JOURNAL OF

THE TRANSACTIONS

OF

The Victoria Institute,

OR,

Philosophical Society of Great Britain.

EDITED BY THE HONORARY SECRETARY,
CAPTAIN FRANCIS W. H. PETRIE, F.G.S., &c.

VOL. XXVI.

LONDON:
(Published by the Institute.)
INDIA: W. THACKER & Co. UNITED STATES: G. T. PUTNAM'S SONS, *N.Y.*
AUSTRALIA AND NEW ZEALAND: G. ROBERTSON & Co., LIM:
CANADA: DAWSON BROS., *Montreal.*
S. AFRICA: JUTA & Co., *Cape Town.*
PARIS: GALIGNANI.
1893.

ORDINARY MEETING.*

H. CADMAN JONES, ESQ., M.A., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed, and the following Elections were announced :—

MEMBERS :—Major-General W. L. Geary, C.B., R.A. ; The Rev. Townsend Storrs, M.A., Head Master, the Grammar School, Doncaster.

ASSOCIATES :—The Rev. Canon Baker, F.L.S., F.S.Sc., J.P., Cape of Good Hope ; The Rev. E. Herbruck, A.B., A.M., Ph.D., Ed. *Christian World*, United States ; The Rev. Alexander Macpherson, Scotland ; J. Whitehead, Esq., F.G.S., Guernsey.

The following Paper was then read by the Author :—

ON SERPENT-WORSHIP AND ON THE VENOMOUS SNAKES OF INDIA AND THE MORTALITY CAUSED BY THEM. By SIR JOSEPH FAYRER, K.C.S.I., LL.D., M.D., F.R.S.

THE serpent is the ancient enemy of the human race, and it is still held in antipathy, not only by man, but by the lower animals. In man, this is probably due as much or more to the lethal properties of some forms, as to the repulsiveness of their aspect generally ; while animals seem to be instinctively imbued with the dread of them. The destructive qualities, albeit the property of but few members of this large order, have come to be attributed so universally to all, that the innocent are classed with the guilty, and the harmless creature which undulates so gracefully through the grass, is popularly associated with the deadly cobra or rattlesnake.

But although dread of their baneful properties may lie at the root of the repugnance in which they are held, yet with this feeling, no doubt, has been mingled a sentiment of veneration for their supposed wisdom and supernatural power, which, combined with fear, originated one of the earliest forms of worship, in which superstition and religious feeling have found expression, for coeval with the worship of trees, the heavenly bodies, and other natural objects, we find that ophiolatry has been general throughout the world from the remotest antiquity.

* March 7, 1892.

Serpent-worship, according to Fergusson,* is characteristic of the Turanian races, and is rarely to be found among Aryan or Semitic peoples. There is no mention of it in the Old Testament from the formation of the Jewish nation, unless the raising of the Brazen Serpent be so considered, but six centuries later, Hezekiah "brake in pieces the brazen serpent that Moses had made; for unto those days the children of Israel did burn incense to it; and he called it Nehushtan," 2 Kings xviii, 4 and 5. Between these periods there is no other mention of it in the Old Testament, but in the book of the Wisdom of Solomon, xi, 15, we read, "They worshipped serpents void of reason"; nevertheless its revival among the Gnostic sect of the Ophites points to the fact that the notion was not extinct. "A wondrous blending of the ancient rites of Ophiolatry with mystic conceptions of Gnosticism appears in the cultus which tradition (in truth or slander) declares the semi-Christian sect of Ophites to have rendered to their tame snake, enticing it out of its chest, to coil round the sacramental bread, and worshipping it as representing the great king from heaven, who in the beginning gave to the man and woman the knowledge of the mysteries" ("Primitive Culture," Tylor).

Serpent-worship, according to Fergusson, has prevailed to a greater or less extent nearly all over the world.

In America it was known in Peru, Mexico, and among the Red Indians, according to ancient records of the United States.

Its prevalence in Western Asia seems doubtful, except in Judæa, to a slight extent in Phœnicia, and in the Troad, among the so-called Ophiogones.

As regards Europe, there are next to no traces of its prevalence among the Germans, though Tylor refers to the "Prussian serpent-worship and offering of food to the household snakes," nor among the Gauls nor Britons. Ophiolatry is said to have been practised by the Druids; according to Fergusson there is not much evidence of this, but other authorities state that the serpent's egg was the Druids' crest, and that the serpent was entwined at the foot of their altars. At Avebury in Wiltshire, there existed the figure of a serpent in stones extending for two and a half miles, of which the head and tail are still obvious. There are traces of it in

---

* To Fergusson's "Tree and Serpent-Worship," and Tylor's "Primitive Culture," I am indebted for much information.

Scandinavia and on the east coast of Scotland, north of the Forth, where sculptured stone monuments have been found on which the serpent appears frequently, and as a prominent figure.

In Greece the temple of Æsculapius was a centre of serpent-worship, whilst the Æsculapian rod symbolises wisdom. In this, as in other cases, the serpent was the symbol of the god, rather than itself the god.*

In Italy the serpent was often represented as the *genius loci*, but there is no direct evidence that beyond this the Romans ever worshipped it. Dante, in his "Inferno," ascribes to the serpent supernatural power, his bite causing a man to be reduced to ashes:—

> "Ed ecco ad un, ch'era da nostra proda,
> S'avventò un serpente, che'l trafisse
> Là, dove'l collo alle spalle s'annoda.
> Nè O si tosto mai, nè I si scrisse,
> Com' ei s'accese, ed arse, e cener tutto
> Convenne che cascando divenisse."
>
> (Inferno, xxiv, 97.)

It probably prevailed in Eastern Europe during the Middle Ages, and in Esthonia and Finland up to a comparatively recent period.

In Africa, Fergusson says that Sheikh Haredi in Upper Egypt is one of the best known sites of modern serpent-worship, but there are very slight traces of its prevalence in ancient Egypt. The Egyptians worshipped many animals, but there is nothing to show that the serpent was honoured above the rest.

In Abyssinia it was worshipped before the introduction of Christianity in the fourth century, and on the Guinea coast serpent-worship flourishes at the present day, and possibly has done so for the last 4,000 years.

In Eastern Asia, Persia affords but slight traces of it. The Iranians were Aryans, and brought with them fire-worship. It may have existed among their predecessors.

Cashmere was one of the principal centres of it. There is no direct testimony of its existence there till a century before the Christian era, and the latest authoritative notice of its practice was in the reign of Akbar (fourteenth century).

In Cambodia and the adjacent countries, serpent-worship reached its fullest development. The country was conquered

* For instance, when a pestilence was raging in Rome in 291 B.C., the god was brought in the form of a serpent from Epidaurus. A sanctuary was built for him on the Tiber Island.

by the Siamese in the middle of the fourteenth century, and since then it has given place, to a great extent, to Buddhism.

It prevailed also in Ceylon till the island was converted to Buddhism, in the third or perhaps the sixth century, and there are traces of it there still.

In China there are only slight traces, but the repetition of the dragon-like forms in connection with temples, pagodas, &c., in China and Burma, is suggestive of something akin to the ophidian worship.

In India it was not noticed before the Mahabhrata, but in that is mention of the Nagas, the great serpent-worshipping race, who, taking the serpent as their emblem or cognizance, came to consider themselves the descendants of serpents. There are tribes in India called Nagas at the present day.

Ophiolatry in a modified form still prevails in many parts of India. It is met with in Manipur, Cashmere, Sumbulpore, Nepaul, in many parts of the Deccan and Southern India. On the festival of Nag-Panchmee, snakes are worshipped by most of the lower tribes of the Deccan.

Serpent-worship has no place in Brahminism, but the Hindus of the present day, if they do not directly worship the snake, will neither injure nor kill, but rather propitiate it. This feeling may be as much due to fear of any bodily harm it may do them, as to the idea of its possessing supernatural powers. Tylor says the serpent has been taken as the symbol of the world, of the Tauut, or heaven-god of the Phœnicians, and as the emblem of eternity; in the latter case it is depicted with its tail in its mouth. It may have been the personification of evil in the Apophis serpent of the Egyptian Hades, and it was so in the wicked serpent of the Zoroastrians, Aji Dahaka; Ajdaha is still applied to the larger constricting snakes. Sir George Birdwood tells me that besides abstract evil, Aji Dahaka symbolised death, destruction, the storm cloud, &c. "There Ingromaniyus (Ahriman) the deadly created a mighty serpent, and snow, the work of Deva." *Cyclopædia of India* (Balfour). He also reminds me that the deadly serpent is the symbol of evil in all Eastern countries, though there, as in Greece and Rome, it may have had also a creative symbolism.

But time does not permit that I should dwell longer on this exceedingly interesting subject; I must rather describe to you those forms of the serpent in which the lethal attributes exist in their most marked conditions, producing fear and repugnance, if not the worship of olden times.

The cobra, as I have said, is an object of veneration and superstitious awe to the natives of Hindustan, for in a religion that deprecates the wrath of a cruel and relentless power which it desires to propitiate, the symbol of evil represented by this reptile is naturally regarded with peculiar deference. The rapidity and deadliness of its poison, and the large death-rate due to its bite, explain these feelings, which need cause no surprise when it is remembered that upwards of 20,000 people die yearly of snake-bite alone.

I shall give you a brief account of the most interesting forms of venomous snakes, confining myself to those that are found in our Indian Empire. It would be barely possible even to enumerate in the time at my disposal, the deadly snakes of other countries, or the innumerable innocent forms.

Wherever climate and other conditions are favourable, snakes are likely to be found, the most venomous as well as the greatest numbers in hot and tropical regions. In our own island, as well as in most parts of Europe, the common adder is the only venomous snake, and its power is feeble compared with that of the snakes of India, the West Indies, Tropical America, Africa, and Australia.

The order Ophidia is divided into Colubriform and Viperiform; the first are both venomous and innocuous, the second are all venomous. Both are numerously represented in India; the colubriform has five genera of *Elapidae*, and four of *Hydrophidae*, the viperiform has two genera of *Viperidae*, and four of *Crotalidae*, making fifteen poisonous genera, which comprise a large number of species, but this is small compared with the number of innocent colubrine snakes.

The most widely distributed venomous snakes are the viperiform; America and Africa abound in them; the *Crotalidae* are most numerous in America, the *Viperidae* in Africa, whilst poisonous colubrine snakes are most numerous in Asia.

The Ophidia are cold-blooded vertebrata, destitute of external skeleton, pectoral arch, sternum, or limbs. In a few there is a rudimentary pelvis and hinder extremities.

The body is covered by a deciduous epidermis and scales, These, with some exceptions, assume on the head and abdomen the condition of scutæ or plates. The bones of the mouth are connected by ligaments, which allow of great distension, thus enabling the creature to swallow prey larger in diameter than itself.

In snakes, one lung is much larger than the other. Their

circulation of mixed arterial and venous blood is regulated by a heart, consisting of one ventricle, and two auricles. Locomotion is effected in the terrestrial forms by the motion of the numerous ribs, which are connected indirectly with the abdominal scutæ. These act as feet, and aided by the undulations of the body, grasp the surface, thus effecting the rapid movements of which a snake is capable. The pelagic serpents swim like fish, motion being effected by the undulations of the body and of the fin-like tail.

Snakes have neither external ears nor eyelids; the eye is protected by a transparent capsule, which is shed with the epidermis. The approach of moulting is indicated by diminution in the brilliancy of the colouration, and a pearly opacity of the eye; the creature itself becoming more or less apathetic until the process is completed.

The scales and scutæ form the basis of classification. Those on the head are named as follows :—

Rostral.	Præ, Post } Orbitals.
Anterior, Posterior } Frontals.	Upper, Lower } Labials.
Vertical.	Temporals.
Supra-ciliary.	Mental.
Occipital.	Chin-shields.
Nasals.	
Loreal.	

The form and arrangement of the scales vary. In some snakes they are plain and lie side by side, more or less lanceolate in form. In others they are imbricated, that is they overlap each other. On the head, in some snakes, they are arranged as large plates or shields. On the abdomen in the land snakes, they are in transverse plates for the purpose of locomotion. In the *Hydrophidae* and burrowing land snakes these are absent.

Snakes are oviparous and viviparous; the colubrine, except the pelagic forms, for the most part belong to the first class, the viperine to the second. The cobra lays twenty to thirty white, leathery eggs, which are hatched in some warm place by natural heat. Some are said to incubate; the python is said to coil itself round the eggs until they are hatched. The female of all snakes is said to be larger than the male; there are slight differences in colour and form, but no other external distinction.

Snakes hybernate in the cold, but returning warmth rouses them into activity. They generally eat living creatures, but

some will eat eggs—the cobra robs the hen roosts, or devours insects, molluscs, and even, it is said, vegetable matter; and some are cannibals—the ophiophagus and callophis live on snakes. In captivity they will, it is said, drink milk.

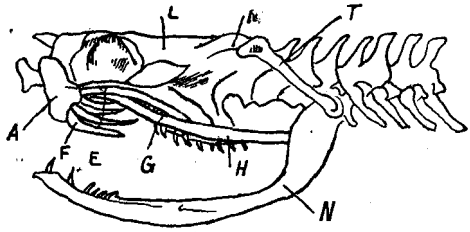
Snakes differ in their habits and modes of life, and are grouped accordingly. Tree and grass snakes live in the trees, bushes, and grass, and are often coloured like the vegetation they frequent; their tails are prehensile. When slender, they are called whip snakes; innocent and poisonous forms are found among these. Ground snakes are found in all three sub-orders; the great proportion belong to this group.

Burrowing snakes live much under ground, have a rigid, cylindrical body, short tail, narrow mouth, small teeth, and are all innocent.

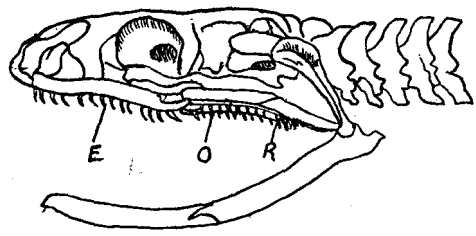
There are fresh-and salt-water snakes. The salt-water snakes are adapted for an aquatic life, and are venomous; the fresh-water snakes have not the same characters as the *Hydrophidae*, and are innocent—a curious fact! The *Hydrophidae* are viviparous.

I.

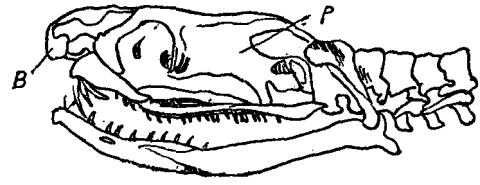
VIPERIFORM (*Daboia Russellii*).



INNOCENT (*Ptyas Mucosus*).



COLUBRIFORM (*Naja tripudians*).



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

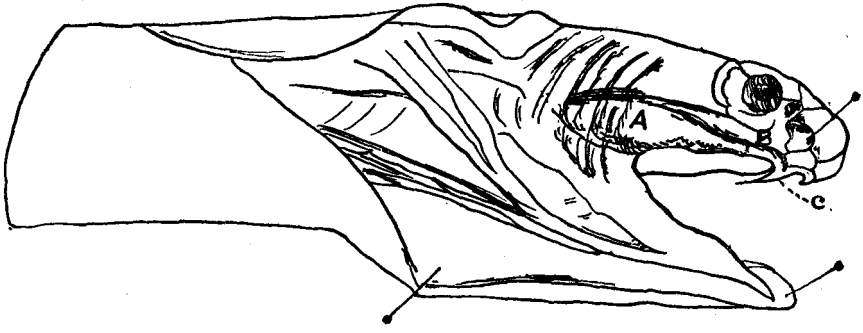
Deglutition is effected in a peculiar way; the prey being seized, the mouth gapes laterally and vertically, each side of the jaws is called separately into action; the sharp and recurved teeth hold the prey firmly, as each side of the jaw alternately advances or relaxes its grasp, and it is thus gradually but inevitably engulfed.

The maxillary bones in the venomous snakes are much shorter, and provided with fewer teeth than in the innocent. In the latter, they are elongated slips of bone set with small recurved teeth. In the poisonous colubrine snakes they are less elongated and have a fixed, large poison fang, several loose, reserve fangs, and one, two, or more fixed smaller teeth, not directly connected with the poison apparatus. In the *Viperidae* the maxillary bone is a short, triangular, movable wedge, furnished with a poison fang lying hidden in the mucous sheath. The movements of the fang are due to the rotation of the maxillary bone. This mobility is great in vipers, whilst it is slight in the colubrines.

When the fang is reclined or erected, the maxillary bone into which it is inserted is pushed by the external pterygoid bone, a movement which is effected by muscular action. The muscular arrangement for opening and closing the mouth at the same time compresses the poison gland, thereby injecting the venom through the tubular fang. The fangs are shed at intervals, and to supply the loss, the reserves are provided. These lie in the capsule of mucous membrane which ensheathes the fang. The fang is, during development

II.

COBRA DI CAPELLO (*Naja Tripudians*).



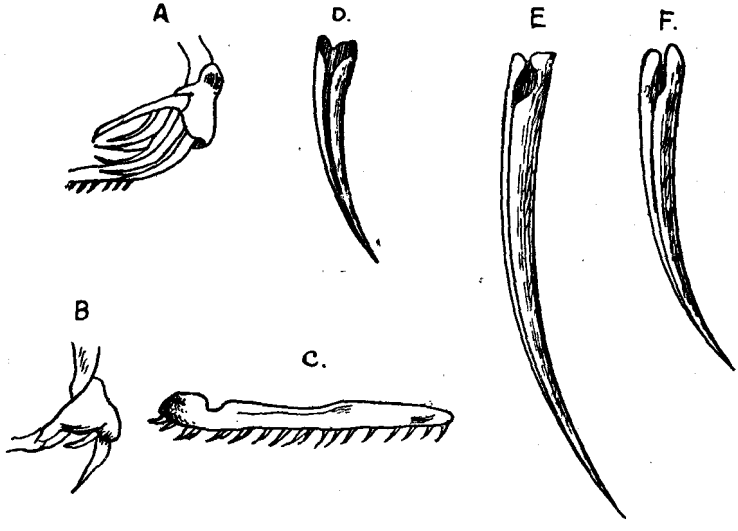
A Poison gland.
B Duct.
C Fang.

folded on itself so as to form a tube. It is along this channel that the poison passes; when the fang is deeply imbedded the quantity of virus injected is considerable, and its effects are rapidly manifested.

The poison glands are situated between the orbit and the tympanic bone; they are composed of lobes and lobules, which having secreted the virus, transmit it under muscular pressure through a duct which communicates with a triangular opening at the base of the fang. They are of various forms and sizes; in *callophis* they are much elongated; in the cobra they are of the size and something of the shape of a small almond.

The virus is a transparent, slightly viscid fluid, faintly acid in reaction, of a straw colour—in the ophiophagus, of a yellow colour; when dried it forms a semi-crystalline substance, like gum arabic. It is secreted in considerable quantities, and if a fresh, vigorous cobra be made to bite a leaf stretched across a tea-spoon—or as the natives do it, a mussel-shell, several drops may be obtained. The poison

III.



A Maxillary bone and fangs of Daboia Russellii (viperiform).
B " " " Naja tripudians (colubriform).
C " " teeth of Ptyas mucosus (innocent).
D Fang of Hydrophis.
E " Daboia.
F " Naja tripudians.

is exhausted when the snake has bitten frequently, but is rapidly reformed; in the interval the reptile is comparatively harmless, but soon becomes dangerous again. A vigorous cobra can kill several creatures before its bite becomes impotent. Removal of the fangs renders the snake temporarily harmless.

Some animals, especially the pig and the mongoose, are supposed to have immunity from snake-bite; fat sometimes protects the former, the latter is so wiry and active that it frequently escapes with only a scratch; but, if either of them be fairly bitten in a vascular part, it succumbs like any other animal.

The chemistry of snake-poison has been studied by Fontana, by Prince L. Bonaparte, Armstrong, Gautier, and others, and recently by Drs. Weir, Mitchell, and Reichert, of the United States. It is a most virulent poison, and may neither be sucked from a bite nor swallowed with impunity. It acts most rapidly on warm-blooded, but is also deadly to cold-blooded creatures, and to the lowest forms of invertebrate life. Strange to say, 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. Snake-poison kills by extinguishing the source of nerve energy. It is also a blood poison and irritant, and causes great local disturbance as well as blood change. If it enter by a large vein, life may be destroyed in a few seconds. The chief effect is on the respiratory apparatus, and death occurs by asphyxia; but general paralysis is also a result. The phenomena of poisoning 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; as a blood poison its results are less marked. Viperine poison, on the other hand, is a more potent blood-poison.

Adder poison is of the viperine character, and though its immediate effects as a nerve-poison are feeble, yet those on the blood and locally on the tissues may be productive of serious symptoms.

It is impossible to enumerate all the antidotes that have been reported beneficial; but amongst those that have the greatest repute may be mentioned arsenic, ammonia, alcohol, quinine, strychnine, acids, snake poison itself, snake-bile, and the snake-stone, so much relied on in India.

These stones are said to attach themselves closely to the bitten part, the blood that oozes out being rapidly absorbed, and when it drops off the bitten person is thought to be out of danger. Faraday said that these are pieces of charred bone. There may be a fragment of truth in the supposition that they are of use, because in absorbing the blood, they must also absorb some of the poison, though so little that their efficacy must be a mere delusion.

Experience shows that so far no physiological antidote to snake-virus is known, and that, when the full effect is produced, remedies are of little avail; but when the poison has entered in smaller quantities, medical treatment may be of service.

The entry of the poison into the system should be arrested, if possible, by a ligature above the injured part; next the poison in the wound should be destroyed or removed by excision or by burning, and the application of potassium permanganate. The subsequent treatment is conducted on ordinary medical principles, of which further details would be out of place here.

I must now describe the principal venomous snakes of India. The *Elapidae* are subdivided into *Najadæ* or hooded snakes, and *Elapidae* proper, which are not hooded. *Najadæ* has two genera, *Naja* and *Ophiophagus; Elapidae* has three, *Bungarus*, *Xenurelaps*, *Callophis*.

Naja includes the several varieties of cobra, which are all of one species, though differing considerably in external appearance.

The cobra di capello (*Naja tripudians*) has numerous synonyms in different parts of India. A common general native term is kala nag or kala samp. There are many varieties, and they are considered by natives to be of different degrees of activity or deadliness; but the probability is that any difference is due to temporary or individual causes.

The cobras are all hooded, bearing on the hood a spectacle mark, or a single ocellus, or no mark at all; this hood is caused by the expansion of a certain number of elongated ribs. The body and tail are relatively of moderate length, seldom together exceeding five or six feet, more frequently three or four feet. The scales are smooth and imbricated; there is no loreal shield, the nostrils are lateral and the pupil is round. The colour generally is from a light chocolate, speckled, to a dark brown or even black. The head is short, and not very distinctly separated from the neck; the fangs

are of moderate size and but slightly movable; there are one or two small teeth behind them in the maxillary bone.

Cobras are most active in the night, though often seen in the day. They will live weeks, even months in captivity, without touching food or water. They go into water readily, but are essentially terrestrial snakes. They occasionally ascend trees in search of food, and are not infrequently found in holes in walls, old ruins, fowl-houses, and among stacks of wood, cellars, old brick-kilns, old masonry of brick, or stone, or mud, among the grass or low jungle: such are the common resorts, and during the rains and inundations they collect in such places of refuge, where men, stepping on, or unintentionally disturbing them, mostly in the dark, are bitten.

The cobra sheds the epidermis with the outer layer of the cornea frequently, the fangs also are shed. The entire slough is often marked by a single rent, through which the creature has emerged, brightly coloured and glistening in its new epidermis. It aids the process of exfoliation by friction against some hard substance, such as the branches of a tree, a stone, or the like, the cast off epidermis being often found in fragments. It is oviparous, the eggs are about the size of those of a pigeon, and the shell is white, tough, and leathery.

The cobra is found all over Hindustan, up to a height of 8,000 feet. It is equally dreaded and fatal wherever met with; fortunately it is not naturally aggressive unless provoked, then raising the anterior third or more of its body, and expanding its hood, with a loud hissing it draws back its head prepared to strike, darts forward and scratches, or imbeds its fangs in the object of attack. In the latter case, the results are often dangerous and fatal, but if the fangs only inflict a scratch, or if the snake be exhausted, the same danger is not incurred. If the poison enter a large vein and be quickly carried into the circulation, death is very rapid. Men have been known to perish from a cobra bite within half an hour. The largest and strongest, as well as the smallest and weakest creatures succumb. Fortunately all who are bitten do not die. In the first place some human beings as well as lower animals have greater tolerance than others; or a wound may have been inflicted and yet but little of the poison inoculated; or in the third place, the snake may be weak or sickly, or it may have been exhausted by recent biting, and thus have become temporarily incapable of inflicting a fatal wound, though it may still poison. But when a cobra in the full possession of its power bites and injects the

poison into man or beast, it is almost surely fatal, and all the vaunted antidotes are futile.

Cobras are frequently exhibited by the so-called snake-charmers. Their graceful attitudes, with raised heads and distended necks, as they sway from side to side watching the movements of their keeper, and frequently striking at him, and the ease with which they are handled, make them general favourites. I may here remark that the cobra depicted in Hindoo legends or old paintings is the gokurrah, or spectacled snake. They are generally deprived of their fangs (which is done by cutting them out with a coarse knife), but the snake-charmers know the habits of the creature so well that they handle them without fear, even when armed, though with great caution, always grasping them tightly below the head with one hand and holding the tail with the other. They know that a new fang is soon produced, and to prevent this they sometimes remove the capsule and reserve fangs, thus making the snake permanently harmless. The sole secret of these men lies in their dexterity and fearlessness. Their *muntras*, their antidotes, and the pipes with which they pretend to charm are as devoid of real power over the snake as are the snake-stones, roots, and other nostrums over its poison. They know that dexterity is their real security.

The snake-charmers occasionally exhibit the ophiophagus, —which, like the cobra, dilates the hood when excited—also the bungarus, daboia, and some of the innocent snakes, such as *Chrysopelia*, *Passerita*, *Ptyas*, and *Erix*, which are remarkable for the beauty of their colours, their activity, or their peculiarity of form. These exhibitions are always accompanied by the music of the pipes.

The cobra is an object of superstitious awe to the Hindus. Should fear or the death of some inmate of the house in which the cobra has taken up its abode prove stronger than superstition, it may be caught and deported in an earthen jar to some field, where it is allowed to escape, but not destroyed. Still the cobra has many enemies. Besides by its natural foes, such as the mongoose (*Herpestes*), pigs, rapacious birds, and other creatures, numbers are destroyed by low caste people for the sake of reward. But still the loss of human life is great.

The *Ophiophagus elaps* (Hamadryad, Sunkerchor) is one of the largest venomous snakes. It attains a length of ten or twelve feet, is very powerful and active, and is said to be aggressive; it is hooded like the cobra, and resembles it in

general configuration. The adult is some shade of olive green or brown; the shields of the head, the scales of the neck, hinder part of the body and tail are edged with black; the body and hood are marked with black oblique bands. There are several varieties with modifications of colouration, but the general characters are essentially the same. The young differ considerably from the old, and might be mistaken for another genus; they are black, with numerous white, equidistant, narrow cross bands. The shields surrounding the occipital are large, and give a distinctive character to the adult snake. This snake, though widely distributed throughout India and in the Andaman Islands, is not common and probably does not destroy many human lives; but it is very deadly, and its virus seems to have similar effects to that of the cobra. It is found in the forest and grass jungle, and is said to live in hollow trees, and to climb them, being frequently found resting in the branches; it also takes to the water very readily. As its name implies it feeds on snakes, though probably when they are not forthcoming, it is contented with other small creatures. Its hood is smaller than the cobra's; it is even more graceful in its movements and turns more rapidly. The snake-charmers, who prize it highly, say it is very difficult to catch and handle. A fine specimen of the ophiophagus, about nine or ten feet in length, lived for some ten years in the Zoological Society's gardens, and died two or three years ago; it consumed numbers of the common English snake, and, I believe, would eat nothing else. It seemed a quiet, unaggressive creature until roused, when it would raise its head, dilate its hood, and strike at any object brought near it.

Bungarus has two Indian species. The *Bungarus cœruleus* or krait, is probably next to the cobra, the most destructive snake to human life. The other species, *B. fasciatus*, sankni, or raj-samp, is probably equally poisonous; but it is not much brought in contact with men, and therefore is less destructive to human life than *cœruleus*. The krait is of a dark, almost steel-blue black to a chocolate brown, with narrow white cross-streaks, rings, or bars of white; the ventral surface is of a dark, livid colour, or white or yellow tinge; but there are varieties in the form of colouration. This species is common all over India. The fangs are smaller than those of the cobra, and the poison is not so rapid in its action, but it is very dangerous and destructive. It is found in the fields, in grassy plains, rice fields, low, scrubby jungle, and among

débris of wood and buildings. It insinuates itself into houses, into the bath-rooms, verandahs, on the ledges of doors, in book-cases and cupboards: in such situations it not infrequently causes fatal accidents. *Lycodon aulicus* is sometimes mistaken for it, but the least examination detects the difference. The scales along the dorsal region are hexagonal and very characteristic. The krait rarely attains the length of four feet.

Bungurus fasciatus, is larger than *cæruleus*, and is beautifully marked with rings of yellow on a dark steel-blue ground. The metallic lustre of the skin is very beautiful; its body is of a triangular shape, and it has hexagonal scales along the dorsal ridge. It is tolerably common in Bengal, Burmah, and Southern India, and is known in the north-west. It is found in the open country, in grass, in low jungle, and in the fields in holes in the ground, sometimes deep down among the roots of trees; it sometimes finds its way into a native hut. It feeds, like the krait, on small animals, mice, birds, frogs, lizards, probably on small snakes, and even insects. It is not very aggressive, but when attacked, retaliates fiercely. It lies coiled up, and when disturbed, jerks itself out like a spring, but does not extend its whole length of body.

Xenurelaps has only one species, which is closely allied to *Bungarus*. It is very rare, and consequently not destructive to human life.

The genus *Callophis* has several species in different parts of India, which are all more or less brilliantly coloured. They are nôt aggressive, and bite reluctantly, so it is sufficient to enumerate some of the species: *Callophis intestinalis, C. Macllellandi, C. anularis, C. trimaculatus, C. nigrescens, C. cerasinus*, and probably others.

The viperiform sub-order has two families, *Viperidæ*, or vipers, and *Crotalidae*, or pit-vipers. The former is represented in India by two genera, *Daboia* and *Echis*, each of which has one Indian species, viz., *Daboia Russellii* and *Echis carinata* or kuppur. *Crotalidae* has several genera; *Trimeresurus*, with seven species; *Peltopelor*, one species; *Halys*, two species; *Hypnale*, one species. These snakes are all venomous, but cause few deaths.

The *Daboia Russellii*, sometimes called cobra-monil and chain viper, is a very beautiful snake; it is of a light chocolate colour, with large, black, white-edged rings; a yellow line is on each side of the upper surface of the head, converging on the snout; rostral and labial shields yellow

with brown margin, a triangular, brown, black-edged spot behind the eye; ventral surface yellowish, or marbled with more or less numerous semi-circular brown spots, on the hinder margin of the ventral shields. It attains a considerable length, forty to fifty inches. It is common in Bengal, the south of India, Ceylon and Burmah, and probably may be found all over the plains and on the hills, up to 6,000 feet, in Cashmir, but its usual habitat is lower.

Fowls bitten by it sometimes die in less than a minute. It is nocturnal, is sluggish, and does not readily strike unless irritated, when it bites with great fury; it hisses fiercely and strikes with great vigour. Its long movable fangs are very prominent objects, and with them it is capable of inflicting deep, as well as poisoned wounds. It does not appear to cause many human deaths, but its misdeeds may be sometimes ascribed to the cobra. The daboia is said to kill cattle when grazing, by biting them about the nose or mouth. In proof of its sluggish nature, there is a well authenticated story of a young person having picked one up, and mistaking it for an innocent snake, carried it home. Its true nature was discovered when it bit a dog. It had not attempted to injure the person who carried it.

There is only one Indian species of *Echis*, *Echis carinata* (kuppur, afae). This snake is much smaller than the daboia, but grows to the length of 20 inches or more; it is terrestrial. It is found in the North-West Provinces, Punjab, Central Provinces, Scinde, and generally in the south of India, in the Anamally Hills, in the Carnatic, and in the vicinity of Madras. It is of a brownish-grey colour, with a series of quadrangular or sub-ovate whitish spots, edged with dark brown; a semi-circular band on each side of the dorsal spots enclosing a round, dark-brown, lateral spot; a pair of oblong, brown, black-edged spots on the centre of the head, converging anteriorly; a brownish spot below and a broad streak behind the eye; ventral surface, whitish, with brown specks. The scales are keeled; those on the lateral series have their tips directed downwards obliquely; the friction of these against each other causes a peculiar rustling sound.

The *Echis* is a very fierce viper; it throws itself into an attitude of defence and offence, coiled up like a spring, rustling its carinated scales as it moves one fold of the body against another. It does not wait to be attacked before darting its head and body at its enemy, the mouth wide open, and the long fangs vibrating, presenting a most menacing

appearance. It is very poisonous; the virus is of the same character as that of daboia. There can be little doubt that it destroys many human lives, as men are much more exposed to contact with it than with the daboia. It is said to live largely on the *scolopendridae,* but probably it preys also on small mammals, frogs, and small birds. In some parts of India it is probably chargeable with a considerable number of deaths.

Pit vipers *(Crotalidae)* have several genera in India. They are less dangerous than their American congeners, but are all poisonous. They are remarkable for the pit or depression between the eye and nostril in the loreal region, the triangular broad head, and short, thick body.

Hypnale is the only Indian genus or species with any vestige of the caudal appendage, which has given the name of rattlesnake to certain American *Crotalidae,* and in this species it is reduced to a horny spine at the end of the tail.

Many of the Indian *Crotalidae* are arboreal snakes, and in colour resemble the foliage and branches of the trees in which they live. The Indian genera are:—*Trimeresurus; T. gramineus, T. erythrurus, T. carinatus, T. anamallensis, T. monticola, T. strigatus, T. macrosquamatus; Peltopelor; P. macrolepis; Halys, H. himalayanus, H. Elliottii; Hypnale, H. Nepa* (or carawilla). The bites of most of these do not seem to differ much in their effects from those of the English adder, except the *Hypnale nepa,* or carawilla of South India, which is more dangerous.

There remains only to notice briefly the pelagic colubrine snakes, or *Hydrophidae.* They may be recognised at once by their peculiarities. With one or two exceptions they are all venomous, and inhabit the sea, the salt-water estuaries, and the tidal streams. They have a very wide range of distribution in the Indian and Pacific Oceans. They have a great variety of form, but the transitions are very gradual; some attain a considerable length; I have not seen one of more than five feet, but no doubt they often exceed this. They are very poisonous, and though accidents are rare, yet fatal cases are on record. The fishermen and sailors on the coasts know their dangerous properties, and avoid them.

The *Hydrophidae* have smaller heads, jaws and fangs than the land snakes; the fangs have open grooves in some, but not all. The virus is very active, and appears to operate as speedily and certainly as that of the land snakes. They have an elongated body like the latter; in some instances it is

short and thick; in others it is very thick towards the tail, and most disproportionately elongated and attenuated in the neck, whilst the head is very minute. The colouration is varied, often brilliant and beautiful. The hinder part of the body and tail is flattened and compressed vertically, almost like the fin or tail of a fish, and they swim with ease and rapidity. When thrown on the land by the surf, as they frequently are, they are helpless. Their food is fish and small aquatic creatures. There are certain parts of the Bay of Bengal where they may be seen in great numbers, and their movements in the blue water are agile and beautiful. There are four genera in the Indian seas; *Platurus*, *Enhydrina*, *Pelamis*, *Hydrophis*. *Platurus* has two species, *P. scutatus* and *P. Fischeri* (Bay of Bengal, tidal streams near Calcutta). This genus has several characters of the land snakes, *e.g.*, well-marked ventral shields; body sub-cylindrical, and not compressed like *Hydrophis;* the colour is black, tinged with yellow.

Enhydrina has only one species, *Enhydrina bengalensis* (valakadyen); it is very poisonous; body and tail compressed, belly carinate; colour, bluish-grey, with dark bands of same, though deeper colour; no ventral shields. *Pelamis* has only one species, *P. bicolor*. This is one of the most remarkable sea-snakes in the Bay of Bengal; no ventral shields, body flattened, yellow sides and belly, back black; it is called kullundur, and is very poisonous.

Of *Hydrophis* the species are numerous; in the Indian seas about thirty have been described, and there are probably others. They present a considerable variety of form and colouration; some have elongated necks and small heads, the posterior part of the body being larger than the anterior: others have not this characteristic, but they all have a strong family likeness, and may be recognised at once by their compressed bodies, fin-like tails, and the general absence of well marked ventral scutæ. Their colouring is also remarkable, green, yellow, black, in bands or rings being a common pattern. They are pelagic, though they enter the tidal rivers; they seldom live long in captivity.

The mortality from snake-bite in India is very great. The average loss of life during the eight years ending 1887 has been 19,880 human beings, and 2,100 head of cattle yearly. Mr. V. Richards said the cobra causes nine-tenths of the human deaths. The snakes which are most destructive to life are so probably in the following order:—the cobra,

Naga tripudians; the krait, *Bungarus cæruleus;* the kupper. *Echis carinata*; Russell's viper, *Daboia Russellii;* the hamadryas, *Ophiophagus elaps;* the raj-samp, *Bungarus fasciatus.*

DEATHS FROM SNAKE-BITE IN INDIA IN 1889 AND 1890.

In Madras in 1889, 1,587 human beings, and 2,037 cattle were killed; 340 snakes were destroyed at a cost of Rs. 49. In 1890, 1,424 human beings, and 1,852 cattle were killed; no snakes were destroyed.

In Bombay in 1889, 1,080 human beings, and 74 cattle were killed; 433,795 snakes were destroyed at a cost of Rs. 7,848. In 1890, 1,075 human beings, and 100 cattle were killed; 406,092 snakes were destroyed at a cost of Rs. 7,136.

In Bengal in 1889, 10,681 human beings, and 480 cattle were killed; 41,189 snakes were destroyed at a cost of Rs. 3,439. In 1890, 10,534 human beings, and 538 cattle were killed; 41,115 snakes were destroyed at a cost of Rs. 3,742,

In the North-West Provinces and Oudh, in 1889, 6,445 human beings, and 221 cattle were killed; 25,663 snakes were destroyed at a cost of Rs. 3,137. In 1890, 5,798 human beings, and 247 cattle were killed; 24,083 snakes were destroyed at a cost of Rs. 2,902.

In the Punjab, in 1889, 915 human beings, and 87 cattle were killed; 68,501 snakes were destroyed at a cost of Rs. 8,232. In 1890, 834 human beings, and 32 cattle were killed; 29,941 snakes were destroyed at a cost of Rs. 4,313.

In the Central Provinces in 1889, 1,063 human beings, and 14 cattle were killed; 1,395 snakes were destroyed at a cost of Rs. 558. In 1890, 1,041 human beings, and 54 cattle were killed; 1,554 snakes were destroyed at a cost of Rs. 565.

In Lower Burma in 1889, 208 human beings, and 689 cattle were killed; 6,178 snakes were destroyed, but no rewards given. In 1890, 223 human beings, and 731 cattle were killed; 6,319 snakes were destroyed, but no rewards given.

In Assam, in 1889, 230 human beings, and 71 cattle were killed; 395 snakes were destroyed at a cost of Rs. 23. In 1890, 214 human beings, and 257 cattle were killed; 478 snakes were destroyed at a cost of Rs. 14.

In Coorg in 1889, 1 person was killed; 14 snakes were

destroyed at a cost of Rs. 3. In 1890, 2 cattle were killed; 26 snakes were destroyed at a cost of Rs. 6.

In the Hyderabad Assigned Districts in 1889, 216 human beings, and 120 cattle were killed; 76 snakes were destroyed at a cost of Rs. 26. In 1890, 191 human beings, and 132 cattle were killed; 113 snakes were destroyed at a cost of Rs. 29.

In Ajmere and Merwara in 1889, 53 human beings were killed; 224 snakes were destroyed at a cost of Rs. 10. In 1890, 78 human beings and 3 cattle were killed; 192 snakes were destroyed at a cost of Rs. 20

In Bangalore, in 1889, 1 human being was killed; 645 snakes were destroyed at a cost of Rs. 231. In 1890, no human beings nor cattle were killed; 746 snakes were destroyed at a cost of Rs. 277.

Throughout India, in 1889 there were 22,480 human beings and 3,793 cattle killed by snakes, while 578,415 snakes were destroyed at a cost of Rs. 23,556. In 1890, there were 21,412 human beings and 3,948 cattle killed; while 510,659 snakes were destroyed at a cost of Rs. 19,004.

"The average result for all the Provinces, shows a mortality of one to every 10,155 of population in 1890, as compared with one to every 9,673 in 1889. The Provinces which showed the greatest loss of life from snake-bite in proportion of population (excluding Ajmere and Merwara) are Bengal (1 to 6,731), the North-West Provinces and Oudh (1 to 8,094), and the Central Provinces (1 to 10,350). The lowest mortality (about 1 to 25,000 of population) occurred in Madras, the Punjab, and Assam."—*Report of Indian Government*, 1891.

As regards the measures to be adopted for reducing the annual loss of life by snake-bite, the chief points are to make known the appearance and habits of the poisonous snakes, and to institute proper rewards for their destruction. With a plain description, and a faithful representation in colour of each species, such as the Government of India have been put in possession of, the people can easily be made acquainted with the characters that distinguish the venomous from the harmless snakes, and thus learn to avoid or to destroy them.

Until some measures are more uniformly resorted to, there will be no material diminution in the loss of human life from snake-bite, which cannot now be rated at less than 20,000 annually.

It is satisfactory to find that the Government of India are insisting upon the institution of measures having for their object the destruction of snakes. It is, however, to be feared that the last measure proposed, *i.e.*, the cutting down and clearing away of jungle in the vicinity of villages, can hardly be expected to have the desired effect, for the reason that the poisonous snakes do not frequent the sort of jungles that surround villages so much as they do other localities, such as ruins, holes in walls and in the ground, grass and cultivated fields, &c., and that also the probability is that a great proportion of bites are inflicted far from the villages, where such clearances as those proposed by Government could not be effected, even were they useful. I would suggest that a reward should be given for each poisonous snake and for no other; there can be no difficulty in identifying them. This could only be effected by an organised system carried out generally in every district in which poisonous snakes exist. If it were decided to try this plan as universally as it is proposed to cut down the jungle, it is probable that a diminution of the evil might be expected; but whatever efforts are made they should be universally sustained and continuous. It is quite admitted that the problem is a difficult one to solve, but no effort should be spared to mitigate what must be regarded as a preventable cause of death.

The PRESIDENT (Sir G. G. STOKES, Bart., V.P.R.S.)—I may take it for granted that the meeting returns its cordial thanks to Sir Joseph Fayrer for this Paper which deals not only with matters of great interest, but seems to raise points of much practical importance. I trust those present who are familiar with the subject will now take part in the discussion.

Admiral H. D. GRANT, C.B., R.N.—With regard to the question of serpent worship in the present day, it may be of interest if I describe a scene which I witnessed in Java a few years ago. I was invited by a Chinaman to go and see this worship in a temple. On arriving I found at the end of the temple an altar with an extraordinary representation of a serpent; outside there was a huge platform erected which overhung the supports in such a way that it was very difficult for anyone to get on to it. This platform was covered with baskets of raw meat and small animals—

pigs and fowls, sheep and geese—and vegetables, besides which they had representations of the serpent in various forms. There was also a representation resembling the pictures of the brazen serpent of Scripture. A sort of ceremony of a strange and weird nature then took place in the temple, and all sorts of noises with dancing and the beating of tomtoms. On a given signal there was a tremendous rush for the platform, and a detachment of cavalry had to be called out to prevent the people stabbing one another, so great was the excitement; ultimately an athletic fellow managed to throw himself up on the platform and then there was a tremendous scrimmage all over the Temple Square. This was supposed to be pure serpent worship; it was entirely confined to the Chinese—the Javanese took no part whatever in it.

Allusion is made in the Paper to the mongoose. I have repeatedly seen fights between a snake and that animal. It was one of the amusements in camp to get a snake entrapped and see it fight with a mongoose. On such occasions I noticed that when the snake was let out of the basket he seemed to divine that there was a mongoose in the room. I used to take my mongoose—a pet animal—under my arm and directly he was released he would walk right round the mess-room without noticing the snake, while the snake stood in the middle of the room (I use the word *stood* advisedly, for it erected its head, spitting in all directions). But the mongoose walked slowly round the room, and one could hardly notice the difference in the radius of the circles he made, but each turn brought him nearer and nearer to the snake; when, in an instant, before you could realise what it had done, the mongoose had caught the snake by the back of the head and killed it or stunned it;* it was very rarely that it was killed outright, but it was disabled and then the mongoose would begin to play with it like a cat does with a mouse. In regard to the tradition about its taking an antidote, I do not believe it for a moment. I have always seen the mongoose return to the attack and have never seen it take anything like an antidote such as I have heard described.

Dr. J. S. PHENÉ.—Judging generally, the Paper gives one the impression that there is very little evidence of Serpent Worship in Europe. I take it that means at the present time. In times of

* The American prairie dog acts in a somewhat similar manner.—ED.

the Greek mythology it was so abundant that you cannot go into the British Museum and see a model of a deity without finding the emblem of the serpent. In days far off they kept living serpents in their temples where they were fed, reminding one of the old story of Eden, not that the serpent is there represented as taking food, but still something that is akin to it. It was said that in Egypt there was very little evidence of serpents being treated with greater honour than any other animal, and yet I do not think you will find an Egyptian temple (generally speaking, at all events), without a serpent, very like a cobra, in the height of exaltation. It struck me as very remarkable, on going through and examining the churches of the Pyrenees, in which they had done away with many of the symbolical carvings, to see the exaltation of the serpent about the cross. In a work I once came across in the library of Edinburgh University, I found evidence given of the prevalence of serpent mounds and worship in Europe, and in the Pyrenees there are those serpent mounds and they have been in all cases Christianised, if I may say so; *e.g.*, a church has been built on them and there is generally a cross. One has been carefully excavated and interesting remains have been found of the earliest and rudest form, which are now in a local museum. Up to the present day in the Pyrenees there is practised an extraordinary religious ceremony of burning living serpents on a particular day, attended by a procession with chanting. Serpent mounds exist in the British Isles, in America, Spain, France, Egypt, etc.

Major-General Sir RICHARD POLLOCK, K.C.S.I.—I should like to ask one question that interests me, as an old judge and magistrate in India. It used to be asserted that some of the cases (a small proportion) that were attributed to snake bites were caused by other poisons criminally administered. People came forward saying death resulted from snake-bite, and I should like to know if it is easy to ascertain the difference between the virulent poison of a snake and other poisons used in India, and whether you could suggest any improvement in regard to checking or detecting such malpractices as I have alluded to.

Surgeon-General W. B. BEATSON, M.D.—Sir Joseph Fayrer, having mentioned my name and pointed to the portrait of a snake that I had the good fortune to send him from Nagpore, I will say a few words, principally to relieve the minds of many people who may

be going to India. I think I have known one or two cases of young ladies refusing eligible matrimonial alliances because they did not like to go to a place so full of snakes. No doubt in India there is great mortality from snake bite; but I was a medical officer in India for thirty years, and at civil stations for sixteen or seventeen years; in Eastern Bengal, abounding in snakes, and at Nagpore in the Central Provinces where there are plenty of ruins and holes abounding in snakes, and I had not, during my thirty years' experience, to treat a case of snake bite. No doubt many natives were bitten, but snake bite is so fatal that the cases do not come in for treatment. I have had snake-bitten bodies brought in by the police for examination, and I have been able to find the snake bite, and to prove that it was the cause of death. The only case of snake-bite in a European I can recollect was in Lahore. During the last year of my life in India a party of soldiers encamped in the neighbourhood of Lahore, one of whom while in bed put out his hand, touched a part of the tent and immediately called out that he was bitten. His comrades rose and, running to his assistance, killed the snake, which was an *Echis Carinata*—it was smaller than the one shown on the diagram. They promptly put a ligature on the man's arm and I believe he was treated with ammonia. I had no part in the treatment; but I believe the man lived without symptoms for two days with the ligature on his arm. They then began to think it was a false alarm, and took off the ligature, fearing the hand would mortify. Immediately the ligature was removed the poison began to act and the man died shortly after. That shows how fatal and irremediable are the effects of snake-bite. I have seen very few snakes except in the hands of snake charmers, and I think I could count all the poisonous snakes that I have seen at large, on the fingers of my two hands. The snake I have referred to was, I think, eight feet long—I believe that is the largest cobra Sir Joseph has ever seen, is it not?

Sir JOSEPH FAYRER.—It was not more than six feet.

Dr. BEATSON.—Sir Joseph doubtless knows best but I certainly thought it was more than *six* feet.—But for Sir Joseph Fayrer having written his book on snakes, I think probably that snake would be living now, and would have killed many hundred people. I do not know how old it was, but the snake man who caught it, and gave it up to me with great reluctance, said it was probably a hundred years old and might be two hundred.

With regard to the destruction of snakes, it is a very hopeless matter. Not only is it impossible to hunt through the ruins and holes and jungles of India, but another great difficulty, I believe, is that when rewards are offered, natives are induced to keep snakes and to breed them for the sake of obtaining the reward.

Sir JOSEPH FAYRER.—That would not pay.

Dr. BEATSON.—I have heard that it has been done, and I think I remember reading, in the Indian Annals of Medicine, the story of a collector who, having to pay such rewards became so encumbered with dead snakes that he did not know how to dispose of them. I fear there is no hope of exterminating snakes so long as India is the country it is now.

Mr. LEONARD.—I was going to ask Sir Joseph Fayrer if destroy- the jungles round the Provinces is for the purpose of diminishing the number of snakes or for sanitary purposes?

Sir JOSEPH FAYRER.—For the destruction of snakes, as well as for sanitary purposes.

Mr. LEONARD.—We cannot help seeing that although there are many deaths from snake-bite in India, the Government has done wonders in killing half a million a year in Bengal; and, while deploring the amount of suffering and deaths caused, at the same time no doubt Sir Joseph Fayrer himself would admit, that there is great credit due to the Government of India for the enormous efforts they have made in trying to keep down the mortality.

Surgeon-General CORNISH, C.I.E.—We are much indebted to our friend Sir Joseph Fayrer for the very admirable Paper he has read on this occasion. I have only a few observations to make, and chiefly with regard to Serpent Worship in India, where it goes on practically to this day, as I have had evidence under my own eyes.

In the neighbourhood of Madras there is, at this moment, a native temple belonging to some of the Sudra castes, where live snakes are kept in considerable numbers about the premises, and where there are regular feasts and festivals, when these snakes are regularly fed and worshipped by the people. The case is mentioned by Surgeon-General Balfour. In the Northern Circars there is a town called Cajamundri where I was walking one morning on the outskirts and found a large ant-hill six or eight feet high, which was stuck all over with representations of the

cobra, cut out rudely on wood. I suppose there were fifty or a hundred of those wooden representations on the ant-hill. I made inquiry and I heard of a well-known cobra in the neighbourhood, and that numbers of people fed the beast regularly, and that it was an object of worship, especially by those ladies who desired to be fruitful—I believe that is a common mode of serpent worship to this day in India.

With regard to the mortality caused by different kinds of snakes, as Sir Joseph Fayrer says, the cobra, no doubt, is the most fatal snake. I have only seen one instance of poisoning from the *daboia*. I once killed a *daboia* in my own garden, which I sent to the Museum as a specimen. It was 4 feet 5 inches in length. It did not kill its victim; but the man bitten seemed to have his whole blood disorganised. Blood came from under his skin, and he was in a dreadful state; but he ultimately recovered.

The *Echis*, which is common in Madras, I have never seen any case of poisoning from. It certainly comes into houses, because I have killed one in my own house, but I have never seen a case of biting by the *Echis*.

I had on one occasion a very remarkable case of poisoning by a *cobra*. I was in my garden one morning, when I directed my gardener to take away a lot of old broken bricks from the side of a wall. On taking them away I saw one of the men withdraw his hand suddenly, and he came to me immediately and said he was bitten by a snake, and I discovered the marks of two fangs. I immediately adopted the usual treatment: I put on a ligament and incised freely the two fang marks, and made the man himself suck the wound. Although it did not take a minute from the bite to the operation the man was certainly poisoned by the snake, and he began to suffer from all the symptoms of snake-bite. I supported him with brandy and ammonia and took him off to the hospital, and he ultimately recovered, but he was very bad for two days. The snake was killed in my presence, and proved to be a young cobra, nearly five feet long.

The AUTHOR.—I do not think there is very much for me to say except to thank those who have added so materially to the interest of the evening by the remarks they have made, especially those connected with Serpent Worship. They are most interesting and valuable.

I could not in the space of time at my command give a disquisi-

tion on Serpent Worship and the whole history of snake bite. I therefore tried to select the most interesting parts of each subject. I am bound to say that I have heard some very interesting matter, especially from Dr. Phené, and am much obliged to him; there would be ample material for a long Paper on Serpent Worship alone, omitting zoological description.

Sir R. Pollock asked if some of the cases which were attributed to snake-bite were not due to other causes. Very likely, but even when those are accounted for, a very large number of snake-bites remain, and when I say 20,000 a year, I am certain that is far within the death rate that occurs. Long ago I took the trouble to investigate the question, from the best returns I could get, and made allowance for such causes as Sir R. Pollock has alluded to.

Dr. Beatson referred to the rarity with which snakes are seen. Many people do not see them because they do not go into the localities where they are. It is chiefly amongst the natives who live in huts and walk about bare-footed at night, and those who are engaged in agriculture and who sleep in huts where the cobra may drop from the roof, as in the case we have heard of, where the man stretched out his hand and was bitten. In the rainy season snakes congregate in dry places, and such are the localities where the people suffer.

I was much interested in what Admiral Grant said, especially about the mongoose. He is perfectly right in implying, as I understand, that the mongoose has no more immunity from snake-bite than any other creature. The cat for instance, is reputed to have nine lives, and it is supposed to take more to kill a cat than any other animal, but I have seen a mongoose and cobra fight for hours when they have been shut up in the same box, and both have escaped serious damage by their agility—the cobra has kept out of the way, and the mongoose has simply been scratched. If you take a hypodermic needle and scratch a person's arm you do not poison him, but if you introduce the needle deep into the flesh and then inject the poison it takes effect, and when that happens to the mongoose, the pig, cat, or dog, or whatever the creature, or man, by the cobra bite, death is inevitable, or if the creature does not die it is because it has not got a sufficient dose of the poison or because the snake has been partially exhausted before biting. All the stories told of the mongoose going out and taking an antidote are interesting, but they are not true.

Mr. Leonard, I think, spoke of the action of Government in dealing with this important question of snake-bite. I am sure no one would do more to recognise, or to do justice to the Government of India than I would, and if I appear to criticise it, it is not because I think they have not done enough, but because I think their efforts have not always been well directed. When you find in one place all attempts to do anything repudiated as useless, and elsewhere a good deal done, there is a want of consistency. I am satisfied that if sustained efforts were made to destroy these creatures the evil would, to a great extent, be remedied; and that there can be any difficulty in recognising the poisonous snakes I cannot believe—for anyone who runs may read. I can imagine that here and there you may find one snake looks like another, but the moment you investigate you can distinguish the venomous from the innocent. And if an organised and a systematic attempt were made to destroy the creatures, it would be beneficial.

I do not agree with Dr. Beatson, that they breed snakes. It would be far too costly, but money *is* wasted in giving it away for innocent snakes. It is easy to recognise the four or five kinds that do mischief.—I am convinced that the evil might be mitigated. That poisonous snakes could be exterminated altogether I have never suggested, nor do I believe it; but the death rate from snake bite might be brought down from tens of thousands to a much lower number. I am glad to see that the returns from India show the desire to do something. They have said "We will not pay more money for snakes; but we will cut down all the jungles round the villages." That would do if all lived there; but they do not. Any efforts made I recognise with gratitude; but I do not think the authorities have always quite realised the necessity as much as they might have done. 20,000 or 25,000 deaths from snake-bite may not seem so great a number out of 250,000,000 people, but it is one in ten thousand or twelve thousand, and if we had such a proportion in this country we should certainly cry out about it.

I was interested in what Surgeon-General Cornish said. It has never been quite clear to me what amount of mortality is due to the *Echis*. I know it is a very deadly snake, and the poison is very virulent, but it can be easily avoided, for it is very demonstrative, and makes its presence known by its rustling. The *daboia* is a more silent and dangerous snake and, happily, is not so common;

what Dr. Cornish said about the condition of the blood of the person bitten is typical. In the case of the cobra it is more of a nerve poison, but both kinds are exceedingly deadly and equally to be dreaded; but the cobra kills his tens of thousands. The *kerait*, perhaps, kills the next largest number. He gets into crevices and open doors and drops on your arm, or you may put your hand into a box and find one. I remember a gentleman who lost his servant in a very sad way: he sent his man to fetch a bottle of soda-water and he was bitten by a snake; the man pointed to his hand and said he was bitten,—he died in two hours.

I am much obliged for the very kind way in which you have received my Paper. (Applause.)

(The Meeting was then adjourned.)

REMARKS ON THE FOREGOING PAPER.

SURGEON-GENERAL C. A. GORDON, M.D., C.B., Q.H.P., &c., writes:—

The learned author of the Paper on "Serpent Worship, and the Venomous Snakes of India," has dealt with the question with his accustomed ability, and with intimate knowledge in regard to the several phases in which he has discussed it; but inasmuch as the scope of his remarks had perforce to be compressed within the limits of an address, he was of necessity debarred from touching upon all the points to which otherwise his attention and that of his hearers would have been directed.

In reference to some of these points I would offer the following remarks:—

Snake Worship. In the Gold Coast of Africa, the Fantee natives were said to have among them several snake temples, with each of which priests, otherwise fetish-men, were connected. To these

temples, or rather mud-huts, with reed or leaf covered roofs, the people resorted from time to time, and there, through the medium of the "priests," presented their offerings to the snakes. The latter, which were said to be kept in the temples in considerable numbers, were of the python or boa tribe, and tame; their ordinary resting place the rafters of the hut. They appear to have been worshipped as incarnations of evil, the object of the worshipper being the aversion of misfortune or other evil with which he was threatened. There were also certain incarnate beneficent spirits to which the Fantees made their devotions and offerings, and certain inanimate objects, more especially stones and isolated rocks, were declared *fetish*, and as such had sacrifices and oblations offered to them.*

Exceptional instances. Although the point has not been actually demonstrated, yet analogy indicates the possibility that the effects of snake poison may not be equally pronounced in all persons. This question is unsuited for discussion in notes like the present, but the mere allusion to it may perhaps lead elsewhere to its elucidation. With regard to constitutional peculiarities, it is admitted that in respect to certain animals they bear some relation at least to colour; thus while in some geographical regions those that are white are injuriously affected by particular indigenous plants, those that are black escape altogether. A similar peculiarity is said to exist in regard to the poison of the rattle snake (*Crotalus horridus*) in pigs, the bite of the reptile being fatal to those of one colour, but not so to those of another.

This being the case, presumption is in favour of the account given by Dr. Honigberger, for many years surgeon to the Maharajah Runjeet Singh, "the Lion of the Punjab," to the effect that instances of such immunity against snake-poison had come under his personal observation. Dr. Honigberger's book† is not now accessible to me, but my recollection is that in it such cases of exemption are related; nay more, that the persons alluded to, not only remained unaffected, at least for some time, but after an interval, varying from weeks to months, experienced a desire to be again bitten by the same species of snake, namely the cobra (*Naja tripudians*) for which purpose they resorted to the jungle, there to seek out the reptile. According to Dr. Honigberger, after a few repetitions of this remarkable process, the subject of the idiosyncrasy would fall into general ill-health, and so die. And no wonder. Perhaps further observation and inquiry in the Punjab may tend to confirm, or to refute the correctness of the views thus quoted.

Fictitious cases of snake-bite. That such cases may occur is in accordance with analogy and with experience, though doubtless in itself a circumstance of extremely rare occurrence. Of the affec-

* Such was the case, at least in 1847–8, during which period I served on the Coast.—C. A. G.

† *Thirty-five Years in the East.*

tions capable of being simulated or fictitious, hydrophobia is acknowledged to be one. Of "snake-bite," a remarkable and striking instance was some years ago related to me by Dr. Henderson, then of the 3rd Light Dragoons, in whose person it took place. Suffice it here to observe that Dr. Henderson was a man of strong nervous, as he was of physical, power. While on the line of march with his regiment in India, he had occasion to insert his hand into a box in which were various articles packed in straw. No sooner had he disturbed them than from the box a cobra darted past his hand and so escaped; as it did so he instinctively withdrew his hand, and so observed that blood trickled from a wound upon it. He immediately experienced the symptoms characteristic of cobra-bite; nor was it until the regimental assistant surgeon, who had meantime visited him, convinced him that the wound was caused, not by a cobra, but by a projecting nail that he began to recover from the alarming, though fictitious, symptoms from which he had suffered. May not the question be asked—Are there many such cases on record?

Snakes in relation to medicine. From very ancient times, down to and at the present day, serpents, poisonous and innocuous, have been used in medicine, not only among uncivilised people, but among those who possessed all the advantages of civilisation. The *tereak* of the ancient Arabian physicians (whence is derived our word *treacle*); the *theriaca* of Andromachus, variously known at the present day under the names of *treak farook*, and Venice treacle, were and still are, believed to owe their antidotal power against poisons, and curative properties in certain diseases, to the presence in their composition of the dried flesh of vipers or other poisonous snakes.

According to *The Dispensatory*, published in London in 1746, among other constituents of *Theriaca Andromachi*, squills, long pepper, opium, and *dried vipers* were enumerated.

According to Chinese therapeutics, "From the habit of a" particular, but unnamed species of venomous "snake, to seek refuge in hedges and crevices, it is concluded that, mixed with other drugs, it introduces itself into the most secret places of the body," and so exerts its curative properties. Several species of snake are used by the Chinese medicinally, or as food. The viper in particular is conveyed about for sale in baskets, tubs, or jars, either alive or made into broth.

In the islands of the Malayan Archipelago the fat of snakes is held to be a sovereign application to wounds. Even in our own country there are districts in which the flesh of the native viper (*Vipera Berus*) is applied locally, in cases of bite of that reptile.

SPECIAL COMMUNICATION.

AUGUSTUS MUELLER, Esq., M.D. of Yackandandah, Victoria, Australia, writes :—

1 It may appear an act of presumption on the part of an obscure Australian country practitioner to offer adverse comments on a paper read by so high an authority on snakes and snake poison as Sir Joseph Fayrer, but as the paper has been sent to me by an Australian scientist for the purpose of eliciting some comments, and as the author has not referred to the results of some recent scientific research on the subject of snake poison, I would, in the interest of science, venture on the task. I agree with Sir Joseph Fayrer that snake poison kills by extinguishing the source of nerve energy, if by this definition he means a merely functional depression or suspension of the motor and vaso-motor nerve centres without organic or structural changes in these organs. But I cannot agree that it is also a blood-poison and that the viperine poison is the most potent one. That all snake poison is a nerve-poison, that its action is purely dynamic, that it reduces in strength and in fatal cases completely suspends the currents of motor-nerve force, both from cell to cell and from cell to peripheral fibre, are scientific deductions that I venture to think can now no longer be called into question. I hold that it has also been proven that this suspension of motor nerve-currents is not accompanied by any structural changes either in the nerve tissue or the blood corpuscles, and that whatever changes occur are merely the result of this suspension and not owing to the direct action of the snake poison.

2 That the colubrine poison is a pure nerve poison, has been demonstrated by me as well as by the observations of medical men in Australia. We cure our patients suffering from snake poison in a few hours by strychnine injections, even when pulse at wrists and respiration have nearly and sometimes completely ceased, and when the quantity of strychnine required to rouse the paralysed nerve-cells into action exceeds what in the absence of snake poison would be a fatal dose. Patients regain consciousness and the use of their limbs at once, and in a very short time recover completely, without showing the slightest sign of blood-poisoning or any other structural lesion.

3 Of vipers we have none in Australia excepting the death-adder (*Acantophis antarctica*). Persons bitten by this deadly snake have also been treated with strychnine injections and with the same favourable result. This snake, however, is not a pure viper. It has permanently erect poison-fangs like our colubrines, but they are perforated like those of the vipers and not merely grooved like those of all other Australian snakes. It also has the body of a viper and its poison more nearly approaches the viper poison in its effects, as it acts with special emphasis on the vaso-motor

centres and the small ganglia in the vaso-motor nerve ends. Extravasations of blood around the bite and in the bitten limb, which are very slight after the bite of even the most venomous Australian colubrines, are more conspicuous, and sudden heart failure with consciousness only slightly impaired is much more frequent. Still, even the poison of this snake is purely a nerve poison, as the following case I select from a number of similar ones will show. A child of tender age was brought into a Queensland hospital, bitten, a few hours before, by a death-adder. The bitten part had been scarified, and a ligature applied above it. The limb was much swollen, but the child quite conscious. Having to attend an urgent case in another ward the house-surgeon left the child in charge of a nurse, but scarcely ten minutes had elapsed when the father of the child rushed into the ward and informed the surgeon that his son was dead. Surely enough, the boy appeared so on inspection, lying on a bed, livid, limp, and cold, without any perceptible pulse or respiration. Strychnine injections combined with artificial respiration were at once resorted to with the result that the child speedily revived and was discharged cured on the following day, showing no sign of blood-poisoning. Granting, however, that death-adder bites cannot be cited as viper bites, since the snake is not strictly speaking a viper, any doubts as to the viperine poison being a nerve-poison or a blood-poison are completely set aside by Feoktistow's experimental researches, which prove most conclusively that the viperine poison is also a pure nerve poison. The correctness of Feoktistow's experiments has been guaranteed to the writer by no less an authority than Professor Kobert, who took an active part in many of them, and kindly presented to him Feoktistow's brochure, an inaugural dissertation, not procurable by the ordinary channel of book-trade. It was published in 1888 after the writer had published his theory of the action of snake poison; and Australian and European researches, whilst arriving at the same conclusions, were carried on simultaneously but quite independent of each other.

4 Feoktistow experimented with the poison of Viperidae and Crotalidae only, and drew his supplies of poison from the richly stocked Terraria of the Universities of Dorpat and St. Petersburg, in which some 200 of these reptiles were kept. His snakes were: Vipera Berns, Vipera Ammodytes and Crotalus durissus, and the laboratories of the universities were at his command with the most elaborate of scientific apparatus. In opposing the theory of blood-poisoning, I will only cite one telling experiment.

5 The whole vascular system of an animal that had received a fatal dose of viperine poison was thoroughly washed out with the warm defibrinised blood of four animals of the same species, not poisoned, the blood being infused into the external jugular vein and allowed to flow out of one of the crural arteries. The

infusion was discontinued, when four times the volume of blood the animal carried in his normal state had passed through it, and every trace of the viperine poison, administered by intravenous injection, had been thoroughly removed. Still with blood completely free from poison, the paralysis of the nerve centres remained the same as before the infusion. The blood-pressure, artificially raised during the infusion, fell at once again, when it ceased and the vessels named were closed. The blood rushed again into the paralysed veins of the abdomen, leaving the rest of the body anæmic, and the animal perished.

6 The blood-changes, that have given rise to the theory of blood-poisoning, are very deceiving, and can all be explained on the ground of vaso-motor paralysis. The blood of a poisoned animal becomes almost stagnant in the paralysed and immensely engorged veins of the abdomen, to which the greater part of it is drawn. It becomes saturated with carbonic acid and assumes a very dark colour, but it speedily parts with the acid, and readily absorbing oxygen becomes bright red again, when slightly beaten in the air. No changes could be detected by Feoktistow in the blood-corpuscles under the strongest immersion systems. Only Bizzosero's blood-plates were not present in the usual numbers. The alleged discovery of Weir Mitchell of blood corpuscles in a disorganised condition, Feoktistow ascribes to his using alcohol immersions that give deceiving pictures.

7 It is only where the snake poison remains for some time in a concentrated form in contact with the blood corpuscles, as it does at and around the bitten part, that the stroma becomes dissolved and the hæmaglobin is set free, but this effect is nothing peculiar to snake poison, as it can be brought about readily by other non-poisonous substances and even by the blood of other species of animals.

8 The hæmorrhages that almost invariably take place under the influence of viper poison, but are also exceptionally observed in Australia in colubrine-poisoning, have their cause likewise in vaso-motor paralysis. The blood stream is retarded and the capillaries are dilated, both by the direct action of the poison and by venous engorgement. A capillary tube in its normal state, just wide enough to allow the blood corpuscles to pass through in a single row but in the expanded condition not wide enough for two abreast, becomes blocked through the corpuscles being wedged against each other. At the same time the stomata in the capillary membrane, through which only leucocytes can force their way in the normal state, become larger and permit the less elastic red corpuscles to pass out by diapedesis. Where the venous engorgement is very great, as in the abdomen, the capillary membrane bursts, and side by side with diapedesis there is capillary bleeding and the hæmorrhage becomes more or less profuse. The process of diapedesis has been minutely

observed by Feoktistow on the mesentery of animals sprinkled over slightly with a two per cent. solution of the poison. Wherever a drop of the liquid lodged, the blood-vessels were almost immediately dilated and small point-like extravasations of corpuscles became visible. Gradually enlarging, they became ultimately confluent, forming uniform hæmorrhagic surfaces of greater or less extent.

9 The hæmorrhagic process in viperine poisoning extends over all the internal organs, but more especially the heart, and in the pericardial sack there is generally a large quantity of a sanguino-serous liquid with numerous blood corpuscles in it. *Preparations of the capillaries from any part of the heart, fixed with chromic acid, show healthy corpuscles in them throughout.*

10 These observations seem to me to place it beyond doubt that the theory of blood-poisoning is not tenable, and that vaso-motor paralysis explains all the blood changes, none of which, moreover, are liable to cause death. The whole group of the phenomena called forth by the subtle ophidian poison, when introduced into animal or man, is thus brought under the operation of one law, the law of suspended motor nerve force, and science has once more fulfilled her noble mission. Walking, so to say, in the footsteps of the Supreme Intelligence that guides the atoms as it rules the worlds, science has discovered the plan and design that underlies the subtle action of snake poison, and by reducing the puzzling symptoms it produces to order, she has at last solved a problem that has for centuries past defied her researches. She has done even more than this. With the first problem solved, with an exact and strictly defined knowledge of the action of snake poison, it was a far less difficult task for her to select as a physiological antidote from the vast storehouse of nature a substance having a directly opposite action to that of snake poison on the human system, and this substance science has found in strychnine administered in large doses by hypodermic injection. Feoktistow, whose researches also led him to experiment with the drug, found it also decidedly antagonistic to snake poison. Unfortunately he confined his experiments, as far as can be learned from his work, to frogs only. Finding that strychnine did not re-establish reflex action in these animals, and that they died under the combined influence of the two poisons, he somewhat prematurely gave it up as the physiological antidote to snake poison, and being unable to find another one, despaired at the conclusion of his experiments of its being found, in the present state of science, whilst all the time it was lying ready at his hands. He did not sufficiently bear in mind, that experiments with a drug as variable in its effect on different species of animals as strychnine, more especially when made in combination with snake poison, equally as variable, must be necessarily misleading and unreliable, unless extended over a number of species and, if

possible, up to man. This conviction impelled the writer, after assuring himself of the correctness of his theory of the action of snake poison, to overstep all the animals and proceed straightway with experiments on man, by administering boldly and fearlessly strychnine in large doses to persons *in extremis* from snake-bite. When a human being is in this condition, and sure to succumb to the insidious venom under any treatment medical skill has yet devised, a little risk is justifiable, when it holds out a reasonable chance of success. I did not hesitate to take this risk by administering strychnine in one-sixth-of-a-grain doses, at short intervals, and the result I consider to be a glorious triumph of scientific deduction, now acknowledged as such throughout the Australian colonies, and ere many years have passed, to be acknowledged throughout the scientific world.

11 It is a subject of extreme regret, that a few unfavourable experiments with strychnine on snake-poisoned dogs, made years ago under unfavourable conditions, by experimenters having but vague notions of the *modus operandi* of snake poison, should stand in the way of the strychnine treatment being adopted in India, since there cannot be the shadow of a doubt that the fearful mortality at the rate of over 20,000 human beings per year, mentioned by Sir Joseph Fayrer, would be considerably reduced if the Indian Government not only made the use of the antidote compulsory to medical men, but also took steps to place it within the reach of the natives. Any intelligent person may be taught how to apply a ligature, cut out the bitten skin, and inject the antidote. There is scarcely a settlement in the Australian bush now where it is not kept in pocket-cases containing likewise hypodermic syringe and printed directions for use. Some of the vendors of these cases have added a strong ligature, a pair of scissors to cut out the bite, and even a patent sucker for the more effectual elimination of the poison. The Government did nothing in the matter, but the people helped themselves. Many cases of snake-bite are now successfully treated by laymen too far from the nearest medical man to procure his services in time, and it often happens that when the doctor arrives his patient is out of danger. The native population of India is not likely to follow the Australian example, and it therefore devolves on the Indian Government to initiate a movement so urgently called for, and much more likely to stem the great mortality from snake-bite in India than vain efforts to exterminate the reptiles.

12 That strychnine will save life under all circumstances, its most enthusiastic advocate does not venture to assert. No physiological antidote can be expected to accomplish that task, and a chemical one we are not likely to discover. Strychnine can cope with a fatal dose of snake poison, but when a quantity equal to three or four fatal doses, such as a powerful cobra gives off at one bite, has been absorbed, corresponding quantities of the antidote are

required; for the snake virus, when the system is thus saturated with it, re-asserts itself repeatedly, after having been temporarily subdued by the antidote, and each relapse has to be met by another injection, if not by two or three. In such cases the strain on the delicate nerve-cells, that form the field of battle between the two poisons, may become too great. Only a very robust constitution, as our Australian experience has shown, can withstand that strain, and emerge scatheless from the ordeal. The antidote is also powerless to save life, when it is administered after extensive internal hæmorrhages have taken place. But given a serious case of cobra-bite, in which at an early stage by prompt ligature and deep excision of the bitten part the poison has been partially eliminated, but which would nevertheless terminate fatally under any other treatment, there is not the least doubt in my mind that the strychnine treatment properly applied would cope with it as successfully as it has done with apparently hopeless cases of tiger-snake bite; for our Australian cobra, the tiger-snake (*hoplocephalus curtus*) is quite as deadly as the Indian cobra, in fact, quantity for quantity, its poison is even more so, but fortunately for its victims, given off less profusely.

13 The adoption of the strychnine treatment in India, as well as in all other countries infested with venomous snakes, is merely a matter of time, but time unfortunately means a terrible loss of human life. I therefore appeal most earnestly to Sir Joseph Fayrer and other influential members of the medical profession to exert their influence in bringing about an early introduction of the treatment in India, on the lines laid down by me in these comments. My own efforts in that direction have been unremitting, and supported by two Australian Governors, but His Excellency the Viceroy had necessarily to refer them to the medical authorities, and the latter decline to move in the matter on the ground of a few experiments on dogs, the failure of which is easily explained. They cannot be weighed in the balance against the favourable observations made for the last four years in Australia, and the results of recent European research.

NOTE ON THE FOREGOING.

All will recognise that Dr. Mueller's statements are specially worthy of attention, and it is a subject for general congratulation that he has already gone so deeply into the task of seeking to give the world a remedy for a great evil.

As regards the remarks in the third paragraph of his com-

munication it is held that both viperine and colubrine venom are not only nerve poisons but blood poisons too, especially viperine. With respect to Feoktistow's experiments, the reptiles referred to are all viperines not colubrines; the poisons of these differ in their action.

In India, the greatness of the need of some remedy for snake bite has caused a large number of cures for the evil to be proclaimed as useful, among them the remedies mentioned in paragraph 11, and including that of strychnine, but it has been urged that its use has not proved successful there; this may perhaps be attributed to the fact that the remedy has not been so carefully used nor with that thorough acquaintance with its proper application that Dr. Mueller's experiments have shown to be so necessary, but it is known that Sir Joseph Fayrer (President of the Medical Board at the India Office) has very lately recommended to the authorities that it should be tried again: but, in dealing with the subject it must be borne in mind that, as a rule, Australian snakes are less venomous than those in India, at least Indian medical men have come to that conclusion.—ED.