was inflicted on the edge of the hood. 20th August. The cobra is not, nor has been affected.

Experiment No. 2.—A fowl had half a drop of poison freshly taken from the krait, mixed with eight parts of water, injected into its thigh at 12-28. 12-29.—Stands in a dejected attitude, feathers staring. 12-35.—Has been lethargic for the last few minutes; eyes closed; crouched; head fallen forward, with beak resting on the ground. 12-38.—Lying down; starts when roused by sound or touch. 12-40.—Lying on its side, paralysed; head fallen over. 12-46.—Muscular twitchings. 12-56.—Still alive; lies motionless except for occasional convulsive twitchings. 12-57.—Dead—in 29 minutes.

Blood removed from the body formed a firm coagulum soon after death.

Experiment No. 3.—Half a drop of cobra-poison mixed with eight parts of water, injected into a fowl's thigh at 12-33. The poison is freshly taken from the cobra; the fowl is rather smaller than the one in the last experiment. 12-36.—Limps on injected leg. 12-40.—Crouched. 12-42.—Head drooping, resting on its beak. 12-45.—Crouching; eyes closed; head nodding. 12-48.—Point of beak resting on the ground. 12-54.—Quite paralysed. 12-56.—Convulsive movements; purged. 12-59.—Quite paralysed. 1 p. m.—Convulsive, springing from the ground. 1-6.—Dead—in 33 minutes.

The object of these two experiments was to test the relative power of the two poisons by taking the same quantity of each, and using it on animals of about the same size.

This fowl poisoned by the cobra was rather smaller than that poisoned by the krait, and yet it lived longest after being inocu. lated: so far the krait's poison would appear to be the most active of the two. It would be almost impossible to judge from one experiment, where there are so many causes that should interfere to disturb the natural results. Yet it is sufficient to prove that the poison of the krait is very similar in its deadly action to that of the cobra.

Experiment No. 4.—A cobra (koyah gokurrah), 3 feet 10 inches long, was severely bitten in the hood by a tentuliah keautiah, cobra, 5 feet 10 inches long, and very vigorous and powerful, at 12-45. The bite was a very determined one, and the poison effused profuse.

20th August.—No evil results, the cobra is unaffected (after seven days.)

Experiment No. 5.—A small frog was bitten by the large krait, which must have been much exhausted by repeated biting, at 1-8 p. m. The frog was dead at 1-14, or in six minutes.

Present: Drs. Fayrer and Ewart.—August 20th, 1870.

Experiment No. 1.—A Bungarus Fasciatus, 68 inches long and 5 inches in girth, was made to bite a middle-sized, but full-grown, pariah dog on the thigh, at 12-45.—He closed his jaws twice or thrice, but the bites were doubtful. 1-35.—Not affected. 1-55.—Not affected, the fangs had evidently not penetrated. Bitten again by the same snake. 2 p.m.—Is evidently affected: sits down, is sluggish. 2-10.—Very sluggish. The dog after this began slowly to recover, on the following day was quite well.

Experiment No. 2.—A young and very lively spectacled cobra, 14 inches long, was bitten in the muscular part of its body by a krait, 48 inches long, at 12-50.—The krait is the one that came from Delhi, and it has not bitten for some days. At 1 p.m. the cobra was very sluggish; at 1-8, so sluggish that it moves with difficulty, and can be easily handled: it makes no effort at resistance. 1-20.—Apparently dying, movements scarcely preceptible. 1-22.—Dead.

There can be no doubt, I think, that this young snake succumbed to the poison of the krait, and this settles the question of the susceptibility of one poisonous snake to the venom of another. But in this case the krait was very large, and the cobra very small. I doubt whether a cobra of equal size would have died.

Experiment No. 3.—A krait, about 30 inches in length, was bitten by the same krait that killed the cobra in last experiment, at 1-22 p.m. 2-4.—Not affected. No apparent effects on the following day. 23rd August.—No effect.

Experiment No. 4.—A full-grown fowl was bitten in the thigh by the same Bungarus Fasciatus that bit the dog in experiment No. 1, at 1-47 p.m. 1-50.—Affected; drooping. 1-55.—Convulsive movements; tail twisted to one side; crouches; head nodding. 1-58.—Fallen over, paralysed. 2-4.—Lies paralysed; reflex action still marked; a fly sitting on the eye-lid, it starts. No convulsions. 2-5.—Dead—in 18 minutes.

The blood coagulated firmly immediately after death. The bitten part was swollen and discolored.

Experiment No. 5.—A nearly full-grown mongoose (Herpestes) was put into a large cage with a very large and vigorous cobra (tentuliah keautiah) nearly six feet long. The snake immediately assumed the offensive attitude in one corner of the cage, whilst the mongoose, evidently terrified, shrunk into the other corner. When roused and pushed towards the cobra, the latter struck at the mongoose, who returned the attack, and they were both scratched about the nose, for both were bleeding. They were in the cage for nearly an hour, each seeming very anxious to avoid the other. The cobra always on the defensive, with his hood erect, and his head raised 20 inches from the ground. Whenever brought near each other the cobra struck, and the mongoose snapped; the result in each case being a bleeding wound about the face or mouth. This cobra's mouth, which he kept open, was red with blood. Both seemed very tired, but the mongoose, though severely scratched, showed no symptoms of poisoning.

They were taken out, and the cobra was made to close his jaws on the mongoose's thigh at 1-20 p.m. This was followed by no immediate effect, they were returned to the cage; and behaved exactly as they had done before. The cobra's poison had most probably been exhausted in its furious assaults.

They were again taken out of the cage, and as the mongoose was not affected, he was bitten again on the thigh by a much smaller cobra; after which they were put into the cage together. In this case the action of the mongoose was quite different, he was evidently not, as he had been of the larger cobra, afraid of this one. The cobra assumed the defensive attitude at once, and as the mongoose ran at him, struck. The mongoose gripped him in several places along the body, and finally caught him by the head, biting him severely about the mouth, in doing which the poison fangs of the snake must have over and over again wounded the mongoose's mouth, for the upper jaw of the snake was repeatedly in the mongoose's mouth, and both were streaming with blood. The cobra was soon *hors de combat* and was removed from the cage—not dead, but very severely hurt. The mongoose had not succeeded in biting into the brain,but only in front of it. The cobra, however, was helpless.

The mongoose was by this time, 1-45, under the influence of the poison, which no doubt was inflicted by the last cobra which bit him on the thigh, and when the mongoose took the cobra's jaw in his mouth. The bitten leg became paralysed, and by degrees he became more and more sluggish, but did not die till 8-5 p.m. After death the blood coagulated firmly.

The result of this experiment was somewhat different to that on a former occasion. Then the mongoose also was not affected during his fight with the cobra, but succumbed immediately afterwards when bitten on the thigh. I imagine the fangs must have penetrated a large vein, for death occurred almost instantly. In this case it did not occur for several hours. But the animal died with the same symptoms as all other creatures poisoned by the deadly venom.

This last experiment, however, certainly seems to show that, whether by its activity or owing to protective influence of its thick hair, it has, when bitten, a toleration of the poison greater than that of other animals of similar size. Such indeed is the case in other animals: for instance, the cat is apparently less sensitive to the poison than the dog.

Present: Dr. Fayrer.—August 27th, 1870.

Experiment No. 1.—A piece of the side of an ordinary patent leather shoe, consisting of one fold of patent leather and one of thin leather lining, was fastened on to a pariah dog's thigh in the fashion of a boot or shoe.

A powerful full-grown fresh cobra was then made to close his jaws on the part. This he attempted to do at once and bit freely several times, but he was evidently quite unable to make the fangs penetrate, or at all events he could not do more than make them partially penetrate. The dog was unharmed. The experiment was made at 4-3 p.m.; at 4-40 the dog was quite unaffected, showing that the teeth had not penetrated. A large quantity of poison was shed on the leather as the snake touched the surface in closing his jaws: it was poured in quantities, at least 20 drops must have been exuded.

It would appear from this experiment that an ordinary shoe would protect the foot from being bitten. Boots or shoes and leather gaiters would be very safe.

Experiment No. 2.—Part of the sleeve of an ordinary black cloth coat lined with silk, was made to cover a pariah dog's hind leg; and the cloth folded over the part was presented to a very powerful and fresh cobra of the largest size, nearly six feet long. He bit fiercely two or three times: the fangs imbedded themselves in the cloth, and it was soon saturated with poison; but the dog showed no signs that the fangs had penetrated his leg, nor was blood drawn. This occurred at 4-7 p.m. 4-37.—Dog not affected. 4-40.—The sleeve again applied, and another very large cobra made to close his jaws on the leg enveloped in the sleeve. This he did with the greatest vigor, but the fangs apparently did not penetrate the leg; as before, the coat was saturated with poison.

A third very large cobra was made to bite, and this time the dog winced as though punctured. 4-50.—The dog seems sluggish, as though partially under the influence of the poison. 5-5.—He now looks lively as though he were unaffected.

He perfectly recovered after this, and at noon the following day was quite well.

The fold of black cloth and silk in this case proved almost a complete protection.

Experiment No. 3.—Two folds of ordinary white flannel were wrapped round a large pariah dog's thigh, and a large and fresh cobra was made to bite through these. The snake bit fiercely and retained his hold for a time. The fangs penetrated the dog's leg, for blood marked the punctures. This was at 4-11. The flannel was soaked with poison. 4-27.—Dog sluggish, evidently affected. 4-37.—Ditto. 4-54—Seems uneasy, whines and snarls. 5 p.m.—Very restless, lies down, up again. 5-8.—When he walks is very lame on bitten leg and staggers in his gait. 5 20.—Vomited. 5-30.—Purged. 5-35.—Convulsed. 5-40.—Dying. 5-50.—Dead—in 99 minutes.

Blood coagulated firmly after death. The flannel partially, though it would not completely protect; the intensity of the poisoning was certainly diminished.

Experiment No. 4.—A woollen knitted sock was placed on a fowl's leg, and a powerful cobra made to bite through it at 4-37 p.m. The fangs penetrated, and the fowl died almost immediately, so rapidly that I was doubtful whether it had not been squeezed to death in handling it.

Experiment No. 5.—The same woollen sock put on to a dog's thigh, at 4-38 p.m., and a full-grown, vigorous cobra made to bite through it. The fangs penetrated, for the dog whined, and blood points marked the punctures. 4-39.—Limps. 4-52.—Much affected, legs weak. 5-4.—Vomiting. 5-10.—Convulsed. 5-12.—Died—in 34 miniutes.

Blood coagulated firmly. The sock was not sufficient protection, the fangs penetrated, and the poison in both cases acted rapidly.

Experiment No. 6.—A large cobra was made to bite on a single fold of a piece of American drill, such as white trousers are usually made of in India. The fangs penetrated and their points could be seen on the other side. This cloth would afford no protection against cobra bite.

Experiment No. 7.—A drop of poison from the cobra shed in experiment No. 1, was dropped into a large fowl's eye, at 4-10 p.m. 4-37.—The fowl has been drowsy and stupid for some minutes; the eye also is much congested. 4-56.—Five drops of cobra-poison put into its mouth and washed down with a teaspoonful of water. 4-58.—Very drowsy. 5-6.—Very sluggish, head drooping; purged. 5-3.—Feathers all ruffled; and purged. 7-3 p.m.—Crouched; head nodding. 8-20.—Convulsed. 9.—Dying. 10.—Found dead.

Blood coagulated firmly on removal. In this case death did not occur till nearly five hours.

Experiment No. 8.—A drop of cobra-poison put into an albino rabbit's eye at 4-24 p.m., and about six drops of the same diluted with a teaspoonful of water, put into its mouth, which it swallowed. 4-26.—Eye very slightly congested. 4-28.—Very restless, twitching movements of head. 4-31.—A few violent convulsions, and then death, in seven minutes.

The blood was removed in fifteen minutes and coagulated firmly. Experiments No. 7 and 8 prove beyond a doubt that the poison is absorbed by a mucous membrane, and that it is dangerous to apply it to those surfaces as to introduce it into the stomach.

The practice of sucking a poisoned snake bite may be attended with danger, and should be discontinued, as it endangers a second life, whilst probably doing very little good for the first. The six first experiments show how far protection may be conferred by certain articles of dress. A pair of boots or shoes and gaitters protect (probably entirely) the parts covered. Broad cloth lined with silk is almost complete protection in case of the cobra bite, and *a fortiori* that of the krait. Flannel, white American drill, and a woollen sock afford some, but very little, protection.

EXPERIMENTS ON SNAKE POISON

BY

V. RICHARDS, Esq.,

Civil Surgeon, Bancoorah, 18*th August* 1870.

COMMUNICATED BY Dr. J. FAYRER.

At 1 P. M.—Some poison was extracted from a Cobra (Kála Kurees), that had killed a fowl in 15 minutes, the day previously. Two drops were inserted between the eyelids of a full grown pariah dog.

2 P. M.—Dog constantly rubbing the eye with its paw which he afterwards licks.

3 P. M.—Conjunctiva extremely congested, and the integuments around the orbit are puffed up. Still rubs the eye and makes a whining noise as if in pain.

5 P. M.—Appears to be rather sleepy, but starts up if called.

19*th*.—The dog seems quite lively. The eye is still very much swollen.

20*th*, 8 A. M.—Swelling very slight. Cornea slightly cloudy.

6 P. M.—Seems quite well.

The dog escaped during the night.

The local effects of the poison were very great, but the constitutional slight.

No. 2.

1-5 P. M.—One drop of the same Cobra poison was applied to the conjunctiva of a small fowl.

P. S.—The local symptoms in the case of the last experiment were very slight.

2 P. M.—Eye very much swollen, the fowl constantly rubbing it with its claw.

2-30 P. M.—Seems slightly sluggish.

5 P. M.—The eye still swollen.

19*th.*—The eye is still swollen, but the fowl is lively.

20*th.*—Perfectly well in every respect.

No. 1.

August 20*th.*—The Cobra with which the experiments of the 18th were made, was well bitten two or three times near the tail by a large Tétuliah cobra quite fresh and vigorous.

21*st August.*—Well.

22*nd August.*—Well.

23*rd August.*—Well.

No. 1.

August 21*st.*—The Tétuliah Kurees of yesterday, was bitten by a small though vigorous Bungarus Cæruleus, Krait, measuring 1 ft. 10½ inches in length at 2 P. M.

August 22*nd.*—Well.

August 23*rd.*—Well.

No. 2.

The Krait was bitten by a fresh and vigorous Cobra (Kála Kurees), near the tail two or three times.

August 22*nd.*—The Krait was found dead in the box where it was kept. The bitten part had commenced to decompose. To prevent the necessity of holding the snake to be bitten, I threw some clay over it near the head so as to prevent it from turning to bite. Death cannot therefore be attributed to rough handling.

No. 1.

August 23rd, 3-57 P. M.—Two drops of poison taken from a fresh vigorous Cobra, (Gokurrah Kurees) was applied to the conjunctiva of a full grown healthy fowl.

4-27 P. M.—Dead in 30 minutes.

This experiment seems to prove, without doubt, that the poison does sometimes prove fatal when applied to the conjunctiva.

No. 2.

August 23rd.—Some Cobra poison just taken from a fresh vigorous Gokurrah was dropped into the eye of a full grown fowl at 3-50 P. M. The fowl was immediately let go.

4 P. M.—Rubbing the eye with its foot.

4-21 P. M.—Eye intensely swollen, is drowsy; defecated.

4-35 P. M.—Squatting down.

4-45 P. M.—Drooping. Very drowsy. Defecated.

5 P. M.—Appears better.

Continued to improve and ultimately recovered. The eye remained swollen up to the 25th. Cornea cloudy.

The local effects were very severe.

No. 3.

3-58 P. M.—Some of the same Cobra poison (3 drops) poured into the mouth of a full grown fowl.

There was scarcely any symptom of poisoning.—Drowsy only.

6 P. M.—Perfectly well.

No. 4.

4-45 P. M.—A fresh vigorous Kála Kurees (Cobra) was made to bite the Gokurrah used in the foregoing experiments.

24th.—Well.

25th.—Well.

26th.—Well.

I believe one Cobra cannot poison another.

No. 1.

August 25th, at 2-24 P. M.—Two drops of Cobra poison taken from a middling-sized fresh vigorous Kála Kurees was dropped into the eye of a full grown fowl. (The one to which the Cobra poison was given by the mouth on the 23rd.) The head was held so as to prevent the poison from dropping from the eye.

At 2-28 P. M.—Another drop was applied to the eye, and the head held as before.

2-37 P. M.—Is very drowsy and gasping; salivated.

2-40 P. M.—Rests its beak on the ground and lifts its head occasionally.

2-45 P. M.—Attempts to walk, but is unable to take more than two or three steps. The local symptoms are very slight indeed.

2-47 P. M.—Defecation. Rests the beak on the ground.

2-49 P. M.—Defecation.

3 P. M.—Rests with its beak on the ground, and endeavours to keep the head up, but it droops again and again.

3-25 P. M.—Convulsed.

3-40 P. M.—Still convulsed.

3-55 P. M.—Same state.

4-30 P. M.—Occasional convulsive movements.

5 P. M.—Same state.

5-20 P. M.—Same state.

5-39 P. M.—Dead in 3 hours and 15 minutes.

The local symptoms in this case were very slight, the eye being only closed and the lid collapsed. Although the general symptoms of Cobra poisoning became evident in 13 minutes, death did not occur until 3 hours and 15 minutes had elapsed. The period of convulsion was unusually long, *viz.*, 2 hours and 14 minutes.

In the fatal cases, for some time after the application of the poison to the conjunctiva, the head of the fowl was held so as to promote a larger amount of absorption; while in those where the general symptoms were transient, the fowl was almost immediately released after the application of the poison.

It will be observed, that in every experiment the snake used was a fresh one full of vigour.

August 26th, 12-26 P. M.—Some poison was taken from a fine fresh vigorous Kála Kurees (Cobra) just brought from the adjacent paddy fields, and two drops were applied to the uninjured eye of the fowl used in experiment No. 2 of the 23rd instant, care being taken to hold the head in such a position as to prevent the escape of the poison.

12-36 P. M.—Drooping. Eye very slightly affected.

12-46 P. M.—Squatting down. Very drowsy. Ptyalism.

12-55 P. M.—Staggers off when disturbed, and then squats down.

1-5 P. M.—Defecation. Beak resting on the ground.

1-36 P. M.—Convulsed.

1-52 P. M.—Dead in 1 hour and 26 minutes. Local symptoms very slight.

No. 2.

Some of the same cobra poison was put into the mouth, (which was afterwards closed to prevent the possibility of any running out) of a young fowl at 12-31 P. M.

12-37 P. M.—Defecation. Is very drowsy.

12-43 P. M.—Found dead in 12 minutes.

I was very much surprised at the rapidity of the fatal action of the poison. There was no abrasion about the mouth.

This experiment seems to shew, that not only does the cobra poison if administered internally in a sufficient dose sometimes prove fatal, but very rapidly so.

August 26th, 1870.—I have been unable yet to obtain any more Kraits, but Cobras, especially the Kála Kurees, are very plentiful.

I am not quite satisfied with the experiment in which the Cobra bit the Krait, as the Krait had been held previously to make it bite the Cobra, so that the possibility of its having been injured must be admitted.

I form the opinion, that one Cobra cannot kill another from the following facts. In neither experiments did the snake suffer, and I have frequently, during the past eight days, made the Cobras fight and bite each other; but not a single death has occurred amongst my collection.

I have a large pucka place built in my compound, 8 ft. by 6 ft., sunk in the ground 3 ft., and raised about the same height, in which they are kept.

The experiments made by me, fully corroborate your opinion, *viz.*, that Cobra poison when applied to mucous membranes, not only is very dangerous, but even fatal, and sometimes very rapidly so.

September 1st, 1870.—The following experiments serve to demonstrate the fact that the poison of a Cobra kept in captivity, is considerably weaker than that of the fresh snake.

No. 1.

August 30th, 2-57 P. M.—Some poison was taken from a large Kála Kurees, which had been in captivity for some time, and applied to the eye of a fowl, the head was held so as to promote absorption.

3-5 P. M.—Rubs the eye which is slightly swollen. Tremor of the tail.

3-8 P. M.—Very slightly affected.

3-31 P. M.—Defecation, appears pretty well.

3-40 P. M.—Improving.

3-44 P. M.—Some poison was taken from a Cobra that had been in captivity only two or three days, and applied to the conjunctiva of the other eye.

4-11 P. M.—Defecation. Sluggish.

4-15 P. M.—Beak resting on the ground.

4-17 P. M.—Defecation.

4-23 P. M.—Very drowsy and squatting on the ground.

5 P. M.—Convulsed.

6-2 P. M.—Dead in 2 hours and 18 minutes from the second application of the poison.

No. 2.

Some poison was taken from a Gokurrah Kurees that had been some time confined and dropped into the eye of a small fowl, the head being held as before, at 3-16 P. M.

This fowl did not exhibit the slightest symptoms of poisoning, nor was the eye affected.

No. 3.

Some poison taken from a Cobra (Tetuliah) that had been in my possession for some time, was administered to a small fowl at 3-28 P. M. No signs of poisoning were observed.

September 1*st*, 12-30 P. M.—Some poison taken from a vigorous Gokurrah Kurees that had just bitten a Krait was administered to the fowl used in experiment No. 2 of the 30th August.

12-33 P. M.—Tail drooping.

12-35 P. M.—Drowsy.

1 P. M.—Convulsed.

1-30 P. M.—Dead in one hour.

I notice, the fresher the snake, the more amber-colored the poison.

The two following experiments were made.

August 30th.—A small Krait was bitten by a larger one near the tail.

At 1 P. M.—Great care was taken not to handle either too roughly.

September 1st.—Found dead this morning.

September 1st.—A full grown fresh vigorous Cobra was made to bite a small Krait, measuring 1 ft. 10 inches in length. Great care was taken not to hurt the Krait, 12 noon.

1 P. M.—Dead in one hour.

This Krait had been in the possession of the men who brought it three days, and was quite well and vigorous.

This last experiment seems to be rather convincing, that the Cobra can kill the Krait.

Notwithstanding the result of the experiment with the two Kraits, I am not at all satisfied they can kill each other. I am quite satisfied the Cobra cannot kill another Cobra.

I have not heard of the Ophiophagus being in this district, but will make enquiries. The Bungarus Fasciatus appears to be very uncommon in this district.

Yesterday morning I made a fine fresh Gokurrah Kurees bite a Krait measuring 2½ feet in length. I took special care not to injure the Krait. The Krait up to the time (6 P. M.,) I am writing, is perfectly well.

September 8th, 1870.—A Daboia (full-sized), was brought to me some days since. I put it amongst the other snakes. On the 4th instant, after being irritated, he attacked and bit a large Gokurrah Kurees very savagely, and it died on the 5th; possibly from injury done by the viper's enormous fangs.

5th September, at 1 P. M.—The Daboia was made to bite a fowl in the thigh, the fowl was dead in less than a minute. The parts bitten were very much ecchymosed.

The blood taken from the body of the fowl was fluid and did not coagulate.

No. 2.

At 2-5 P. M.—A middling-sized Krait was made to bite a very small Cobra that had been in my possession 9 or 10 days.

The Cobra died at noon on the 6th.

There appears to me to be no doubt in this instance, the Krait killed the Cobra. Every care was taken not to injure the little Cobra while being bitten by the Krait. It was for some time after perfectly lively, proving it had not been injured.

I have on three occasions set aside the blood taken from the bodies of persons dying from snake bite, and in neither instance did it coagulate. One man was bitten by the Krait, the other two persons by snakes unknown.

The Daboia which appears to be pretty generally known here is called the Seah-Chunder.

No. 1.

7th September, 1870.—Some poison taken from a Daboia that had been kept in captivity for a few days, was dropped into the eye of a fowl at 1-54½ P. M.

1-57 P. M.—Defecation.

2-25 P. M.—More poison applied to the conjunctiva.

2-27 P. M.—Very drowsy.

2-29 P. M.—Squatting on the ground. The beak rests on the ground, and the head falls over to one side.

2-35 P. M.—Eye very much swollen.

3-22 P. M.—Head drooping constantly.

3-37 P. M.—Endeavours to keep the beak on the ground, but the head rolls over to one side at once.

6-10 P. M.—Apparently in convulsions.

10-30 P. M.—Same state.

8th September, 9 A. M.—There is a marked improvement, the fowl only appears drowsy, and the feathers are drooping.

9th September.—Recovered; but the eye is still much swollen.

I was quite astonished on the morning of the 8th to find the fowl not only alive, but considerably improved.

The snake in this instance was not fresh, hence I believe the recovery of the fowl.

No. 2.

At 2-9 P. M.—Some poison extracted from a Cobra (Gokurrah) that had been in my possession some time, was applied to the conjunctiva of a fowl.

2-17 P. M.—More poison put into the eye.

2-25 P. M.—Squatting on the ground. Head drooping.

2-29 P. M.—Attempted to get up, but could not.

2-36 P. M.—Convulsed.

2-45 P. M.—The same.

2-59 P. M.—Dead in 50 minutes from the first application of the poison.

No. 3.

At 2-3 P. M.—Some poison was squeezed out of the poison-gland of a Krait (Bungarus Cæruleus,) that had been in my possession some time, (the fangs were broken,) introduced into a fowl's eye.

2-20 P. M.—Drooping.

2-30 P. M.—Seems very sleepy.

3-38 P. M.—Defecation; still drowsy.

4 P. M.—Seems better.

This fowl gradually recovered. The snake was by no means vigorous, and it died 3 days after.

No. 1.

September 8th.—Some poison was taken from a fine fresh Krait 39½ inches long, and applied to the conjunctiva of the fowl used in No. 3 experiment of yesterday, at 12-28 P. M.

12-30 P. M.—Drooping. Rubs the eye with its claw. The eye is not much swollen.

1-35 P. M.—Beak resting on the ground. Very drowsy.

2 P. M.—Convulsed.

2-25 P. M.—Occasional convulsive movements.

3 P. M.—Dead in 2 hours and 42 minutes.

The opinion you had formed, *viz.*, that snake poison is absorbed through mucous membranes, appears to be beyond a doubt, correct. I believe the poison, if fresh, properly applied, and in a sufficient quantity, is as surely fatal by absorption through mucous membranes, as by the direct application of the poison; only its fatal action, of course, is greatly retarded under the former condition.

To-day 2 Kraits and 1 Daboia were brought to me. One of the Kraits measures 45¼ inches in length, and 3 inches in circumference, and is beautifully marked.

September 10th.—Two drops of poison taken from a vigorous Bungarus Cæruleus measuring 39½ inches, was administered to a fowl at 12-38 P. M. by the mouth.

1-2 P. M.—Tail droops and the bird is crouching.

1-5 P. M.—Defecation.

2-0 P. M.—Appears drowsy.

10-0 P. M.—Very drowsy.

11*th.*—Crouching.

12*th.*—Is slightly drowsy and crouching.

Two drops of poison taken from another fresh middling-sized Bungarus Cæruleus were given at 4-30 P. M.

5 P. M.—Is very drowsy.

5-49 P. M.—Very sleepy and squatting down.

6-30 P. M.—Squatting still. Head drooping.

9 P. M.—Convulsed.

10-5 P. M.—Dead in 5 hours and 25 minutes from the *second* application or rather administration of the poison.

September 10*th*.—A very small quantity of poison taken from a small Krait (Bungarus Cæruleus) was diluted with a drop of water and applied to the conjunctiva of a fowl at 1 P. M.

4 P. M.—Very drowsy. Crouching.

6 P. M.—Same state.

9 P. M.—Is very drowsy and squatting down.

10-15 P. M.—Beak resting on the ground, and the head drooping on one side.

10-30 P. M.—Convulsed.

11 P. M.—Dead in 10 hours. In this instance, however, the poison was not only applied once but it was diluted. In the former experiment, the fowl had been brought under the influence of the poison previous to the second administration.

No. 1.

September 20*th*.—An old bull was bitten by a large vigorous Krait (Bungarus Cæruleus) in the groin twice at 8 A. M. (My snake-man having objected to take part in an experiment on this animal, I had to manage as best I could, and the consequence was, the snake was some time before it could be made to bite). It bit ultimately, however, most savagely.

2 P. M.—Staggers as it walks.

3-3 P. M.—Is lying down. Salivation and profuse discharge from the nostrils, tongue protrudes from the mouth on one side. Is much purged.

4 P. M.—Breathing hard, and making a low moaning sound with each expiration. Legs occasionally convulsed.

4-45 P. M.—Dead in $8\frac{3}{4}$ hours. Blood coagulated, but not very firmly after being taken from the body.

No. 2.

September 27th.—An ox was bitten by a nearly full-grown Daboia in the groin at 11 A. M.

12-45 P. M.—Is a little unsteady on his legs.

1-5 P. M.—Is lying down.

2 P. M.—Walking about very unsteadily. Lame with the right hind leg.

6 P. M.—Lying down, seems very weak. The bitten part is swelling rapidly, gives occasional short, quick, forcible expirations.

September 28th, 8 A. M.—Appears better, but is very drowsy and weak.

8-30 P. M.—The Daboia of yesterday and a smaller one were made to bite the animal again in the groin.

9 A. M.—The groin and right thigh are very much swollen. I notice several bleeding points about the skin. (This the snake-man told me would be the case, but I doubted it.)

10 A. M.—Is very *costive.* Endeavours to defecate, but cannot.

4 P. M.—Is standing up, the bitten parts are enormously swollen.

September 29th.—To-day the animal is looking very drowsy, and is made to walk with difficulty. The legs are in the same swollen state.

September 30th.—Is quite well; has been purged. The swelling is rapidly decreasing. In this instance, neither of the snakes was fresh, and both had been used recently in experiments.

No. 3.

September 28th.—An ox was bitten in the thigh by a full grown Cobra, which had not only been kept in captivity for a long time, but was casting its skin.

3 P. M.—Does not seem affected, possibly the fangs were broken.

3-40 P. M.—Bitten by another Cobra (Kála Kurees) that had been in my possession for some time.

6 P. M.—Appears very weak, and is much purged.

September 29th.—Is pretty well, but weak; purging still continues.

September 30th.—Recovered. Was bitten by a vigorous Gokurrah Kurees, which had been in my possession only a short time, on the inside of the upper lip at 9 A. M.

10 A. M.—Is very drowsy, and is slightly salivated.

1 P. M.—Convulsed. The part bitten is not much swollen.

1-30 P. M.—Dead in 4½ hours.

The blood was firmly coagulated in the heart and great vessels.

The above experiments demonstrate how much the fatality of the bite of a snake depends upon the condition of the snake at the time it bites.

Experiments on the effect of the Tanjore Pill in Snake Poisoning, communicated by Dr. J. Fayrer.

The following experiments were made at my request, by Mr. Richards, of Bancoorah, to test the efficacy of the so-called Tanjore Pill. I am indebted to Mr. Gibbons, of Messrs. Scott, Thompson's, for the pills which were made up according to the recipé given in Dr. P. Russell's work on Indian Serpents, and must have cost much trouble in the preparation, for some of the ingredients are difficult to procure. They were administered in accordance with the instructions in Russell. Even the application of the fowl's liver was not omitted. Two or three of the experiments are suggestive of good results, but they are also suggestive of large animals, probably imperfectly bitten. The other experiments, as well as many as I have myself made, dispel the idea that this antidote is any more effective than others that have been tried.

No. 1.

October 4th, 1870.—At 3-30 p. m., on the 3rd of October, an old bull was bitten in the thigh, very vigorously, by a fine fresh Cobra (Kála Kurees) 4 feet, 7 inches long, which had just been brought from the jungle. The bitten part was well incised; the liver of a fowl rubbed in, and one of the "Tanjore" pills mixed with warm water was administered at once.

Note.—From Russell's Indian Serpents.

Tanjore Pills.

Take White Arsenic,
„ Roots of Velli-navi,
„ Roots of Neri Vishana,
„ Kernel of Nervalam,
„ Black Pepper,
„ Quicksilver, of each equal quantities.

Juice of the wild Cotton (Mudar) sufficient to make into a mass, and divide into five grain pills. Each pill contains a little over ½ a grain each of Quicksilver and Arsenic.

These pills are given in doses of one or two, and at intervals of an hour, in some cases not so frequently.

A fowl's liver is also to be applied directly to the bite which is scarified.

4-45 P. M.—The animal appears perfectly well; is walking about and grazing, another pill mixed with warm water was given.

6-10 P. M.—Appears perfectly well, and is grazing still.

7-5 P. M.—Another pill administered, appears perfectly well, and is quite strong.

10 P. M.—In the same state.

11 25 P. M.—Standing up and is perfectly well. The skin is very sensitive.

October 4th, 8 A. M.—Well.

5 P. M.—Perfectly well.

This animal never exhibited a single symptom of poisoning. He was not even rendered sluggish.

No. 2.

October 4th.—With a view of testing the powers of the snake used in the former experiment, I made it bite a fowl in the thigh at 11-26 A. M.

11-27 A. M.—Drowsy

11-28 A M.—Lying down and is gasping.

11-31 A. M.—Same state.

11-35 A. M—Convulsed.

11-36 A. M.—Dead in ten minutes.

This leaves no doubt as to the power of the snake to poison.

No. 3.

At 12-52 P. M.—A goat was bitten in the groin by a fine fresh vigorous Cobra (Kála Kurees) just brought from the jungle.

12-58 P. M.—The part was well incised, and the liver of a fowl rubbed in.

1-5 P. M.—A pill mixed with warm water was administered.

1-31 P. M.—Appears well.

2-12 P. M.—Appears well and is feeding.

3-5 P. M.—Half a pill administered.

3-45 P. M.—Is running about.

4-30 P. M.—Appears very slightly sluggish. Administered the other half of the pill.

5-30 P. M.—The animal is feeding and appears very well, only that the tail occasionally droops slightly. Urine is passed pretty frequently. This was the case also with the ox.

6 P. M.—Appears very well.

6-10 P. M.—Same state.

It ultimately recovered.

No. 4.

The cobra used in the foregoing experiment was made to bite a fowl in the thigh, at 1-10-20 P. M.

1-11-20 P. M.—Administered half a pill mixed with warm water; incised the bitten part and applied a portion of the other half of the pill.

1-13 P. M.—Beak resting on the ground and head falling on one side.

1-14-40 P. M.—Convulsed.

1-17 P. M.—Dead in 6 minutes and 40 seconds. Blood coagulated immediately when taken from the body.

No. 5.

A fowl was bitten in the thigh by a large Krait, that had been in my possession for some time, at 1-24-30 P. M.

1-25-15 P. M.—Half a pill was rubbed into the part bitten, after it was incised.

1-25-40 P. M.—Half a pill administered.

1-34-30 P. M.—Drooping.

1-34-45 P. M.—Another half of a pill administered.

1-43 P. M.—Head drooping.

1-46 P. M.—Head lying on the ground. Beak quivering.

2-7 P. M.—Dead, in $43\frac{1}{2}$ minutes.

No. 6.

The Krait used in experiment No 5, was made to bite a fowl in the thigh at 1-30-15 P. M. The fowl was immediately lame.

1-33 P. M.—Squatting down.

1-35-30 P. M.—Head drooping.

1-40 P. M.—Convulsions commenced.

1-50 P. M.—Dead in $20\frac{1}{4}$ minutes.

No. 1.

October 5th.—A weak country goat was bitten in the thigh, which had been previously shaved, by a large Krait that had been in my possession for some time at 1-5 P. M. The snake held on for some time and was with difficulty taken away.

1-12 P. M.—Liver rubbed into the part after incision.

1-17 P. M.—A Tanjore pill was administered.

1-20 P. M.—Tremor of the hind quarters.

1-42.—Staggers.

1-43.—Strongly convulsed.

1-46.—Eyes turned upwards, abdomen tympanitic.

1-51.—Dead in 46 minutes.

On opening the body, I found the blood coagulated, and the stomach highly congested in patches, as if from poisoning by arsenic.

A fowl bitten by the above Krait, died in 22 minutes.

A Small Pig.—Up to the time I am writing (6-50 P. M.) it is very well, and was bitten by a Cobra at 3-25 P. M., three hours and 25 minutes ago. A fowl died in 59 minutes after being bitten by the same Cobra. The pig was bitten most severely.

The pig died at 8 P. M.

October 5th.—A small pig was bitten by a Cobra at 3-25 P. M.

3-27 30.—Half a pill administered.

3-31.—The bitten part well incised, and a liver (fowl's) applied.

3-42.—Seems quite well.

3-47.—Seems very slightly sluggish.

3-52 P. M.—Is lying down.

4 P. M.—Apparently better and is running about.

4-27 P. M.—Sluggish again, a quarter of a pill administered.

4-40 P. M.—Has rigors.

5 P. M.—Another quarter of a pill.

7-50 P. M.—Salivation.

8 P. M.—Dead in 4 hours and 35 minutes.

October 7th.—A small country goat was bitten by a Gokurrah Kurees at 11-34 A. M.

11-39 P. M.—Part incised, and liver applied.

11-40 P M.—Pill administered.

1-49 P. M.—Is slightly drowsy.

1-58 P. M.—Half a pill administered.

3 P. M.—Convulsed.

4-15 P. M.—Dead in 4 hours and 41 minutes. A fowl bitten by the same Cobra after it had bitten the goat. Did not die until 3 hours 24 minutes had elapsed, although no antidote was administered.

An ox is still alive that had been bitten by a Cobra, and the antidote administered; but it looks very unwell, and shows some symptoms of poisoning by arsenic.

Ox dead in 7 hours and 42 minutes.

Note.—Gokurrah, Keautiah, Kála Kurees, Gokurrah Kurees, and Tetuliah are native names for varieties of the Cobra or Naja Tripudians.

9th Series

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EXPERIMENTS ON THE INFLUENCE OF SNAKE-POISON.

(Continued.)

BY J. FAYRER, M.D.,
Professor of Surgery, Medical College of Bengal.

PRESENT:—Dr. Fayrer and Mr. Sceva.

EXPERIMENT No. 1.

15th October.—A fish (Ophiocephalus Marulius), about ten inches in length, was bitten by a fresh Cobra, at 11-20 a.m., in two places, on the dorsal and ventral surfaces.

11-22.—The fish turned over on its side in the water.

11-23.—Struggling and plunging violently in the water.

11-25.—Turned over on its side.

11-26.—On being roused, plunges violently.

11-40.—Dead.

Bitten at 11-20.

Died at 11-40. Dead in 20 minutes.

EXPERIMENT No. 2.

A large snail (Achatina Fulica) was bitten at 11-28 by a Cobra; it immediately withdrew itself within its shell.

11-45.—In order to examine its condition, the shell was broken; it still continued to contract.

12.—No contraction; all irritability seems extinct. Dead.

EXPERIMENT No. 3.

Two snails of equal size—shells previously broken; one was bitten by a Cobra at 12-28. It immediately shrank and contracted itself. The other snail was not bitten, and was kept for comparison.

12-40.—Irritability of the bitten snail much diminished.

The bitten snail seemed to lose its vitality much sooner than the uninjured one; but the precise time when irritability ceased was not noted.

These were the only invertebrate animals I could procure on this occasion. The experiments, though not very satisfactory, leave no doubt that the molusc was affected by the poison.

Experiment No. 4.

A full-grown Cobra was bitten at 11-40 a.m. in two places near the tail by a Daboia Russelli.

11-48.—No effect.

12-50.—No effect.

10th October, 8 *p.m.*—The snake was perhaps not so lively, but there was no marked effect, and it lived.

Experiment No. 5.

A full-grown Cobra was bitten in two places, on the ventral surface and the middle of the body, by a Daboia, at 11-58.

12-50.—No effect.

16th October, 8 *p.m.*—No effect; the snake lived.

Experiment No. 6.

A half-grown chicken was bitten by a fresh Cobra in the thigh at 12-2.

12-3-45.—It crouched; head drooping, beak resting on the ground.

12-4-30.—Paralysed; head lying on the ground.

12-5.—Convulsed.

12-5-10.—Dead, in 3 minutes and 10 seconds.

Experiment No. 7.

A second chicken was bitten by the same Cobra at 12-9-30 in the thigh.

12-10.—Leg partially paralysed.

12-13.—Lying down, beak resting on the ground.

12-13-30.—Paralysed, beak resting its point on the ground.

12-14.—Convulsed; dead in 5 minutes and 30 seconds.

Experiment No. 8.

A third chicken was bitten by the same Cobra in the thigh at 12-17-30.

12-18-30.—Fell over; rested the point of its beak on the ground.

12-19.—Convulsed.

12-21.—Dead, in 4 minutes and 30 seconds.

This chicken was rather smaller than the two preceding ones.

These three experiments shew that the snake had lost but little of its power in three efforts. The Cobra used in these experiments was not full-grown, but it was very active and vicious.

EXPERIMENT No. 9.

The above small Cobra was bitten at 12-35 in two places, on the middle of its body and on the ventral surface, by a large and fresh Cobra.

16th October, 8 *p.m.*—Not affected ; it lived.

EXPERIMENT No. 10.

19th October, 11-40 *a.m.*—A large Dhamin (Ptyas Mucosus) was bitten in two places by a Daboia.

11-47.—Is partially paralysed; the mouth is wide open; appears unable to move; respiration continues.

11-47.—Moving about slowly.

11-52.—Appears to be recovering.

12.—More active.

20th October, 6 *a.m.*—Appears sluggish.

10 *a.m.*—On being roused, moves slowly; but is weak and stiff.

Recovered subsequently.

October 26th, 12-47-1.—Bitten again by another Daboia.

1 *p.m.*—No effect.

Became sluggish, and died at 10-40 p.m., 27th October.

PRESENT: Dr. Fayrer and Mr. Sceva.

26th October.—The following experiments were made with the view of again carefully examining the blood before and after the snake-bite.

The blood was very carefully examined on three occasions—

1*st*, before the animal was bitten.

2*nd*, whilst it was under the influence of the poison.

3*rd*, after death.

In no case was anything found to support Professor Halford's theory, or to confirm his observations. There was no appearance of any new corpuscle, nor was there any change of importance in the condition of either the red or white globules of the blood.

My impressions were in favour of the theory advocated by Professor Halford, and if any bias existed, it was certainly for rather than against the explanation he gives of the pathological changes in the blood. Nothing, however, that I have seen after many observations supports the view in question; and I am constrained to believe that the change in the blood is of a much more subtle character than can be detected by the microscope. Moreover, in rapid death, as for example where it occurs in from 30 to 40 seconds, it is impossible that such developmental changes could have taken place. The cause of death is evidently an impression made on the nerve centres through the medium of the circulation; but it is, I think, evident also that it is one of a dynamical nature, and not immediately dependent on any structural changes that may, if any do, occur in the blood, and can be seen with the microscope. When death is protracted, and the venom has thus time to set up blood changes, as in the case of zymotic poisoning, I can well imagine that the blood, as such, becomes unfitted for the purposes of life, and that death results in consequence of these changes; but I have not as yet seen anything to confirm this view of the cause of death, nor do the post-mortem appearances shew that it is due to asphyxia, from pulmonary congestion or embarrassment. I do not, however, positively assert that such is not the case. I merely record the fact that, up to the present time, I have been unable to discover the blood changes described by Professor Halford. Further investigation may lead me to a different opinion.

Experiment No. 11.

A pariah dog was bitten in the hind leg, very slightly, by a Cobra at 11-55 a.m.

The blood was examined before the dog was bitten, and the appearance noted. The white corpuscles were apparently, relatively to the red ones, rather numerous.

12.—Not affected.

12-23.—Bitten again in the right hind leg by another Cobra. The snake struck of his own accord.

12-48.—The dog is fully under the influence of the poison; he is slightly convulsed, lying almost paralysed on the ground. The blood was again examined; no change could be detected.

12-58.—The dog died.

Blood examined again after death, but no change could be detected. It coagulated firmly when removed from the body after death, which occurred in 63 minutes.

EXPERIMENT No. 12.

At 12-4 a pariah dog was bitten on the right hind leg and on the back by a Daboia. The blood had been previously examined; there was nothing peculiar in its appearance. The wounds made by the snake's fangs bled freely.

12-18.—Very much depressed; staggering; almost paralysed in hind legs.

12-20.—Lying down, head resting on the ground.

12-21.—Cannot rise; hind legs paralysed.

12-40.—Blood again examined under microscope. No change.

12-48.—Dead. Blood examined after death. The microscopical appearances not changed.

In this case death occurred in 44 minutes. The blood was kept for 24 hours after death, and it did not coagulate. It is worthy of note that the blood of the dog in the last experiment, poisoned by a Cobra in 63 minutes, did coagulate firmly. In neither case did the microscope reveal any structural change in the corpuscular elements of the blood.

EXPERIMENT No. 13.

A ligature was tied round a fowl's thigh so tightly as apparently to obstruct the circulation. The limb below the ligature was then bitten by a fresh Cobra at 12-31.

12-33.—Stretches out the leg, and is lame; wings drooping; it seems to be feeling the effects of the poison.

12-35.—Crouching; wings spread out; point of the beak resting on the ground.

12-37.—Fully under the influence of the poison, but can still be roused.

12-42.—Insensible and is convulsed.

12-47.—Again convulsed, and died. Death occurred in 16 minutes. This experiment shews that the pressure of the ligature, although it did not completely prevent the entrance of the poison into the circulation, so far prevented it that death was deferred for 16 minutes. In a fowl of the same size, bitten by a Cobra in the same place, had no ligature been applied, death would probably have occurred within one minute.

PRESENT : Dr. Fayrer and Mr. Seeva.

15*th November*.—The following experiments were made with the view of testing the action of the poison of the Bungarus Fasciatus on animals, and the influence of other snake-poison on the Bungarus itself and other poisonous snakes :—

EXPERIMENT No. 14.

A full-grown Bungarus Fasciatus, said to be fresh, bit a young dog in the thigh at 1-37 p.m.

1-34.—Restless ; moves about, whining.

1-48.—Apparently not much affected.

1-54.—Seems uneasy and restless.

1-58.—Lying down, and getting up in a restless manner.

2 *p.m.*—Apparently not much affected.

2-10.—Staggers a little ; is evidently uneasy.

2-20.—Seems sleepy ; when roused he moves about, but quickly lies down again.

2-27.—Is sick.

2-38.—Very drowsy ; breathing hurried. Staggers when he walks ; vomits, and has general tremors.

Bitten at 1-37 p.m.

Died at 6-5—*i.e.*, in 4 hours and 28 minutes.

6-5 *p.m.*—The blood coagulated firmly after death.

EXPERIMENT No. 15.

The same Bungarus bit a fowl in the thigh at 1-35 p.m.

1-37.—Fowl runs about much excited.

1-38.—Does not now seem much affected.

1-40.—Apparently not affected.

1-45.—Begun to shew the effects of the poison ; staggers, and runs with its beak almost resting on the ground.

1-50.—Paralysed; has fallen over.

1-55.—Is convulsed.

1-57.—Still convulsed.

1-59.—The same.

2-1 *p.m.*—Dead.

Bitten at 1-35.

Died at 2-1—*i.e.*, in 26 minutes.

Experiment No. 16.

Another fowl bitten by the same Bungarus in the thigh at 1-40 p.m.

1-42.—Walks lame on bitten leg.

1-44.—Staggers; fell over with its head on the ground.

1-45.—Is paralysed; cannot rise or move.

1-49.—Convulsed.

1-55.—Again convulsed slightly.

1-57.—Dead—*i.e.*, in 17 minutes.

Death was more rapid in this case than the last, although the snake had bitten before. The fowl was about the same size as the one previously bitten, and its more rapid death may be attributed to more rapid absorption of he poison, twhich was probably caused by the snake's fangs having entered a vein.

Experiment No. 17.

A fowl was bitten slightly by another Bungarus, at 1-50, in the thigh.

At 2-10.—Slightly affected.

2-25.—Sleepy, but can be roused.

2-30.—Very drowsy; resting the beak on the ground.

2-45.—Still alive; it died at 3-45 p.m.

These experiments prove that the action of the poison of this snake is not so vigorous as that of the Cobra or Daboia. The nature of its action is probably much the same, but the quantity injected is probably much less, as the poison fang of the Bungarus is so much smaller than that of the Cobra.

The Bungarus Fasciatus, (Bengalee name Sankni,) is a black and yellow-banded colubrine snake, and it derives its name from a vernacular name Bungarum, used in some parts of the Coast of Coromandel. Their bite is dangerous, but the fang is so short that the wound inflicted is superficial. They are shy and attempt to escape, but defend themselves fiercely when attacked, says Gunther; they lie coiled up, and, when irritated, dart in a peculiar manner sideways, uncoiling themselves as though with a spring. This is the largest species of the genus Bungarus; it attains to a length of five feet or more. It has a wide range—Java, the Malayan Peninsula, Burmah, China, Bengal, and the Coromandel Coast. There are several species:

1. Bungarus Fasciatus (synonyms)
   Pseudoboa Fasciata
   Bungarus Amularis (Bengalee Sankni)
2. Bungarus Cœruleus (synonym)
   Pseudoboa Candidus
   Boa Krait*
   „ Lineata
   Bungarus Lividus
   „ Candidus
   „ Arcuatus
   „ Lineatus
3. Bungarus Ceylonicus
4. „ Semifasciatus

and other species of the same genus; but they are not found in the peninsula of India, I believe.

Experiment No. 18.

A Bungarus Fasciatus was severely bitten three times, about 8 inches from the head, by a powerful and fresh Cobra, at 1-55 p.m.

No apparent effect was produced either at the time, soon after, or later. The Bungarus was alive and well two days later. It died a day or two after, but its thorax and lungs were found filled with blood. The Cobra fang had probably penetrated the lung.

Experiment No. 19.

A Daboia was severely bitten by a fresh Cobra in three or four places at 2-10 p.m.

No present or subsequent effect was produced. The snake remained quite well.

Experiment No. 20.

Another Daboia was severely bitten by a fresh Cobra about a foot from the tail at 2-22 p.m. No effect produced. The snake remained perfectly well.

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* This is the Krait of Bengal. I have not yet succeeded in obtaining a living specimen. It is found in Bengal, Southern India, and in Assam, but not in Ceylon.

Experiment No. 21.

Two fresh and vigorous Cobras were made to bite each other in several places at 2-35 to 2-37 p.m. No evil result followed; both remained quite well.

The result of these experiments has been to demonstrate that the invertebrata and hœmatocryal vertebrata are, like the hœmatothermal vertebrata, subject to the deadly influence of snake-poison. The molusca, fish, and innocuous colubrine snakes rapidly succumb when bitten by either the viper or the elapidæ.

The weight of evidence, however, tends to shew that the poisonous snakes have little, if any, power to injure each other, for in none of these last series of experiments was the bite of a venomous snake fatal to any other venomous snake. The Bungarus that died after being bitten by a Cobra, probably died from internal hæmorrhage, and not from the poison.

In repeated careful microscopical examinations of the blood of animals before they were bitten, during the action of the poison, and after death, I failed to detect any structural changes, such as are described by Professor Halford.

I may here note, in anticipation of future experiments on the efficacy of the so-called antidotes, that the application of a ligature to the thigh of a fowl bitten by a Cobra manifestly retarded the entry of the poison into the circulation, and warded off for a time its fatal effects.

I hope ere long to commence a series of experiments for the purpose of testing the value of various remedies, antidotes, prophylactics, &c., proposed from a variety of sources for snake-poisoning. This will be the natural sequel to the experiments that have been hitherto made with a view of investigating the effect of the poison on the living body and the pathological changes produced.

CASE OF SNAKE-BITE.

Communicated by J. Fayrer, M.D., C.S.I.

(*Re-published from the Indian Medical Gazette.*)

I am indebted to Major C. A. McMahon, Officiating Commissioner of Hissar, for the following very interesting account of a case of death from the bite of bungarus ceruleus, in which hæmaturia was a prominent symptom, and where life seems to have been prolonged by the internal administration of stimulants.

From Major C. A. MacMahon *to* Dr. Fayrer.

I enclose an interesting account of a death from snake-bite. Mr. Davis, a customs' patrol, was bitten on the 31st August, (evening) and did not die until 11 a.m. on the 3rd September, having been kept up by ammonia and brandy all that time. The case is interesting, because Mr. Davis had skilful treatment from the first, and the most approved remedies appear to have been applied. Mr. Davis became perfectly insensible almost immediately after he was bitten (showing that the poison was powerful and active) and yet he was restored, not only to consciousness, by the internal administration of ammonia and brandy, but he became sufficiently well to do some work, and sign some official papers, (the latter part is not mentioned in the accounts I send you). the influence of the poison having been checked for so long, one would hardly have anticipated a fatal termination about sixty-three hours after the poison was received into the system. It almost seems as if when a man is being bitten by a full-grown cobra, or krait, stimulants only postpone the fatal hour.

The case is an interesting one, and I shall be glad to hear your opinion on it.

The snake was evidently a krait. How ignorant men are of what snakes are deadly and what are not! Mr. Davis surely did not know.

The two accounts I enclose are by Mr. Edwardes, District Superintendent of Police, Rohtuck, and the Sub-Assistant Surgeon of Hansi. I think they give, taken together, a very full, complete, and accurate account of the case.

Statement of Mr. F. N. Edwardes.

On the 31st August, 1871, I was on my tour of inspection at police station Mahim in this district, and on the customs line.

middle of one night I was called out by Major H., who informed me that one of his horse-keepers had been bitten by a snake, was very ill, and had been taken to the hospital, where I at once proceeded. About fifteen minutes were said to have elapsed since the receipt of the injury before I saw the patient, who was then in a state of utter prostration and dreadful alarm at the idea of closely impending death; he was covered with a cold clammy perspiration, had a rapid pulse, but the respiration was unimpeded. The bite was in the foot, but had been so pinched and pulled about, that it was impossible to ascertain if it had been inflicted by fangs or not. The usual stimulant remedies, especially ammonia, were freely exhibited; the man was kept moving about, but the symptoms after two hours remained much the same. I was then informed that this was the second time he had believed himself to be bitten by a venomous snake; on the first occasion he had been equally ill, but by some means it was ascertained that his antagonist had been a little mouse, which, when he had satisfied himself of, he got well. Finally I became firmly convinced that he was only suffering from fear; I told his master so, who then asked if I had any objection to allowing a snake-charmer trying his remedies for the purpose of relieving his mind, as he persisted that he had been injured by a cobra. I assented, several hours having now elapsed. Unfortunately the appearance of the snake-charmer had exactly a contrary affect to soothing the patient, who argued I had given him up; there was now no hope, and he soon became worse. As it seemed probable his words might come true, I again took the case in hand: a good blister and galvanism with stimuli were required before he came round; in fact, it was only by causing great bodily pain that I was able to draw his attention from his mental affection, as this in reality was. Doubtless most medical officers in India can recall such cases as the above to their recollection, or those of cholera in which fear has been the cause of death, or the latter has only been prevented by such means as recorded in this instance.

ON THE INFLUENCE OF LIQUOR AMMONIÆ HYPODERMICALLY INJECTED.

Communicated by J. Fayrer, M.D., C.S.I.

(Re-published from the Indian Medical Gazette.)

The following experiments were made at my request by Mr. Richards of Bancoorah, the object being to ascertain the effects of the hypodermic injection of the liquor ammoniæ.

In the first experiment, ten drops of liquor ammoniæ, with an equal quantity of water, were hypodermically injected. The man was kept in the recumbent posture, and during observations continued from 4-18 p.m. to 5-38 p.m. no change was observed in the axillary temperature, the number of respirations or the pulse. The only results noticed were that the pulse, which was 80 at 3-47 p.m. before the injection, fell, after it, to 64 at 4-16 p. m.—8 minutes after the injections, and continued subsequently throughout the observations at 60.

In the second experiment, 20 drops of liquor ammoniæ, mixed with 20 drops of water, were injected into another man's arm.

The man was kept in the recumbent posture, and the observations were continued from 9-40 a.m. to 11-32 a.m.; at 9-16 a.m., 24 minutes before the injection, his temperature was 97·50°, respirations 21, pulse 64.

At 10 a.m., 20 minutes after the injection, temperature was 96·90°, respirations 21, pulse 60.

The temperature gradually rose, and at 11-30 was 97·50°, respirations 33, pulse remaining at 60.

The temperature and the number of respirations were both gradually augmented, whilst the pulse was unaffected throughout.

In the third experiment, 30 drops of liquor ammoniæ, with an ounce and a half of water, were administered by the mouth, at 9-14 a.m.

Before taking the ammonia, and whilst in a sitting posture, the temperature in axilla was 97·90°, respirations 16, pulse 60;

at 10 a.m., 46 minutes after taking the ammonia, the respirations were 16, the pulse 60.

The observations were continued at intervals, after 11-26 a.m., during which time the thermometer stood at 97·30°, having been at 10-42 a.m. 98·30°.

The respirations rose to 28, the pulse remaining at 60 throughout, of the same force.

The effect of the ammonia administered by mouth was very much the same as of that administered by hypodermic injection.

In the fourth experiment, 15 drops of liquor ammoniæ, with 25 of water, were injected into the arm at 4-25 p.m. Primarily, the temperature was 99°, pulse 76, respiration 18.

By 5-45 p.m., the pulse had declined to 68, the respirations had continued at 18, the axillary temperature had fallen to 98·60°.

In the fifth experiment, a healthy man, aged 30, had two ounces of brandy with hot water administered; the pulse being 78, respirations 30, temperature 98·55°, at 3-58 p.m.

The pulse at first rose to 82, temperature 98·80°, respirations 33.

At 5-27 p.m., the temperature had risen to 99·70°, the respirations had fallen to 28, pulse 74, weaker.

In the sixth experiment, 15 drops of liquor ammoniæ with 25 of water, were injected hypodermically at 2-55 p.m. the axillary temperature being 99°, respirations 22, pulse 68. At 3 p.m., 2 ounces of brandy with water were administered by mouth.

At 3-41 p.m., temperature was 99·20°, respirations 44, pulse 64, weak; the respiration and pulse had both declined.

Some brandy was given at 3-5 p.m.

The temperature rose again temporarily to 99·50°, and by 4-50 had again fallen to 99°, the respirations had risen to 26-30°, the pulse 76.

Such were the results of a series of experiments most carefully carried out by Mr. Richards; they are appended in detail, with his remarks. The inference is that any benefit derived from these stimulants, could only be kept up by repeated doses, which apparently might be administered without danger.

BANCOORAH, *December* 12*th*, 1870.

MY DEAR DR. FAYRER,—I have the pleasure to forward the results of my first experiments with the liquor ammoniæ.

The men operated on were healthy and of the Bowri caste (palkee wallahs.)

I can vouch for the accuracy of the observations, as they were carefully noted by myself.

December 11th, 3-28 p.m., a man, aged 30 years, was placed on a couch in a horizontal position, and one of Dr. Aitkin's curved thermometers was put into axilla.

3-36 p.m., thermometer 99°

3-40 ,, ,, 99·40°

3-57 ,, ,, 99·50°, respirations 20, pulse 80.

4-8 ,, 10 drops of liquor ammoniæ, with 10 drops of water, were hypodermically injected on the outer side of the left arm, near the insertion of the deltoid muscle.

4-16	p.m.,	thermometer	99·70°,	respirations	20,	pulse	64
4-30	,,	,,	99·60°	,,	20	,,	60
4-38	,,	,,	99·40°	,,	20	,,	60
4-44	,,	,,	99·40°	,,	20	,,	60
5	,,	,,	99·40°	,,	20	,,	60
5-21	,,	,,	99·90°	,,	20	,,	60
5-38	,,	,,	99·0°	,,	20	,,	60

During the whole time the man remained perfectly quiet in the horizontal position. No difference in the force of the pulse was perceptible. The temperature of the room was 74°. The thermometer was kept in the axilla the whole time.

December 12th, at 9-1 a.m.—Another man, aged 27 years, was placed on a couch in a horizontal posture, in which position he remained during the time the observations were made; a thermometer was placed in the axilla.

9-16 a.m., thermometer 97·50°, respirations 21, pulse 64.

9-40 ,, 20 drops of liquor ammoniæ, with 20 drops of water, hypodermically injected.

10	a.m.,	thermometer	96·90°,	respirations	21,	pulse	60
10-17	,,	,,	97·20°	,,	25	,,	60
10-50	,,	,,	97·50°	,,	28	,,	60
11	,,	,,	97·50°	,,	30	,,	60
11-32	,,	,,	97·50°	,,	33	,,	60

Temperature of the room 70°

The respiratory movements were greatly augmented, while there was no alteration in the number or force of the pulse.

At 9 a.m., a straight self-registering thermometer was placed in the axilla of a healthy man, aged 30.

He remained in a semi-erect position until 9-11 a.m. when the thermometer was 97·90°, respirations 16, and pulse 60.

At 9-14 a.m., 30 drops of liquor ammoniæ in an ounce and a half of water, were administered by the mouth, and the thermometer (the index of which had been previously re-set) again put into the axilla.

10	a.m.,	respirations	16,	pulse	60
10-35	,,	,,	22	,,	60
10-42	,,	,,	26	,,	60

The thermometer registered at this time a maximum of 98·30°.

11-26 a.m., thermometer 97·90°, respirations 28, pulse 60 ; the force of the pulse continued pretty well the same throughout; the skin was slightly moist; the respiratory movements were (as in the previous case) much increased.

December 14*th*.—A strong healthy man, æt. 25 years, was placed on a couch, and a curved thermometer put into the axilla at 4 p.m.

4-6 p.m.,	thermometer	99·25°,	respirations	18,	pulse	76
4-20 ,,	,,	99·0°	,,	18	,,	76

15 drops of liquor ammoniæ, with 25 drops of water, were injected into the left arm at 4-25 p.m.

5-3 p.m.,	thermometer	98·80°,	respirations	18,	pulse	72
5-20 ,,	,,	98·60°	,,	18	,,	70
5-45 ,,	,,	98·60°	,,	18	,,	68

A healthy man, æt. 30 years, was placed in a semi-erect position, and a thermometer put into the axilla at 3-48 p.m.

3-58 p.m., thermometer 98·55°, respirations 30, pulse 78, weak.

Two ounces of brandy with hot water were administered now.

4-14 p.m.,	therm.	98·80°,	resp.	33,	pulse	82.	
4-40 ,,	,,	99·40°	,,	32	,,	78	full.
4-57 ,,	,,	99·70°	,,	32	,,	78	,,
5-27 ,,	,,	99·70°	,,	28	,,	74	weaker.

A quarter of an hour after the administration of the brandy, the temperature had increased 0·25°, the respirations 3, and the pulse 4.

Temperature of the room, in which these observations were made, 73°.

December 16*th*.—A man, æt. 30, was placed in the horizontal position, and a thermometer put into the axilla at 2-31 p.m.

2-45 p.m., thermometer 99·0°, respirations 22, pulse 68; 2-55 p.m., 15 drops of liquor ammoniæ, with 25 drops of water, injected into the arm; 3 p.m., brandy, two ounces mixed with warm water and administered.

3-9 p.m.,	thermometer	99·40°,	respirations	25,	pulse	74	full
3-21 ,,	,,	99·20°	,,	25	,,	74	,,
3-41 ,,	,,	99·20°	,,	24	,,	64	weak

3-50 ,, an ounce of brandy given.

4 p.m.,	therm.	99·40°,	resp.	26,	pulse	70
4-16 ,,	,,	99·50°	,,	26	,,	70
4-50 ,,	,,	99· 0°	,,	30	,,	76.

It must be remembered that all these men were in the habit of taking alcohol.

I leave it to you to draw conclusions from these observations. I may remark, however, that 10 and 15 drop injections appear to have very little effect, and that I should be inclined to place more reliance on a combination of brandy and ammonia administered by the mouth as a stimulant; twenty drop injections seem to have some effect. The arms of the men were rendered very painful by these experiments, but a little cold water dressing and a rupee *bukshcesh* appears to be an efficient cure.

V. Richards.

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ON THE IMMEDIATE TREATMENT OF PERSONS BITTEN BY VENOMOUS SNAKES.

By J. Fayrer, M.D., C.S.I.

(Re-published from the Indian Medical Gazette.)

It is, I believe, usual to supply the police thannahs with liq: ammoniæ, to administer to those who are bitten, and who come under the notice of the police, before they can be brought under any medical treatment.

The practice is a good one, and I would advocate its continuance and extension. Ammonia is a powerful stimulant and may do good—it cannot do any harm; administered in doses of ten or fifteen drops with half a wine glass (chittack) of water, every quarter of an hour, or even more frequently, it may be of benefit; and, as in the police stations and elsewhere in England, tables giving general instructions for the treatment of the drowned or suffocated, are hung up by the Humane Society, so in the Indian police stations, and other public places where such might be useful, I would hang up tables giving brief and clear instructions how to act in the case of snake-bite.

As soon as possible after a person is bitten by a snake, apply a ligature, made of a piece of cord, round the limb or part at about two or three inches above the bite.

Introduce a piece of stick or other lever between the cord and the part, and by twisting, tighten the ligature to the utmost.

Apply other two or three ligatures above the first one at intervals of 4 or 6 inches, and tighten them also. After the ligature has been applied scarify, by cutting across the punctures to the depth of $\frac{1}{4}$ of an inch with a pen-knife or other similar cutting instrument; let the wounds bleed freely; or better still excise the punctured part. and also the

Apply either a hot iron or a live coal to the bottom of these wounds as quickly as possible, or some carbolic or nitric acid.

If the bite be [redacted] where a ligature can be applied, ~~raise up the integument with the finger and thumb,~~ ~~and~~ with a sharp penknife cut out ~~a circular piece as big as a~~ [redacted] ~~the points of the finger and thumb~~, to the depth of $\frac{1}{4}$ or $\frac{1}{2}$ an inch. Then apply the hot coal or hot iron to the very bottom of the wounds.

Give fifteen drops of liq: ammoniæ, diluted with an ounce of water, immediately, and repeat it every quarter of an hour, for 3 or 4 doses, or longer, if symptoms of poisoning appear.

Or give hot brandy or rum or whisky or spirits, with equal parts of water, about an ounce of each (for an adult) at the same intervals. ~~Send at once for medical aid; or take the person to the nearest medical man without delay; if none be near—in half an hour,~~ should no symptoms of poisoning have appeared, the ligatures should be relaxed, or the part will perish from gangrene.

If symptoms of poisoning ~~do~~ appear, do ~~not~~ relax the ligatures until ~~the person be recovering from~~ the poison, or until the ligatured part be cold and livid.

Suction of the wounds is likely to be beneficial, ~~but~~ as it may be dangerous to the operator, it cannot be recommended ~~as a duty.~~

If, ~~notwithstanding~~, symptoms of poisoning set in and increase, if the patient become faint or depressed, unconscious, nauseated or sick,—apply mustard poultices, or liq: ammoniæ on a cloth, over the stomach and heart; continue the stimulants and keep the patient warm, but do not shut him up in a hot stifling room, or a small native hut,—rather leave him in the fresh air than do this.

Chronic ~~[illegible]~~ is milder cases must be treated on the same and general principles.

Do not make him walk about if ~~weary and~~ depressed; rouse with stimulants, mustard poultices or ammonia, but let him rest.

If the person be brought, as he or she probably will be, some time after the bite has been inflicted, and symptoms of poisoning are present, the same measures are to be resorted to. They are less likely to be successful, but nothing else can be done.

In many cases, the prostration is due to fear, the bite may have been that of a harmless or exhausted snake, and such will rapidly recover if so treated and encouraged. If poisoned, but, as frequently is the case, not fatally, these measures are the most expedient; if fatally poisoned, no others are likely to be more efficacious.

It will frequently happen that the bitten person is seen by an educated person (though not a medical man) who may have the opportunity of ~~applying the magnetic or electric current to the heart and diaphragm, or of making other additions to the~~ measures already described. ~~By such, the so-called antidotes may be given, though I fear they can add but little if any benefit.~~ The snake should always, if possible, be produced.

The measures suggested are no doubt severe, and not such as under any other circumstances should be entrusted to non-professional persons.

But the alternative is so dreadful, that even at the risk of unskilful treatment, it is better that the patient should have this chance of recovery.

In addition to a supply of liq: ammoniæ to all police thannahs or other public localities away from the dispensaries and stations where the ryots might apply for aid in case of bites, I would suggest the addition of a small supply of strong whip cord, an actual cautery iron and a small knife for the purposes I have described, and a bottle of carbolic or nitric acid.

A plain summary or translation of these suggestions might be hung up in ~~every police thannah and other~~ public place. The people should be warned against incantations, popular antidotes, and loss of time in seeking for aid.

Every Police Inspector, of whatever grade, might be taught the application of the simple measures I have described, and should be enjoined to make them known as widely as possible among the police and the people.

Read at Medical Society of London
28th January 1884.

ON THE NATURE OF SNAKE-POISON.

THE communication which I have the honour of making to you this evening is in fulfilment of a promise made last April, after the discussion of a paper on a similar subject by Dr. Badaloni of Nocera, which excited considerable interest and some criticism with regard to the purely scientific aspect of snake-poisoning, its treatment, and its relation to the vital statistics of countries in which venomous snakes are more numerous than in our own (in this respect) more highly favoured one.

I purpose to describe the nature and the mode of action of snake-poison on living creatures; and, being most familiar with the Ophidia of India, I shall select some illustrations from that source, especially as it affords typical examples of snakes which are endowed with this terrible power of destroying life.

Let me ask your attention to some points in the structure of the apparatus which is concerned with the elaboration and inoculation of the poison which it is the purpose of this paper to describe.

The order Ophidia has three subdivisions:

1. Ophidii Colubriformes (innocent).
2. Ophidii Colubriformes Venenosi.
3. Ophidii Viperiformes.

The two latter are all poisonous—they are the Thanatophidia, and well merit this name in India, where they destroy, probably, 20,000 human beings annually.

The general anatomical structure and distinctive characters of a snake are well known, but I will ask you to notice certain differences between:

1. An innocuous and a poisonous snake.
2. Between a poisonous colubrine and a viperine snake.

The crania drawings and dissections before you illustrate these differences. Snakes are provided with sharp re-curved teeth, which are firmly fixed in the maxillary palatine, and pterygoid bones; by the form and arrangement of these teeth, poisonous may be distinguished from innocent snakes.

The harmless snake has two complete rows of ungrooved

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The harmless snake has two complete rows of ungrooved small teeth, one outer or maxillary, and one inner or palatine row; in the majority, there are from 20 to 25 teeth in the outer row.

In the venomous snakes, the outer row is represented by one or more large tubular fangs, firmly anchylosed to the maxillary bone, which is movable, and by its movement causes the erection or reclination of the fang which is so marked in viperidæ. In the innocent snake, the maxillary bone is elongated, and gives insertion to a row of teeth; in the poisonous colubrine, it is much shorter, giving insertion to only one or more teeth, the anterior and largest of which is the poison-fang.

In the viperine snakes, the maxillary bone is reduced to a mere wedge, giving insertion to a long curved and tubular fang, which is a much more formidable weapon than the fang of the cobra, or other colubrine snake.

These fangs, when reclined, are covered by a sheath of mucous membrane, in which lie also several loose reserve fangs, in different stages of growth. When the working fang is lost by accident, or is shed, one of the reserve fangs takes its place, becoming fixed to the maxillary bone, and placed in communication with the duct of the poison-gland.

The teeth vary considerably in the different subdivisions of the order. They are described as being perforated. Though this is apparently the case, it is not really so. They are dense and compact, enclosing the usual pulp-cavity; but being folded on themselves form either an open groove, as in the hydrophidæ; a complete canal, as in cobra; or a more complete tube still, as in viperidæ.

During development, the laminated tooth folds like a leaf on itself, and so forms the channel along which the virus is conveyed; and thus the tooth makes a most complete hypodermic syringe.

The poison is secreted by a conglobate racemose gland situated in the temporal region behind the eye. It is of considerable size—about that of an almond in the cobra—and is furnished with a duct which opens into the capsule of mucous membrane enveloping the base of the fang; the venom thence flows into the dental canal, and is injected into the wound when the tooth penetrates the bitten object. At the orifice of the duct it seems probable that there may be a sphincteral arrangement of muscular fibres which would enable the snake to control the ejaculation of the virus.

I have not been able to make out such a sphincter in the elapidæ; but Dr. Weir Mitchell says it exists in crotalus. I may have overlooked it, and think it probable that further examination may detect it in other poisonous snakes. I may here just refer to the remarkable mechanism by which, the ectopterygoid bone being pushed forwards, the maxillary is made to rotate, and to erect the fang in the viperine snakes; and to the action of the temporal and masseter muscles, which, whilst they close the jaw in the act of biting, at the same time compress the gland, and force the poison through the duct. Time does not admit of anatomical details; but they are fully described in the *Thanatophidia* (pp. 1 to 5), and are represented in the sketches and specimens before you.

Before I pass on to consider the poison, let me say a few words about the poisonous snakes themselves. Here I may remind you that the only poisonous snake in Great Britain, and, indeed, in a great part of Europe, is the adder—*Pelias berus*—a viper (or some variety of it); and that, in comparison with the cobras and vipers of India and the Tropics, it is feeble in its venomous power.

The venomous colubrine snakes of India are: of elapidæ, the naja tripudians or cobra, ophiophagus elaps or hamadryad, bungarus ceruleus or krait, bungarus fasciatus or raj-samp, sankni; of xenurelaps, x. bungaroides, and the various species of callophis; hydrophidæ a very numerous family of sea-snakes all are very poisonous, but, being confined entirely to a marine or estuarial life, are not so dangerous to human life as others.

The viperine snakes are represented by daboia russelii (or tic polonga, or chain-viper); echis carinata (or kupur, or phoorsa-snake); these are true vipers; whilst the crotalidæ, or pit-vipers, are only feebly represented by the trimeresuri, peltopelor, halys, and hypnale; these are much less poisonous than their American congeners, crotalus, lachesis, cruspedocephalus, and others.

The najadæ are the most virulent of the colubrine snakes; none are more deadly than the cobra or hamadryad. Of viperidæ the daboia and echis are probably as deadly as any of the African forms.*

In 1868, I resumed an investigation, begun in 1854, on

* Of American elapidæ, elaps corallinus, and lemniscatus. Of American crotalidæ, crotalus, (rattle-snake), lachesis-mutus; craspedocephalus (West Indian). Of African elapidæ, naja-haje, naja-hæmachates: of viperidæ, cerastes, and four or five others are very dangerous.

the subject of poisonous snakes and the nature and effects of their venom. During that inquiry, which continued till 1871, I ascertained from official sources that out of a population of 120,972,263 (Dr. Hunter), 11,416 persons died of snake-bite in the year 1869. Subsequent returns show that the mortality continues at very much the same rate. The Sanitary Commissioner, in his report on the North-West Provinces and Oude for 1882, tells us that 6,515 persons were killed in that year by snakes and wild beasts, out of a population of 44,107,869. In 1881, in all India, there were 22,377 deaths from the same cause.

In destructiveness the snakes stand in about the following order: cobra, krait, echis, daboia.

The ophiophagus elaps, bungarus fasciatus, and hydrophidæ are deadly but less numerous, and therefore less destructive to life.

The returns cited represent only a portion of India, and there is good reason to believe that the total annual mortality of the whole peninsula is not much, if at all, under 20,000 persons, or roughly about one in every 10,000.

The subject is of much general interest, and it is as important to humanity as to science to ascertain the nature and properties of the poison, and to discover what may best counteract it.

Snake-poison is secreted by glands which represent the parotids in other creatures (a small gland is connected with the duct of the poison-gland in daboia, and was figured in a drawing by me, made in 1869. Dr. Wall suggests that its secretion may in some way modify the action of the poison, perhaps giving it the peculiarity in which it differs from the cobra-venom) and is probably a modification of the saliva, though different in its action from that innocent and indispensable secretion. The analogy is more probable if, as suggested by some physiologists, Mr. Busk and others, there be an active principle in it, closely allied to the ptyaline of saliva.

The virus is a transparent, slightly viscid fluid, faintly acid in reaction, of varying specific gravity, 1·058 being the average (according to Wall) of a mixture of virus taken from several cobras. It has a bitter taste in the cobra, but not bitter in daboia. It is of a faintly straw-coloured hue in cobra; in the ophiophagus of a golden yellow. When dried it loses from 50 to 75 per cent. of water (Wall) and forms a semi-crystalline substance like gum-arabic. It is secreted in considerable quantities, and if a fresh and vigorous cobra be made to bite through a leaf stretched across a spoon or shell, several drops can be thus obtained. Examined under the microscope it is structureless, but a few cell-forms and micrococci may be detected. The mucus of the mouth may be the origin of these organisms, and it is probable that there is nothing characteristic in them (Wall), for the most active venom is free from them The poison is exhausted when the snake has bitten frequently, and it is then comparatively harmless; but it rapidly becomes dangerous again.

"If the virus be kept in the liquid state it first becomes neutral, then alkaline, and a few feathery cubic crystals form; if preserved in a loosely corked test-tube, it will become cloudy, smell offensively, and swarm with bacteria, but still it is poisonous.

"The alkalinity now lessens, and the reaction becomes again acid; the fluid then coagulates into a firm whitish opaque substance, somewhat like the coagulated white of an egg, but of a lemon colour.

"If a small quantity of fluid be left uncoagulated it is poisonous, and the washings of the coagulum are also poisonous." (Wall)

Heating cobra-poison to boiling point (Wall says) does not destroy its physiological action, though less local inflammation is caused by it so treated.

Snake-poison has been examined by chemists, but a complete or exhaustive analysis has not yet been given.

Fontana, in 1781, and Prince L. Bonaparte, in 1843, made an analysis of the virus of the adder *(Pelias berus)*, and came to the conclusion that it contained an active principle, to which he gave the name of echidine or viperine, which he succeeded in separating. The paper in which he describes the process was read before the Union degli Scienziate Italiani at Lucca in 1843, and is in our library; so far as I know but little has been added since Prince Louis Bonaparte's investigations; further analysis will probably confirm or modify his views, and perhaps add to our information. The Prince laboured under the disadvantage of having only adder-poison to analyse. With a better supply of cobra, daboia, or crotalus virus, which might now be obtained, there are good grounds for hoping that the chemistry of snake-poison will be exhaustively worked out. This is now being done in America by Drs. Weir Mitchell and J. E. Reichardt, who have published some results of their work.

In 1873, cobra-poison from Bengal was submitted to Dr. Armstrong, F.R.S., for analysis, and he obtained the following results :—

Crude Poison.	Alcohol Precip.	Alcohol Extract.	Albumen for Comparison.	
				(Ralfe)
Carbon, 43.56	45.76	43.04	53.5	53.5
Nitrogen, 40.30	14.30	12.45	15.7	15.5
Hydrogen........................	6.60	7.0	7.1	7.0
Sulphur...........................	2.5	...	...	1.6
Oxygen...........................	...	...	...	22.0
Phosphorous	...	...	...	0.4

This is an incomplete analysis, but it is to be hoped that the same eminent chemist may be disposed to continue the investigation when supplied with more virus.

The following is an epitome of Weir Mitchell and Reichardt's investigations, which relate chiefly to crotaline poison, but include a partial analysis of some dried (colubrine) poison from India. They find that the venom of the crotaline snakes can be subjected to the action of the temperature of boiling water, without completely losing its poisonous powers. The activity of the venom, however, of *crotalus adamanteus* seems to be destroyed by a temperature below 176 deg. Fahr. Mitchell, some years ago, showed that the venom of *crotalus durissus* is not destroyed by boiling, and the curious fact is noted that the venom of *crotalus adamanteus* should thus differ from the venom of other snakes.

The symptoms caused by the venom of the different snakes with which they have operated do not, they say, differ radically, save in degree, but there are symptoms which suggest that further investigation may enable them to point out certain differences by which it will be possible to discriminate one form of poisoning from the other. This is partly in accordance with what has already been observed in India, and notably by Dr. Wall.

The investigations, so far, lead them to conclude that the poison of the cobra is the most active, next the copperhead, then the mocassin, and lastly, the rattle-snake; but their researches on this head are not yet complete.

They are unable to confirm the statement of Gautier of Paris, that an alkaloid, resembling a ptomaine, exists in cobra poison. Professor Wolcott Gibbs, they say, was unable to find an alkaloid in the poison of crotalus, but they have satisfied themselves that the venom contains three distinct proteid bodies, two of which are soluble in distilled water, one which is not soluble. These bodies have certain properties and reactions, which are detailed in their monograph on the subject.

Hitherto, observers have regarded the venom of different snakes as each representing a single poison; but it appears that, of the three proteids before mentioned, one is analogus to peptones, and is a putrefacient poison; another is allied to globulin, and is a most fatal poison, probably attacking the respiratory centres, and destroying the power of blood to clot, while the third resembles albumen, and is probably inocuous. The separation of the poisons necessitates a long and elaborate series of researches, the results of which will be subsequently reported. They have also ascertained that the poison of the rattle-snake (*crotalus adamanteus*), copper-head (*Trigonocephalus contortrix*), and mocassin (*Toxicophis piscivorus*), are destroyed by bromine, iodine, hydrobromic acid (33 per cent.), sodium hydrate, and potassium permanganate.

It appears that the activity of the venom differs not only in character and intensity in different genera and species, but also in the same individual under varying conditions of temperature, climate, health, and state of vigour or exhaustion at the time. It is a most virulent poison, and it takes effect when absorbed into the circulation, either by inoculation, or as I demonstrated in India (quite against all former and universal belief) when applied to a mucous or serous membrane, proving that it may neither be sucked from a bite, nor swallowed with impunity.

It acts most rapidly on warm-blooded creatures, sometimes with lightning-like rapidity, when it enters a vein; it is deadly also to cold-blooded creatures, and to the lowest forms of invertebrate life. Strange to say, and this, to me, is one of the greatest of its mysteries, a snake cannot poison itself, or one of its own species, scarcely its own congeners, and only slightly any other genus of venomous snake, but it kills innocent snakes quickly. It has been ascertained that a vigorous cobra can kill several dogs, or from a dozen to twenty fowls before its bite becomes impotent, and then the immunity is of brief duration, for the virus is rapidly reformed.

In 1868 and 1869 I observed that, whilst the general characters of the effects of snake-poison are alike, yet viperine differs from colubrine poison. The poison of naja kills without destroying coagulability of the blood, whilst that of the daboia (viper) produces complete permanent fluidity (*Thanatophidia*, p. 4), and, in connection with this, "the blood of an animal killed by snake-poison is itself poisonous, and, if injected into an animal, rapidly produces its poisonous effects. I have transmitted the venom through a series of three animals with fatal results."

In 1868 I described the difference of the action of cobra and daboia-venom in the case of two horses bitten by these snakes (*Thanatophidia*, p. 79). At pp. 72-73, *op. cit.*, I also pointed out the peculiar action of daboia-venom in causing early convulsions. In some the convulsions are more marked, and, in others, death is preceded by a more decided state of lethargy. In the bite of the echis the local symptoms are peculiarly severe, so (*Thanatophidia*, p. 631) Dr. Wall gives a more complete exposition of the varying effects, and shows them to be greater than I supposed.

Snake-poison is a narcotic, and kills by extinguishing in some way (some molecular change) the source of nerve-energy. It is also a blood-poison and an irritant, if applied to mucous and serous surfaces it causes inflammation; absorption then takes place, and the symptoms of general poisoning are induced. It causes great local disturbance as well as blood-change; for, if the bitten creature survive long enough, the areolar tissue may inflame, suppurate, and slough. If it enter by a large vein, life may be destroyed in a few seconds. It was supposed the more active poisons acted by shock through the nervous system, but the rapidity with which a poison can be distributed through the circulation would account for the most rapid death from snake-bite. The chief effect is on the respiratory apparatus, and death occurs by asphyxia; but the whole voluntary muscular system is also affected, and general paralysis results; whilst the long continuation of cardiac pulsation after apparent death, proves that it is not due to failure of circulation.

The action of snake-poison is discussed at full length in the *Proceedings of the Royal Society* by Dr. T. L. Brunton and myself (1873-74-75-78). These researches led us to conclude that the action of the poison is: (1) on the cerebral and spinal centres, especially the medulla, inducing general paralysis, especially of respiration; (2) in some cases, where the poison has been conveyed through a large vein directly to the heart by tetanic arrest of cardiac action, probably owing to action in the cardiac ganglia; (3) by a combination of these causes; (4) by blood-poisoning of a secondary character.

The phenomena vary according to the nature of the snake, and the individual peculiarities of the creature injured, the chief difference being observed in viperine as contrasted with colubrine poison. The latter is a nerve-poison of great deadliness; but as a blood-poison it is not of much power. Viperine poison, on the other hand, is a more potent blood-poison. Dr. Wall summarises the difference in the action of daboia (viperine) or cobra (colubrine) poison as follows: "Cobra-poison, when introduced slowly into the circulation, produces gradual general paralysis, but, at the same time, shows a preference for certain nerve-centres; paralysis of the tongue, lips, and larynx being very marked symptoms, and respiration is very quickly extinguished after the paralysis shows itself. Death is often attended with convulsions, which are clearly due to carbonic acid poisoning. Introduced with a fair amount of rapidity, these symptoms are rapidly developed, the paralysis being preceded by gentle stimulation, which causes slight muscular twitchings. Injected in a large quantity into the circulation, the stimulation is so violent as to cause general convulsions, of which, however, the respiratory muscles have the chief share, and which are immediately followed by paralysis and death.

"Daboia-poison, though not injected directly into the circulation, causes the most violent convulsions, which are in no way necessarily followed by paralysis and death, but may be, for the time, completely recovered from. They do not depend on carbonic acid poisoning. The paralysis that succeeds is general, and lasts a very considerable time before respiration is extinguished. There is no evidence of the tongue, lips, and larynx being especially paralysed; they probably only suffer in the same degree as other parts. Cobra-poison very quickly destroys the respiratory functions—after slight acceleration the respiration becomes slower, and the excursus is lessened. Daboia-poison at first quickens the respiration very much more than cobra-poison does, and the lessening of the excursus and the slowing of the breathing does not occur so soon. The respiration generally in daboia-poisoning has a peculiarly irregular character. This function certainly exists longer under the influence of daboia-poison than under that of cobra-poison. The effect of cobra-poison on the pupil is so slight as to be a matter of doubt. Daboia-poison nearly always causes wide dilatation in the earlier stages of the poisoning. Salivation is a constant symptom of cobra-poisoning; it is exceedingly rare in daboia-poisoning.

"The effect of cobra-poison in the blood is not very great, Sanious discharges are rare, albuminuria has not been seen, and recovery is striking and complete when it takes place. In daboia-poisoning, on the other hand, sanious discharges are the rule. Albuminuria is usual should the victim live any time; and, after the nerve symptoms have passed away, the subject has to go through a period of blood-poisoning little, if at all, less dangerous than the primary symptoms; we have, in addition, the greater local mischief caused by daboia-poisoning, and the greater power it has of destroying the coagulation of the blood.

"The physiological properties of daboia-poison undergo great change by its being heated to 100C. in solution, losing the power of producing primary convulsions, whereas cobra-poison remains unaltered. Daboia-poison kills birds at once in convulsions, whereas, with cobra-poison, unless the poison has been directly injected into the circulation, death occurs only after paralysis.

"Lastly, amphibia recover from an amount of daiboia-poison that would be necessarily fatal in the case of cobra-poison."

Without unreservedly accepting Dr. Wall's conclusions, I regard them as an able summary of the action of different kinds of snake-poisons, and they confirm the deadly nature of Indian as compared with European snake-poison.

The local effects of the poison are partial paralysis of the bitten part, pain, infiltration, swelling, inflammation, and ecchymosis round the spot where the poison has been introduced, and sometimes in other and distant parts, and, if the animal survive for some hours, infiltration and incipient decomposition of the tissues and hæmorrhagic discharges. The general symptoms are depression, faintness, cold sweats, nausea, vomiting, exhaustion, lethargy, unconsciousness.

Dogs vomit, and are profusely salivated. They present an appearance as if the hair were "staring." As the poisoning proceeds, paralysis appears in the limbs, commencing generally in the hinder parts, with a tendency to creep over the whole body, involving the muscles of deglutition, and loss of co-ordinating power of muscles of locomotion. Albuminuria (especially in viperine poisoning), hæmorrhagic discharges, relaxation of sphincters; exhaustion, lethargy, and convulsions precede death.

In fowls the appearance is that of great drowsiness. The head falls forwards, rests on the point of the beak, and gradually the fowl, no longer able to support itself, rolls over on its side. There are frequent startings, as if of sudden awaking from the drowsy state, then convulsions and death.

In cases where the quantity of poison injected is large, and it is at the same time very active (as in cobra), the bitten animal small and weak, or if it have entered a vein death is almost instantaneous, as from shock. In such case, the cardiac ganglia are probably paralysed; at all events, the heart suddenly ceases to beat.

The effects of snake-poison on man are much of the same character, and may be studied in the details of sixty-five cases recorded in the *Thanatophidia*, which also give an idea of the duration of life. Dr. Wall has summarised them as follows: "The average length of time of the sixty-five cases is 15·17 hours; but the average is raised by the exceptionally long duration of a few cases of viperine poisoning, so that a better estimate of the probable duration of time will be obtained by dividing the period in spaces of one hour each, and determining what percentage of deaths occur in each.

	Per centage.		Per centage.
One hour and under ...	10.76	Between 7 and 8 hours...	4.61
Between 1 & 2 hours ...	12.3	" 8 " 9 " ...	3.07
" 2 " 3 " ...	13.84	" 9 " 10 " ...	7.69
" 3 " 4 " ...	7.61	" 10 " 12 " ...	4.61
" 4 " 5 " ...	1.54	" 12 " 24 " ...	9.36
" 5 " 6 " ...	1.54	Over 24 hours	20.00
" 6 " 7 " ...	3.07		

"The most fatal periods appear to be between two and three hours, and more than twenty-five per cent. of the total deaths take place between one and three hours after the infliction of the bite."

It appears, also, from the above report in which, in fifty-four cases the exact spot is described, that 94·54 per cent. are wounded in the extremities.

Place of Bite.	Per centage of Cases.	Place of Bite.	Per centage of Cases.
Fingers and wrist ...	31.48	Leg	3.70
Fore arm	1.85	Thigh	1.85
Elbow	5.56	Breast	1.85
Shoulder	1.85	Ear	1.85
Feet, toes, ankle ...	48.15	Perinæum	1.85

This is a matter of some interest, as the hope of success lies in preventing access to the circulation, and in the facility of removing the part injured, and with it the inoculated venom.

The greater proportion of deaths recorded, result from the direct effects of the poison; chronic cases, in which death or recovery resulted after protracted periods, are less frequently referred to.

Snake-poisoning in this country is of the viperine character, and though happily the activity of our viper is feeble compared with that of the tropical viperidæ, and except in the case of very weak or young creatures, its immediate effects as a nerve poison are feeble; yet the effects on the blood, and, locally, on the tissues, may be productive of severe and even dangerous symptoms.

The result of my experience is that, so far, no physiological antidote to snake-virus is known, and that when the full effect on the respiratory centres is produced, remedies are of little, if any, avail; albeit, when the poison has entered in smaller quantities, treatment may be of service on general principles.

Viewing the apparent analogy between curare and snake-poisoning, death in both being caused by paralysis of the respiratory apparatus, Dr. L. Brunton and I hoped that, by keeping up artificial respiration, and supporting the body-temperature, we might keep an animal poisoned by snake-virus alive until elimination had taken place; and the result of some experiments justified the anticipation to some extent, for animals were kept alive for many hours, but succumbed at length when the artificial respiration was withdrawn. Mr. V. Richards, who repeated our experiments in India, succeeded in thus keeping an animal alive for days, though it, too, succumbed finally. In the case of curare, artificial respiration is completely successful, though not so in snake-poisoning. This seems to show that the damage done by the snake-poison is of a more serious and permanent nature than that by curare, as indeed I am inclined to believe, though I do not say that a physiological antidote is impossible; all I assert is, that it has not yet been found. I would encourage efforts to devise a method of treating snake-poisoning in whatever degree it presents itself, for some means of neutralising the poison, or of restoring the damaged nervous system and blood, may still be found; at any rate, it is with snake-virus as with other deadly poisons: there must be a quantity, however small, which, though dangerous, is not of necessity fatal, in such cases we may influence the result by treatment, and save life in some. But after long and repeated observation in India, and subsequently in England, I am forced to the conclusion that all the remedies hitherto regarded as antidotes are absolutely without any specific effect on the condition produced by the poison, and that such aid as we can give must depend on preventive and local treatment.

I will now briefly describe the measures to be adopted in the treatment of snake-poisoning, and especially refer to the permanganate of potash as a remedy, and shall read a letter from Dr. M. de Laçerda, of Rio de Janiero, written by that distinguished physician as a commentary on the discussion which took place here last April on Dr. Badaloni's paper.

The first and most important indication is to prevent the poison entering into the circulation; to this all else is subsidiary. The rapidity with which this takes place depends a good deal on the part of the body bitten, and on its vascularity. When the poison enters a vein, if the bite be inflicted by a vigorous snake, the result is generally rapidly fatal. Experiments on animals show that bites inflicted on parts, even where large veins are not implicated may produce their effects so rapidly, that only immediate severance of the part, or complete constriction, prevents absorption.

It is necessary, therefore, as quickly as possible after a bite has been inflicted, to apply a ligature above it, and so tighten it as to completely arrest the circulation. As it happens in 94 per cent. of cases that the bite is inflicted on an extremity, this may frequently be accomplished; but, in parts where no ligature or elastic bandage or cord can be applied, proceed at once to excise the bitten part; this, indeed, should be done in all cases, ligatured or not; then make an incision through the bite, and reflect the skin; expose the tissue wherever that is altered in colour, dissect it out, and be careful to remove every part of it; then apply cautery, some escharotic, or the permanganate solution, taking care that it reaches, as much as possible, in every direction where the poison may have infiltrated. After this is done, the ligature may be relaxed; for, if the virus be destroyed, the danger of its entering the circulation is past. Should it have already entered, as is only too probable, all that can be done is to give stimulants, keep the patient warm, at rest, and, when the respiration begins to fail, use artificial respiration, and endeavour to keep the patient alive till the poison be eliminated.

In 1869 I gave instructions for the treatment of snake-bite, and, excepting that I would substitute Esmarch's bandage for the ligature, as recommended by Dr. Wall;—that permanganate, five per cent. solution, should be applied to the wound when the venom has been carefully dissected out, or injected when it has not been cut out, I have nothing to alter in these suggestions.

Suction, being unlikely to be of much avail, is practically useless to the patient and dangerous to the operator, and should neither be encouraged nor relied on. Insist on the importance of quiet and perfect rest; the temperature should be kept up; the respiration, if it begin to fail, supported by artificial methods. Where the poison has happily been limited to the seat of inoculation, and in cases where no great quantity of virus has been absorbed, we may hope to do good; but where the poison has entered the circulation in larger quantities, and the physiological symptoms are developed, the prognosis is exceedingly unsatisfactory.

As soon as possible after a person is bitten by a snake, apply a ligature made of a piece of cord, or elastic bandage, round the limb or part, at about two or three inches above the bite. Introduce a piece of stick or other lever between the cord and the part, and, by twisting, tighten the ligature to the utmost. After the ligature has been applied, cut the punctures, to the depth of a quarter of an inch, with a penknife, or other similar cutting instrument; let the wounds bleed freely; or, better still, excise the punctured part and all the infiltrated areolar tissue subjacent to it. Apply either a hot iron or a live coal to the bottom of these wounds as quickly as possible, or inject into the subcutaneous cellular tissue a solution of permanganate of potash, five per cent., or some carbolic or nitric acid. If the bite be where a ligature cannot be applied, with a sharp penknife, cut out the bitten part and all the infiltrated cellular tissue to the depth of a quarter or half of an inch; then apply a hot coal or hot iron to the very bottom of the wound, or, better, the permanganate of potash. Give fifteen drops of liquor ammoniæ diluted with an ounce of water immediately, and repeat it every quarter of an hour for three or four doses, or longer if symptoms of poisoning appear; or give hot brandy, or rum, or whisky, or spirits with equal parts of water, about an ounce of each (for an adult), at the same intervals. Suction of the wounds is not very likely to be beneficial, and as it may be dangerous to the operator, it cannot be recommended.

If symptoms of poisoning set in and increase, if the patient become faint or depressed, unconscious, nauseated, or sick, and respiration begin to fail, with symptoms of paralysis of tongue and fauces, apply mustard poultices, or liq. ammoniæ on a cloth, on the stomach and heart; continue the stimulants, and keep the patient warm; but do not shut him up in a hot stifling room, or a small native hut; rather leave him in the fresh air than do this.

Chronic, *i.e.*, milder cases, must be treated on the same and general principles. Do not make the patient walk about; if depressed, rouse him with stimulants, mustard poultices, or ammonia, but let him rest.

If the person be brought, as he or she probably will be, some time after the bite has been inflicted, and symptoms of poisoning are present, the same measures are to be resorted to. They are less likely to be successful, but nothing else can be done.

In many cases the prostration is due to fear; the bite may have been that of a harmless or exhausted snake, and such will rapidly recover if so treated and encouraged. If poisoned, but, as frequently is the case, not fatally, these measures are still the most expedient.

A plain summary or translation of these suggestions might be hung up in public places. The people should be warned against incantations, popular antidotes, and delay in seeking for aid. Every police inspector, of whatever grade, might be taught the application of the simple measures I have described, and should be enjoined to make them known as widely as possible among the police and the people.

There can be little doubt that recoveries from Indian snake-poisoning occur chiefly in cases where the snake has been exhausted or harmless, or has bitten imperfectly, and in a few cases where prompt interference has prevented the entry of the poison into the circulation.

Let me now make some remarks on the remedial value of permanganate of potash. During my investigation of the value of remedies for snake-poisoning, permanganate of potash was not omitted, and I made the following experiments:—

June 12th, 1869.—First, a fowl was bitten by a cobra in the thigh at 3 p.m.; at 3.1 fifteen drops of liq. potass. permanganate were injected into the spot; dead in seven minutes, 3.35. Second, forty drops of liq. pot. permanganate injected into the external jugular of a dog. This produced no apparent effect on the animal. At 3.48, bitten by a cobra (which had bitten before and was not fresh) in the thigh; the fang punctures were at once washed with the strong solution of permanganate, which was well rubbed in; 3.52, sixty more drops injected into the vein; 3.54, two drachms injected into the bowel, all the symptoms of cobra-poisoning advancing rapidly; 4.12, forty more drops injected into jugular vein; 4,25, dead in thirty-seven minutes.

In 1878 Dr. Brunton and I made the following experiments, which confirm the power of the permanganate to neutralise the poison before it has entered the circulation, but show its inefficiency when it follows it.

Experiment 1.—Five milligrammes of poison were dissolved in one cubic centimètre of water, and mixed with one cubic centimètre of liquor potassæ permanganatis, and injected under the skin of a guinea-pig. No symptoms were produced, and the animal remained quite unaffected.

Experiment 2.—Two rabbits of the same litter, each weighing exactly 2 lbs., were taken. Five centigrammes of cobra-poison, dissolved in one cubic centimètre of liquor potassæ permanganatis, and allowed to stand for about eight minutes. The mixture was then injected under the skin of the flank of one rabbit. No symptoms whatever were produced, and the animal though kept under observation for some weeks, remained quite unaffected by the poison. Five milligrammes of cobra-poison, dissolved in two cubic centimètres of water, were injected into the other rabbit at the same time. During the injection a little of the poison was lost, so that the animal did not receive the full dose, yet it died in thirty minutes.

Experiment 3.—April 4th, 1878. Guinea-pig, weighing 1½lbs.; injected four centigrammes of cobra-poison into leg. 4.1 p.m., ligature applied immediately; permanganate of potash applied immediately. 4.5 p.m., twitching; 4.10 p.m., dying; 4.13 p.m., convulsion; 4.14 p.m., dead.

Experiment 4.—April 4th, 1878. Guinea-pig weighing 1 lb. 3.45′ 20″ p.m. Injected ⅔ grain (= 4 centigrammes) of cobra poison, under skin of leg. A ligature was applied round the leg in one minute, and in five minutes permanganate of potash was rubbed into an incision made over the site of injection. 3.52 p.m., ligature cut; 3.53, twiching violently, leg paralysed; 3.57 p.m., dying; 3.58 p.m., dead—less than thirteen minutes.

Dr. Wall, who has carefully investigated the subject, makes the following pertinent remarks *Indian Snake-Poisons*, p. 129) : " As it was found that potassium permanganate does destroy the poison, steps were taken to see if it would be of any practical use in the treatment of animals suffering from snake-bite. It was found, by experiment, that a considerable quantity of potassium permanganate, dissolved in a weak saline solution, could be injected into the circulation of an animal without producing any immediate effect (I found the same with a strong solution). A dog, suffering from cobra-poisoning, had a cannula placed in its saphena vein ; a solution of potash was injected, but though a large quantity was cautiously and gradually introduced into the circulation, and though at the same time life was prolonged by artificial respiration, in no way was the least benefit to be perceived from the remedy. The reason is obvious. It is quite true that potassium permanganate destroys the active agent of cobra-poison by oxidising it ; but, when introduced into the blood, it of course commences oxidising indifferently all the organic matter with which it comes in contact; but it has no power of selecting one organic substance for oxidation rather than another. The oxidising power of the permanganate is, therefore, exerted on the constituents of the blood generally, instead of being reserved for the cobra-poison in it alone; so, if cobra-poison is dissolved in an organic solution, and the permanganate is added before injection, the poison suffers little, if any, diminution in strength, for oxidation has taken place chiefly at the expense of the other organic matter. Thus, it would be necessary to destroy all the constituents of the blood by oxidation before all the poison in it could be destroyed too. If a substance should be found having the power of oxidation, with a special affinity of exercising it on snake-poison, the problem of the treatment of snake-bite would be solved, but potassium permanganate has not the special power."

It has been pointed out that there are other substances which greatly diminish or destroy the action of snake-poison when mixed with it out of the body. Of all such agents, permanganate of potash is probably the best ; still it seems to be of little practical use.

Wall further remarks : " It may be asked why, if metallic salts, tannic acid, hydrate of potash, and permanganate of potash, destroy snake-poison,should not these substances be used in preference to excision. The reply is obvious.

If we could know the exact position of the poison, and if there were only one deposit, we might probably succeed in destroying it by injection. But to remove the poison deposited by the bite of a snake requires a most intelligent observation, guided by eye-sight and judgment, but an injection of a chemical agent must be, to a great extent, made by guess-work, and the solution, instead of following the poison, takes the line of least resistance in the tissues, often leading it far from the poison."

In a pamphlet *(Experiments on Permanganate of Potash and its Use in Snake-poisoning)* dated 1882, Richards says: "A solution of 5 per cent. of permanganate of potash is able to neutralise the poison;" and recommends that this should be injected into the bitten part after a ligature has been applied; it is less likely to cause sloughing of the tissues than any other agent which could neutralise the venom. In his letter dated July 22nd, 1882, he says: "It is, in my experience, the best local application we possess. It is not a physiological antidote, but is a chemical one, and is utterly powerless to effect any influence on the lethal action of snake-poisoning." (He means the constitutional action.) He is of opinion "that whenever opportunity offers, the injection of permanganate of potash should be resorted to, assuming that a ligature has been efficiently applied (where it can be applied at all) within five minutes from the bite. In the average run of cases, the permanganate will certainly destroy the poison lying beyond the ligatured part," if it come in contact with it; but, as Wall pointed out, the difficulty of insuring its contact with the poison is so great as to render it practically unreliable. I agree with Richards that, so far as it goes, it is a good local application, and as such it ought to be used, or, in its absence, tannic acid or liquor potassæ might be resorted to with the same object; but as a constitutional remedy, as a physiological antidote, it is powerless, like all others that have been tried and failed to do good. Dr. de Laçerda himself, although he attributes the highest value to it as a chemical antidote, both as a powerful oxidising agent, and by the action of the potash, says; "as to the idea of finding a physiological antidote for snake-poisoning, I entirely agree with you that it is a Utopia."

Dr. de Laçerda's letter is most interesting and instructive. He says that he has been led to write it by reading the report of a discussion at this Society on April 16th, 1883. With some preliminary observations, he continues:

"I beg leave to protest against an opinion attributed to me by some of your colleagues, but which I have never sustained. I refer to the opinion that attributes to bacteria the effects of the poison. I have weighty reasons for considering such an hypothesis as entirely false. I recognised, indeed, by means of repeated and careful observations that the venom contains micrococcus in great numbers, and I made a communication on this subject some three years ago to the Academy of Sciences of Paris. These corpuscles, however, exist in the venom in an accidental manner, as also in the human saliva, and play no important part in the effects of the poison. This last acts as a chemical agent producing a rapid alteration in the molecular composition of the albumina which enters into the formation of almost all animal tissues. On the blood, given certain conditions, its effects are very rapid, almost instantaneous; the same happens with the nervous and other elements whose functions are disturbed immediately that the venom comes in contact with them. Now, such immediate action can never be attributed to bacteria. You see, therefore, that this unsustainable theory cannot be invoked in endeavouring to explain the neutralising effects of permanganate of potash.

"Having made this protest, I will proceed to indicate the points on which I cannot agree with certain of your colleagues and with yourself, in regard to certain questions relative to snake-poisons. In the first place, I do not consider it exact to say that this venom inoculated in the tissues of an animal, invades rapidly the organism.* On the contrary, numerous experiments made during three years have proved to me that the venom is slowly absorbed by fractions, acting first locally on the tissues in which it has been innoculated, the elements of which imbibe the venom little by little and fix it. This destructive local action is at times, of itself alone, sufficient to produce, a short time after the inoculation has been effected, general disorders of a reflex character which are not unfrequently confounded with the disorders due to to the generalisation of the venom which require a greater time for their manifestation.

* Dr. de Laçerda may possibly have operated only with the crotaline snakes, and if so, he has not had the opportunity of witnessing the different action excited by colubrine poison. In my experience, frequent experiments showed that direct general contamination follows the bite even when no large vein has been wounded.

"In those cases in which the effects of a generalisation of the venom were produced within a short time after the innoculation, some vessel had been opened by the inoculating instrument, giving the venom free entrance into the circulation.

" Another point in regard to which I cannot agree with some of your colleagues, is that there are species of snakes whose venom actuates principally upon the blood, while others act specially upon the nervous centres. For the Brazilian species, at least, I can affirm that this opinion is erroneous, and it does not appear to me probable that the species inhabiting India furnish an exception to the rule of unity of action of the venom, that I have verified for Brazil. With the venom from a single species, I may even say, of a single individual, an animal may be made to succumb by causing profound perturbations in the central nervous system, without apparent alteration in the blood ; or *vice versâ*, with slightly pronounced disorders of the nerve-centres and profound alteration of the blood. Everything depends on the conditions in which the experiment is made.

" Passing now to the essential point of the discussion that took place in the Medical Society, I will give in a few words how I comprehend and how I judge that the efficacious effect of permanganate of potash should be comprehended. You yourself, by experiments made in 1869, recognised that permanganate of potash mixed with the venom, took from it its noxious properties. Certain conditions of the experiments led you, however, to deny the efficacy of this chemical agent in the cases in which the venom had been inoculated in the tissues. As you know, however, I have demonstrated by numerous experiments and innumerable clinical facts that the neutralisation takes place even in the midst of the tissues, which makes this substance a chemical antidote of great value.

" The permanganate of potash acts upon the venom, destroying it in two ways : first, as a powerful oxidising agent ; second, by the potash that forms the base of the salt. Passing a current of nascent oxygen through a concentrated solution of the venom, this loses entirely its noxious properties. This experiment, which I have repeated many times, gave me always the same result. Let us suppose now that an individual is bitten. If injections are made in the place of the bite from five to ten minutes after the inoculation of the venom, this is promptly neutralised *in situ*, and the individual runs no further danger.

A great number of facts like this have been observed in Brazil. If aid is given late, hours after the bite, when the tumefaction of the wounded part is very pronounced, and the phenomena that indicate the entrance of the venom into the circulation have already declared themselves, injections repeated in various parts of the wounded member, parting from the wounds made by the fangs of the reptile, still give very good results. Nor is it difficult to explain the good results in this case. The venom, as I have said, acts first locally, and only enters the general circulation after the lapse of a certain time, and by portions. The permanganate of potash, meeting in the tissues with the venom, which is little by little diffusing itself, neutralises it in the various points where it has been diffused, and thus stops the source of supply. The entrance of new and successive portions of the venom into the general circulation being thus impeded, the organism takes charge of the elimination of what has already been introduced, and which was insufficient to compromise the life of the individual.

"We will now suppose a case of greater gravity, in which a vein is wounded, and there is a rapid penetration of a large quantity of venom into the circulation. Even here, an injection of a solution of one-hundredth of permanganate of potash may be practised in the vein, since we have recognised that no bad effects are produced in dogs by a dose of from two to three cubic centimètres. In this case, the good results are problematic, in view of the rapid diffusion of the venom in the organism; but then, if permanganate of potash does no good, no other substance could be useful. These cases, fortunately uncommon, are beyond all help.

"As to the idea of finding a physiological antidote for snake-poison, I entirely agree with you that it is a Utopia."

After careful consideration, fully admitting that in permanganate of potash we have an agent which can chemically neutralise snake-poison (as indeed was shown by Dr. Brunton and myself in 1878), I do not see that more has been done than to draw attention to a local remedy already known as a chemical antidote, the value of which depends on its efficient application to the contaminated part, which, Dr. Wall has pointed out, is too uncertain to be reliable. We are still then as far off an antidote as ever; and the remarks made by me in 1868 are as applicable now as they were then; they were as follows:—

"To conceive of an antidote, as that term is usually understood, we must imagine a substance so subtle as to follow, overtake, and neutralise the venom in the blood, and that shall have the power of counteracting or neutralising the poisonous and deadly influence it has exerted on the vital force. Such a substance has still to be found, nor does our present experience of drugs give hopeful anticipations that we shall find it. But I repeat that where the poisonous effects are produced in a minor degree, or where the secondary consequences are to be dealt with, we may do much to aid the natural powers in bringing about recovery."

In conclusion, fully acknowledging the value of recent researches, I would express a hope that the subject may receive further vigorous investigation, and that efforts may be prosecuted, especially in the direction of search for some method of increasing elimination of the poison, of ascertaining the exact nature of the lesion of the nervous system and blood, and how far they are removable; that, as to local measures, with the view of preventing entry of the virus into the circulation, and of neutralising it *in situ*, improvements on present methods may be sought for. As to advance in the investigation of the physiological and chemical aspects of the question, much may still be done, as also in respect of the chemistry and microscopical character of the virus itself, and the blood and tissues of the poisoned. But these inquiries, of such importance to the human race, can, I fear, make but little progress whilst the present restriction on all physiological research continues to be maintained.

A review of the subject of snake-poisoning would be quite incomplete without acknowledgement of the valuable labours of such Indian observers as Dr. Short, Dr. Nicholson, and Dr. Stradling; Drs. Stuart, Ewart, Richards, and Wall, who have added materially to our knowledge, as also have Dr. Halford, in Australia, Dr. de Laçerda, in Rio de Janiero, Dr. Lauder Brunton, F.R.S., in London, and Drs. Weir Mitchell and Reichardt, in America, who are now engaged in the most important and much needed investigations into the chemistry of the poison, and the condition of the blood and tissues of the poisoned.

I am indebted to the Director-General of the Army Medical Department for the following interesting case, which will appear in the next *Army Medical Department Report*.

Colonel M., while serving in Zululand, near the lower

Tugela river, was bitten in the leg just below the knee, and, after the lapse of a few seconds, became sensible of extreme shock, and at once felt certain that a snake had bitten him. He rode back to camp, and, when first seen, ten minutes after the infliction of the injury, was in the following condition. There was pain, ecchymosis, swelling, and partial paralysis of the bitten part. He was so exhausted that he had nearly fallen off his horse. The forehead and hands were bathed in cold perspiration; the extremities were cold and pale; there was great nervous depression, with sense of impending death; respiration was hurried. Quickly following this, bilious vomiting set in, with loss of co-ordinating power; numbness of extremities and lips, and dragging sensation of the face; intense pain in neck, troublesome cough, with thick viscid expectoration. The pulse was, from the first, weak and rapid, rising from 120 to 150; restlessness and anxiety became very distressing. Vomiting ceased at 9 p.m., but soon afterwards still graver symptoms developed; vision rapidly failed; the eyelids drooped, the speech became thick and nasal; there was paralysis of the tongue and soft palate, with dysphagia. The were also chronic convulsions of the upper extremities of the muscles of the chest; the breathing was stertorous, with low muttering. At 12.45, he spoke for the last time, and then lapsed into a semi-comatose condition, and died at 2 a.m., ten hours after the bite.

Tight compression was made above the seat of injury, between the bite and the heart; wound enlarged, and an attempt made to remove all the blood and poison from it. Nitrate of silver and ammonia were applied freely to the surface of the wound. Ammonia and diffusible stimulants were administered by mouth. To relieve the distressing vomiting, sinapisms were applied to region of stomach, and brandy, with soda-water, given; the restlessness was combated with hypodermic injections of morphia (half a grain for a dose); the morphia gave great relief, which, however, was only transitory. Hot water-bottles were applied to the feet, and stimulants were given with an unsparing hand, but were not always retained. Ammonia was also injected subcutaneously.

Post mortem examination made nine hours after death; body well nourished. Cadaveric rigidity well marked. Hypostatic congestion. Great discolouration of scrotum and finger-nails. Situation of bite on left leg at upper and inner side of calf, about three inches below internal condyle of femur, and immediately over internal saphena vein. Appearance that of a small pin-puncture; lower part of leg rather swollen. On removing the skin from the region of the wound, there was found great sero-sanguineous extravasation into the surrounding tissues, and the muscles were soft and infiltrated with blood; the internal saphena vein was punctured. The venous system on the left side much congested. The glands in left groin, in long axis of limb, enormously enlarged and congested. Glands in right groin normal; pericardium normal. Heart, right cavities of, full of fluid blood; left cavities empty; valves healthy; no clots. Lungs normal. Liver congested, and slightly enlarged. Gall-bladder fully distended. Spleen somewhat enlarged, otherwise normal. Stomach slightly congested, rugæ well marked; contents, a small quantity of glairy mucus. Kidneys normal. Omentum contained much adipose tissue. Intestines normal. Bladder normal, contained a small quantity of urine. Brain somewhat congested, otherwise normal. Blood in a fluid state.

The snake which inflicted the fatal wound was not seen; in all probability Colonel M. trod on one asleep, which then struck at him. The systemic shock was at once apparent after receipt of the injury, which is accounted for by the puncture of the internal saphena vein, and the introduction of the poison direct into the general circulation. The clothing traversed by the fang of the snake was, first, cloth garter; second, khakee riding-breeches; third, drawers of light material. From the high situation of the puncture, the opinion of competent judges was that the snake which inflicted the wound was a "black mamba," one of the large African vipers, species not determined.

The following were exhibited:—

Crania of innocent snakes.
Crania of venomous colubrine snakes.
Crania of viperine snakes.
Dissections of muscular apparatus for erecting fangs.
Dissections of poison gland and duct.
Models of fangs.
Drawings of the above.
Also coloured figures of venomous snakes of India.
The following snakes were exhibited:—

Naja tripudians, bungarus ceruleus, bungarus fasciatus, callophis, elaps corallinus, daboia russellii, echis carinata, vipera rhinoceros, vipera cerastes, lachesis mutus, crotalus durissus, pelias berus, and several non-venomous snakes.

EXPERIMENTS ON THE ACTION OF THE COBRA POISON.

By J. Fayrer, M.D., F.R.C.S.E.,

Surgeon, Bengal Army; Professor of Surgery in the Medical College of Bengal.

Fourth series.

Experiment No. 1.

At 3-29 p. m. a full-grown, vigorous, and fresh cobra was made to bite a very powerful full-grown cobra of a black color. The scales were scraped off near the head, and the other snake was made to plunge his fangs into the exposed part, and retain them there for some time. It was then made to bite the cobra in the mouth, by closing the jaws on the under-jaw of the bitten snake. The wounded snake was then placed in a large cage, and watched. It did not show any symptoms of being affected by the poison, and was perfectly well, vigorous, and active on the 10th at 2 p. m.—At 2 p. m. of the 11th June, the bitten snake was well and active. This appears to be almost conclusive that the cobra is not affected by the poison secreted by another cobra.

Experiment No. 2.

At 3-30 p. m. a full-grown, fresh cobra of light brown color, with one occellus on the hood, was made to bite a large Rana Tigrina (Bullfrog) on the inner side of the thigh, the integument having been previously raised. The snake was made to close his jaws on, and under the fangs in the muscle, retaining them there for some time.

3-36 p. m.—Apparently not affected; leg not paralysed; moves about as usual.

3-55.—No very apparent change, except that the bitten thigh is much ecchymosed; rather sluggish.

4-10.—Very sluggish; hardly moves when stirred; appears almost paralysed.

4-25.—Appears to be paralysed, so as to be unable to move; respiration goes on well. There are reflex movements when the hind legs are irritated. The legs are drawn up.

4-30.—Reflex movements have ceased.

4-45.—Dead. Body much swollen and distended with air. This experiment proves that the frog is susceptible, though much less so than warm-blooded animals, to the action of the poison.

Experiment No. 3.

A full-grown, active Ptyas Mucosus (*Dhamin*) was bitten at 3-36 p. m. in the mouth by a powerful, vigorous, and fresh cobra. The snakes were made to close their jaws on each other. The snake remained unaffected, and on the 11th, at 2 p. m., was quite well. There could be no doubt that the cobra's fangs were deeply inserted in this case.

Experiment No. 4.

A large Varannus Flavescens (*Gosamp*) was bitten, at 3-55 p. m., by a full-grown, fresh, and vigorous cobra of the light colored variety, with one occellus, which the Natives of Bengal call "Keowtie," in the mouth and in the thigh, the integument having been previously raised to ensure the penetration of the fangs and insertion of the venom.

3-57.—The bitten leg is dragged as though paralysed; the mouth is bleeding from the cobra's bite.

4-25 p. m.—Drags the leg; is rather sluggish, but not much affected.

4-27.—Lies prone. Is nearly paralysed, and moves with great difficulty.

4-35.—Apparently paralysed; can be moved with difficulty.

4-55.—Much the same. After this the Varannus began to improve, and at 2 p. m. the following day he appeared better, though still sluggish. On the 11th June, at 2 p. m., I found the Varannus dead in the cage. He was seen alive about noon.

Experiment No. 5.

At 4 p. m., a half-grown fowl was inoculated in the muscular part of the thigh with four drops of cobra poison removed from the snake the day before. The poison was injected with the ordinary hypodermic syringe. The effect was almost instantaneous. The fowl staggered when placed on the ground; was in convulsions at 4-1, and was dead at 4-4. This experiment would appear to show that the poison loses very little of its power, if any, by removal; and that its action depends much on the instrument with which it is injected. The hypodermic needle resembles the cobra's fang, and was almost as rapid in inducing the full effect of the poison.

Experiment No. 6.

At 4-7 p. m., a very large Rana Tigrina was injected with ten drops of the same poison, with the same instrument as that used for the fowl. The axilla and the abdominal wall were the places selected for injection.

4-22.—Slightly convulsed, and then partially paralysed.

4-30.—Almost motionless; respiratory movements still apparent. 4-35.—Dead.

4-20.—He is beginning to be sluggish, but is very slightly affected.

This experiment points to the difference of the effect of the poison on cold and warm-blooded animals. With three times the amount of the poison as was used in the case of the fowl, it took seven times as long to kill the frog.

Experiment No. 7.

One drop of carbolic acid was administered to a full-grown, vigorous cobra at 4-14 p. m. In two minutes the snake was in convulsions, and powerless to strike, or even erect his hood.

4-34.—Still struggling ; convulsed ; mouth open, but unable to move or strike.

4-45.—Has gradually been recovering ; looks still very weak, and the head trembles, and can be raised with difficulty. At 2 p. m. the following day the snake had recovered, but still seemed weak, and unable to dilate his hood perfectly.

A smaller cobra to which the same quantity, one drop, was administered, died in less than five minutes.

Experiment No. 8.

Two drops of carbolic acid were administered to a large frog, Rana Tigrina, at 4-15 p. m.

4-20 p. m.—Apparently not affected.

4-22.—Began to be sluggish.

4-24.—Very sluggish ; reflex movements when the hind legs are irritated.

4-30.—No reflex movement ; lies almost paralysed ; respiratory movements ging on slowly.

4-40.—Quite dead.

When dead, the body became quite collapsed and pinched in, whilst the frog killed by cobra poison was much distended.

The poison used for inoculating on this occasion had been taken from three cobras the day before. There was altogether about forty or fifty drops. It is a slightly viscid, somewhat opalescent fluid ; clear when pressed out of the poison gland, but becoming slightly turbid afterwards, with a slightly acid reaction, and under the microscope presenting the appearance in the annexed sketch,* which I observed after very careful examination.

This poison used on the day after its abstraction had lost very little of its virulence ; for, when injected through the hypodermic needle, it caused death very rapidly. Where it has appeared to fail, the apparent failure has probably been due to the mode of insertion. The hypodermic syringe is very like the poison fang, and it appeared to inject the poison just as efficaciously.

I may note that the experiments with cobras have been made with three varieties of the "Naga Tupudiana." They vary in color from black or prismatic dark-purple to a light brown or ash color. The snake-catchers describe three kinds : the *Goomun*, marked on the hood with spectacles ; the *Keowtie*, marked on the hood with one occellus, and generally of a light color ; the *Kalasamp* or the black cobra.

The Bungarus Fasciatus they call *Sankni*.

The Daboia Russellii is called by them the *Bora*, and is regarded as a very poisonous snake. As yet I have had no opportunity of trying any experiments with this snake.

June 9th, 1868.

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* Owing to a delay, the sketches are postponed,—Ed., *I. M. G.*

21 Oct 1867

ON THE ACTION OF THE COBRA POISON.

By J. Fayrer, M.D., F.R.C.S.E., Surgeon, Bengal Army,
Professor of Surgery in the Medical College of Bengal.

The subject of snakebites, the *modus operandi* of the poison, and of its reputed antidotes, have been lately attracting so much attention, that I determined to make some experiments for the purpose of ascertaining how far observations confirmed or refuted what has been said on the subject.

A very thoughtful and suggestive paper in the *British Medical Journal* of July 20th, 1867, communicated by Professor Halford of Melbourne, rendered the investigation more interesting, as it seems to indicate the nature of the pathological changes induced in the blood by the poison, and to point out a new direction in which to study them, as well as to suggest a rational antidote. The following experiments, so far as they go, only partially confirm Dr. Halford's views; but I do not consider them conclusive, and intend to pursue them further, as opportunity offers, with the view of obtaining more information. But, admitting the probability of Dr. Halford's theory of the cause of death, I am inclined to think that it can only be of partial application. It is peculiarly applicable to those cases in which, owing to a smaller quantity, or a less potent quality, of the poison having been injected, death takes place slowly, and time is allowed for blood changes to occur. But it can hardly be said to explain the cause of death in those cases where death occurs within a few minutes after the animal is bitten by a powerful snake, and where the fatal event results almost immediately, as if by a shock, or by disorganization of the nervous centres. As opportunities are afforded in this country of studying the subject of the effects of snake-poison, I may have opportunity of continuing the experiments, the first of which are recorded in the following paper.

The only antidote as yet experimented with, is one to which much importance is attached by many in this country—the "Aristolochia Indica." But I regret to say that, in the case in which we tried it, the result was a perfect failure; indeed, I doubt very much whether any remedy exists which is capable of counteracting the deadly effects of the bite of a full-grown cobra, though it is possible that, in the case of a large animal bitten by a small or exhausted snake, remedies might conduce to recovery.

The experiments here recorded were made with three full-grown cobras recently caught, and the poison was inserted, either by closing the snake's jaws in the part of the animal bitten, or by inoculating the poison with an instrument, at various periods, after its removal from the poison gland. The mode of procuring the poison is very simple; it is obtained by making the cobra bite through a thin leaf stretched across a mussel shell; the poison, like limpid syrup, runs in considerable quantities down the grooved tooth into the shell, where it is collected, and may be preserved for experiment. From a full-grown cobra ʒj. or ʒij. may be collected in a very short time. Much care is necessary in handling the reptile, and this is done with the greatest dexterity by the professional snake-catchers, who take up a living and vicious cobra without the slightest difficulty, and either make it shed its poison in the way I have mentioned, or render it harmless for the time by cutting out its poison fangs. The cobra, though very powerful and active, is apparently sluggish until roused, and its muscular power is not sufficient to enable it to twist sufficiently round to turn on any one who is bold enough to seize it by the tail, hold it at arm's length, and keep its head from darting at the legs, by pressing it down with a stick held in the other hand. Such is the way in which the snake-catchers manage them.

In the present instance, there were three full-grown fierce cobras confined in a small box. Raising the lid carefully, the old snake-catcher put in the end of the stick and lifted out one about four feet long, hissing, and with its hood erect, looking the very incarnation of mischief. He then gently dropped the snake on the ground; and, as soon as the latter began to move off, seized it by the tail, raised it off the ground, and placed the stick, holding it at arm's length, about midway under its body. He then allowed it to struggle, and make efforts to dart at him over the stick, on which it hung in a festoon, keeping up an oscillating motion by his knee, which seemed to influence the reptile's movements, as it kept time, moving its head at about the same rate as the man moved his knee. He then placed it on the ground, dragging it gently by the tail; and watching his opportunity, placed the stick on the snake's back, just behind the head, and so pressed it to the ground. Holding the tail under his naked foot, he quietly seized the snake behind the head, and squeezing it, made it open its jaws, when the poison fangs could be distinctly seen; in this way the snake was made to bite the animals experimented on, or the leaf, when the poison was collected in a shell. The experiments were made by myself, Dr. J. Anderson, Curator of the Indian Museum, and Dr. J. A. Purefoy Colles, Professor of Physiology in the Medical College. Some of them were conducted in the compound of the Asiatic Society, and others in the Museum of the Medical College.

Autopsy.—There was no congestion of lungs. The blood coagulated firmly, and was examined that evening under the microscope. The blood of the dog (Experiment No. 1) was also examined with a Powell and Lealand's $\frac{1}{25}$ inch object-glass, for the use of which I was indebted to Professor C. N. Macnamara, who very kindly examined the blood with me.

In the dog's blood nothing remarkable could be observed. The red corpuscles seemed unaltered, and the white corpuscles were present in the usual proportion. But in the fowl's blood the appearances were remarkable. In this case death occurred slowly—in 3 hours; whereas in the dog it took place in 26 minutes. On carefully examining the fowl's blood with the $\frac{1}{25}$ inch object-glass and "A" eye-piece, the following appearances were observed:—

The oval red corpuscles were unaltered; but in the field of the microscope, in addition to the blood corpuscles, a number of large granular bodies were to be seen, which, after careful examination, were discovered to be contained within a distinct cell wall. These granular bodies were coloured by an ammoniacal solution of carmine, but neither the cell wall enclosing them nor the red corpuscles were affected by it. As many as 5 or 7 of these large nucleated cells were seen at one time in the field of the microscope. The granular nucleus was very distinct, and appeared to be adherent to the inner side of the delicate, though distinct cell wall. Although these nucleated cells were numerous, we were unable to detect the circular patches in the cell wall depicted by Dr. Halford, and which he states were coloured by carmine; but in other respects our observation agrees with his.

This is a matter for further investigation in future experiments; in the meantime there could be no doubt of the appearances here described, for they were peculiarly obvious. The absence of any such appearance in the dog's blood was equally certain.

It is curious that such a difference in the time of death should have occurred. The full-grown dog died in 26 minutes, when the poison was inoculated by the snake's fangs. The small bird died in 3 hours, when inoculated with the same poison, perfectly fresh, transferred at once from the poison gland to the knife, and from the knife to the fowl's thighs. It would seem that the poison loses something of its effect in being removed from the snake.

Experiment No. 3.

A full-grown ptyas mucosus (rat snake), about five feet long, very vigorous and active, was bitten at 1-46 p. m., in two places, by a fresh and powerful full-grown cobra. The snake was made to close his jaws, and the fangs pierced deeply, and were kept there long enough for a large dose of the poison to be inoculated.

At 1-56 the respiration appeared somewhat accelerated, but gradually became normal; this quickening of the respiration was probably not a morbid symptom.

At 3-15 the ptyas was active and vigorous as usual, appearing in no way affected by the bites. I made inquiry about it the next day, and it was reported to be perfectly well.

The snake-catcher, who handled the cobra, said, when the ptyas was bitten, and persisted in saying so for some time, that it was sure to die. He was mistaken, for no evil result followed. The snake-catcher's idea is that innocuous snakes suffer from the bite of their poisonous congeners, but that poisonous snakes are unable to harm themselves or each other with their poison. This is a point on which further experiment is needed.

Experiment No. 4.

A full-grown cobra was made to plunge his fangs into another equally large cobra at 2-13 p.m. At 3-15 not the slightest effect was produced, nor did any follow subsequently, the reptile remaining perfectly unaffected.

Experiment No. 5.

At 2-42 p.m., a full-grown pariah dog was bitten on the thigh, in the same way as in the first experiment, by a large, fresh, powerful cobra.

The limb was immediately drawn up, and became partially paralysed. Respiration became hurried, and the dog was very restless. By 2-46 salivation commenced. 2-48.—The dog is lying down licking the wound, but continually rising up and lying down again; looking exceedingly distressed, with saliva running from the mouth, and curious movements of the head, and snapping of the jaws. 2-58.—Staggering and throwing the head upwards and downwards, and oscillating the body backwards and forwards irregularly. This continued for a few moments, when the animal lay down again, staggering as if intoxicated; head drooping; coma coming on with jerking diaphragmatic respiration and twitching of the angles of the mouth *(risus sardonicus)*. 3-2.—Hind quarters convulsed, restlessness great. 3-3.—Convulsion repeated, eyes glazed, tongue hanging out of the mouth; involuntary discharges. 3-12 p.m.—Dead.

Autopsy.—No congestion of lungs; blood coagulated shortly after removal; heart empty; no coagula; abdominal viscera healthy. Membranes of brain slightly injected; tissue about the snakebite infiltrated with dark discolored blood.

In this case a full-grown dog, severely bitten by a vigorous, full-grown cobra, died in 30 minutes from the effects of the poison, showing that the Aristolochia could have had little or no effect in the first experiment, where a similar dog was bitten by an equally vigorous cobra, and died in 26 minutes.