Snake Bite

By R. K. Bhattacharya, M. B., Nabadwip, (Nadia)

By Courtesy of I. Krishna Rao, M B., B.S., Editor of the Anticeptic

I. Case Incidence.—Snake bite constitutes an emergency of the first order. Perhaps it falls to the lot of every medical practitioner to treat a case of snake bite now and then. About 20,000 deaths are annually reported in India to be on account of snake bite. In 1900, the reported mortality was 22,393, distributed as follows :— Presidencies :—

Bengal ...	... 10,557	Bombay ...	... 701
N. W. F. P. and Oudh	... 6,056	Assam ...	... 170
Madras ...	... 2,037	Berar ...	... 104
C. P. ...	... 994	Ajmere and Marwar	... 4
Punjab ...	... 893	Bangalore ...	... 2
Burma ...	... 874	Coorg ...	... 1
			22,393

The average death rate per million was calculated in the ten years ending 1869— as ranging from about 45 per million in the Punjab, to about 130 per million in Bengal; and in the district of Burdwan in Bengal it was as high as 173 per million. It will thus be seen that Bengal alone contributes about 50 per cent of the huge number of victims.

The number of cases, all over India, that actually call for medical aid, must be very vast indeed, considering that the accident always includes, along with bites by poisonous snakes, those by non-poisonous snakes, and cases of supposed snake bite.

Dr. S.K. GANGULY, M.B., D.T.M., Assistant Professor of Entomology, School of Tropical Medicine, Calcutta, estimates that about 25 per cent of all snake bite cases are by poisonous snakes, and that about 100,000 are annually bitten by snakes in India. Of these about 20,000 die, and 80,000 survive. This computation, however, would put the death rate by poisonous snake bites at 80 per cent, which is much higher than the following reckonings MANSON BAHR says :—The mortality from snake bite, even of the most venomous varieties is not so great as it is popularly supposed to be : it is estimated at about 30 per cent.

KNOWLES says that cobra bite, even if untreated, has a mortality of about 40 per cent only. In the Medical Annual 1917, it is recorded with refrence to a list or 53 cases of snake bite reported in the Central Provinces, that in cases treated with Antivenene, the mortality was 64·1 per cent. On the whole working out the death rate at 50 per cent of poisonous bites, snd reckoning 25 per cent of all snake bite cases as by poisonous snakes, 20,000 deaths would yield 160,000 snake bite cases in the year, all over India.

It therefore needs no apology to press the claim that every practitioner in the tropics should possess a ready and working knowledge about snakes, their poisons, and treatment.

II. About Snakes.—Ophidia :—About 1,700 species of snakes are known, of which about 300 may be classified as venomous. Within Indian limits including Burma, there are about 330 species of snakes, of which about 70 (40 land species and 30 sea species), are poisonous. There are 7 non-poisonous families of snakes, and the two families to which the poisonous or thanatophidia belong are the colubridae and the viperidae. The diamond shaped head and the narrow neck and the short, sharp, stumpy tail are familiar viperine characters. Colubridae are a very large family and form roughly 9/10ths of all species.

Snakes are sub-divided as follows in reference to poison fangs, *i.e.*, grooved teeth—(glypha):—

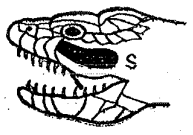

FIG. 1.
Aglypha (no poison fangs) S. Salivary gland.

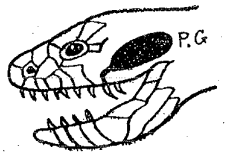

FIG. 2.
Opisthoglypha usually harmless to man as fangs are too far back.

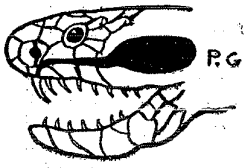

FIG. 3.
Proteroglypha (cobras and kraits) Very Poisonous.
P. G. Poison Gland.

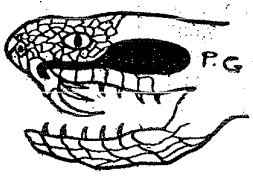

FIG. 4.
Solenoglypha (vipers) Very Poisonous.

Colubridae:—

(1) Aglypha—no poison fangs. (Fig. 1). (2) Opisthoglypha—some of the posterior maxillary teeth are grooved and connected by a duct with poison gland. Usually harmless because the fangs are too far back (Fig. 2).

(3) Proteroglypha—the anterior maxillary teeth (fangs) are grooved—(Fig. 3).

Viperidae:—

(4) Solenoglypha—(tubelike groove) the Viperidae and Crotalidae, all are more or less poisonous and possess large poison fangs (Fig. 4.)

The poison fang is a long conical tooth so inrolled upon itself as to give rise to a deep groove along its anterior aspect. In the viperidae the groove is converted into an actual canal by the union in front of its bounding laminae, and the tube thus produced opens at the extremity of the fang by a minute fissure. Connected with the poison fang is a poison gland which may be regarded as a specially modified salivary gland and is situated below and behind the eye, one on each side of the mouth. This gland secretes the clear viscid fluid which is the venom, and it is covered by one of the muscles of the cheeks. When the animal bites, the contraction of this muscle forces some of the poison out of the gland into the duct of the fang whence it penetrates the wound. It will thus be seen that in the viperidae, owing to be peculiarity of the channel, the poison always reaches the deepest part of the wound.

Behind the poison fang in the solenoglyph and the proteroglypha, are situated reserve fangs destined to take the place of the function fang, if the latter should break. Those who deal with snakes and yet are ignorant of this fact have often paid the death penalty or come to grief with the false sense of security, having once broken off the poison fangs.

The two families viperidae and colubridae are seperable upon the osteological characters of the skull. In the viperidae the maxilla is short and lies obliquely, almost at a right angle, while in the colubridae it is of considerable length and lies horizontally (Fig. 5 and 6). In the former the maxilla can be elevated or depressed by the peculiar lever-like arrangement of the other bones of the skull and mouth (mandible, quadrate squamous, etc. See Fig. (5.). When the mouth is opened the mandible presses on the quadrate and the fang is elevated, and when it is closed the fang comes to lie nearly horizontally along the palate, hidden between folds of the mucous membrane of the mouth.

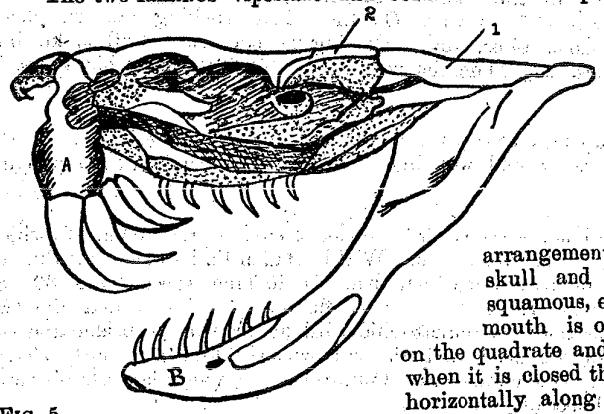

FIG. 5.
Viperine Scull.
A. Maxilla—almost perpendicular.
B. Mandible.
1. Quadrate; 2. Spuamous.

In this connection the following general peculiarities in snakes are worthy of mention :—

The ribs are numerous, but a sternum is not developed. The abdomen is covered with transversely elongated scales or "Scuta" or "Ventrals". The ribs are extremely movable, and are terminated by tapering cartilages, which are attached by muscular connections to the abdominal shields. By means of this arrangement snakes are enabled to glide rapidly along the ground. But they cannot run as fast as one would suppose from their agility.

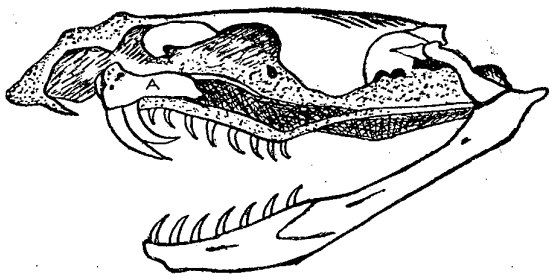

FIG. 6.
A. Maxilla—horizontal.
Colubrine Skull.

Their eyes are unprovided with eye-lids, and are covered by a layer of transparent epidermis, which is periodically shed with the rest of the epidermis of the body, they being rendered thereby temporarily blind. Snakes are therefore often sluggish just after moulting.

The head has no tympanic cavity or external auditory meatus. They can, however, feel the vibrations of the earth produced by footsteps or thuds of sticks and the like. It is doubtful whether there is any mechanism to catch airborne sound vibrations.

The tongue consists of two muscular cylinders united towards their bases, but free towards their extremities. It is probably not an organ of taste but of touch. One wonders whether it also acts to help the eyes in judging distance from the victim, considering the rapidity with which it is alternately protruded and drawn in when a snake becomes circumspect. Its most natural use is of course for licking up liquid.

The two rami of the mandible are connected in front by ligaments and muscles only. The two sides of the lower jaw thus move independently. All the teeth are conical, recurved, and anchylosed with the bones to which they are attached, being suited for killing or holding the prey and not for mastication. Owing to the above peculiarities snakes are enabled to open their mouths laterally as well as vertically, and to swallow large morsels entire.

The left lung is in general rudimentary or absent. The right lung is long and tubular and ends posteriorly in a sack or air reservoir.

III. *The Poison.*—The venoms vary greatly in degree of toxicity ; their lethal action on different species of animals and their physical characters and chemical composition differ to some extent according to the species or family to which the snake belongs. The specific action of the venoms appears to depend upon the ferments and lysins they contain. As far as is known the following substances enter into its composition :—Fibrin ferments ; proteolytic ferments ; cytolysins acting upon red cells, leucocytes, epithelial cells and nerve cells ; agglutinins ; and neuro toxins, with affinity for all nervous tissues, and specially for the respiratory centre. The neuro-toxins preponderate in the venom of the colubrines, while those which act upon the blood and cardio-vascular system are most characteristic of the viperines. Colubrine venom also contains hæmolysin and cardiac stimulant and viperine venom contains a hæmolysin, a coagulin and a cytolysin.

The venom of the cobra when freshly ejected is a light amber-coloured liquid, like clear varnish, feebly acid in reaction : it dries in the air into a yellowish film which tends to split up into bright yellowish scales and granules This yellow powder has an acrid odour and is an irritant to mucous membranes. It is soluble in water, the solution becoming actively toxic The dried venom retains its toxicity for several years, and may be heated up to 125 without losing its poisonous properties.

Viperine venom is less resistant to heat and more easily destroyed by caustic agents than colubrine venom.

The snake venom has a local as well as a remote action. Locally it acts as an irritant and hence causes immediate burning pain in the wounded part, followed by swelling and inflamation. Its remote action is exerted mainly either on the nervous system or on the circulatory system or on both.

In the Colubrine bite an interval of fifteen minutes to an hour elapses before the appearance of general symptoms. Then appears a feeling of intoxication, dullness, and apathy followed by loss of power in the legs, the patient staggering or falling if he attempts to walk. Nausea and vomiting may appear early. The loss of power gradually spreads to other muscles, those of the tongue and larynx becoming early affected, and the powers of speech and deglution are lost; the saliva trickles away. The mind remains active to some extent. The paralysis gradually becomes general. Of course minor muscular twitchings are possible and often take place. The respiration becomes slow and weaker and weaker till death occurs by asphyxia. The heart beats for some time yet. Death seldom occurs before half an hour. The pupil is contracted throughout. Should the patient survive the paralytic symptoms, recovery is rapid.

In Krait venom, in addition to the above, hæmorrhage into stomach and bowels may occur, accompanied in many cases by violent abdominal pain. The paralysis may not typically begin in the legs.

In the Viperine bite, the local irritation is very marked. The bite causes severe pain, with rapidly forming and extensive oedema, together with blood-stained discharge from and ecchymoses around the puncture marks. Nausea and vomiting soon supervene. The pupils are dilated and insensitive to light. Loss of consciousness is more or less complete, but temporary recovery may sometimes occur. Should the effect of the toxin wear off, the local condition of the wound continues to give trouble. There are no symptoms of paralysis. In protracted cases, and especially in bites by the Phoorsa (Echis Carinata) the tendency is to hæmorrhages-subcutaneous, from mucous surfaces haematuria, melaena, extravasations, oedemas. The suffering may continue for days and death may ultimately occur by exhaustion and septicaemia, hæmorrahges, or other complications. Death may even be almost instantaneous. Very rapid deaths are due to an extensive intravascular thrombosis, especially of the pulmonary arteries. This explains the leading symptoms in the rapidly fatal cases, namely, the gasping with quickened and laboured respiration and violent convulsions. In viperine poisoning nervous symptoms may appear but the peculiar colubrine paralysis of the tongue and larynx with salivation is never seen. Mental shock is also a factor in many cases of snake bite and may be so great as to prostrate the patient in a state of trance; or may even cause death even in a non-poisonous case.

IV. *Diagnosis.*—An anomalous position often appears after ligature of the bitten limb, especially in colubrine poisoning. If there appear no general symptoms of poisoning and the patient looks all right, people get suspicious whether the bite is by a poisonous snake, and whether the case is one of snake bite at all, particularly when the fang marks and the local reaction are not conspicuous. This has often led people to loosen the ligature and court disaster. The fang marks may not always be the classical two punctures with sanguinious oozing from them. There may be two scratches, or the marks may even be so indistinct as to require a lens for their detection. On the other hand, several teeth marks may appear in some cases.

Unfortunately, no test has yet been discovered to know whether the poison has been deposited in the wound in doubtful cases. A popular method is to apply small-sized chickens to the enlarged wound with their cloacal orifices pared with a razor. This is said to serve two purposes:—

(1) If the raw surface comes in contact with the poisoned blood of the patient, the chicken would be poisoned and thus succumb; (2) it is popularly believed that contractions of the cloacal orifice would serve to suck the poison out of the wound. The experiment is worth trying if it can be managed.

Sometimes the assailing snake is killed or captured and exhibited along with the patient. Although it is sometimes difficult to ascertain whether a snake is poisonous or not, some guidance may be obtained fromt the following notes :—

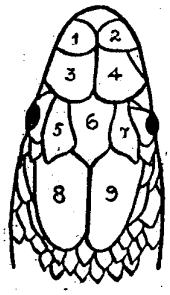

Fig. 11.
Head of Colubrine Snake (Note nine shields)

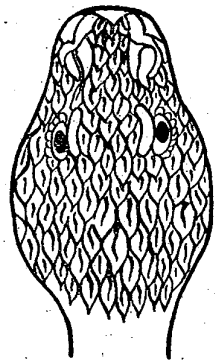

Fig. 9.
Head of Viperine Snake

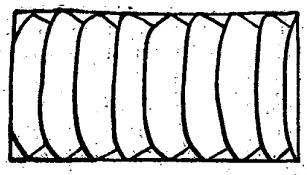

Fig. 8.
Ventral scales of Poisonous snake.

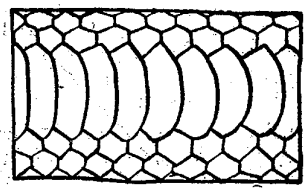

Fig. 7.
Ventral scales of Non-poisonous snake.

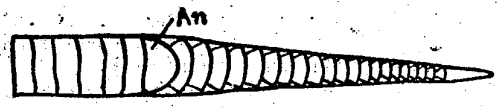

Fig. 12.
Tail of Bungarus Candidus (under side) Note Single row. An-Adal Shield.

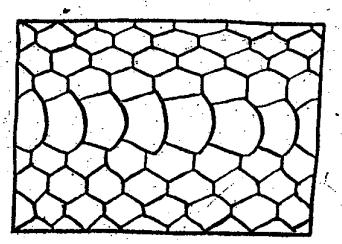

Fig. 10.
Back of common Krait (Note middle row of Vertebral Scales)

(1) Scales on belly similar to those on back, or when broad not extending completely across-non-poisonous. (Fig. 7.)

(2) Ventrals broad and extending completely across belly—poisonous. (Fig. 8.)

(3) Scales on top of head all small, head pear shaped, and sharply separated from body by a neck—Viperidae-poisonous. (Fig. 9.)

(4) Pit at side of head between eye and nostril—Viperidae-poisonous.

(5) Third supralabial scale not counting anterior central scale, touches nasal scale and eye-poisonous.

(6) Fourth infralabial scale not counting anterior central infralabial scale—is the largest-poisonous.

(7) Central row of scales on back are definitely the largest—most probably poisonous. (Fig. 10).

(8) If poison fangs can be discovered—positively poisonous.

(9) Some scales on top of head are large, usually nine in number—probably poisonous (Fig. 11 vide page 122)

(10) Large scales on top of head, no pit, third supralabial does not touch nasal scale and eye—may be poisonous.

V. Treatment—The horrible nature of the accident and the appalling mortality demand prompt and vigorous treatment. In the great majority of cases the extremities

are the sites of injury and admit of ligaturing to stay the absorption of the poison into the circulation. The all-important first aid is, therefore, to tie an efficient tight ligature above the part bitten, with anything at hand A second ligature is to be tied tightly around the next higher upper part having a single bone within, like the femur or the humerus, as around part containing double bones the circulation through deep veins cannot be efficiently impeded. The ligature should not be slender, as that would easily injure the soft parts in its grip, including blood vessels, and lead to necrosis and gangrene easily. If available, rubber tubing or the inner tube of a cycle wheel is the best ligature material. The bitten person must not be allowed to walk or run, for that would accelerate the circulation of the poison.

Amputation of the bitten part may be effective if it can be chopped off immediately. It is of no avail after symptoms have appeared. It is often advised in the text books that the bitten part should be sucked to draw out the poison. The procedure is not without its danger. Besides, it is extremely doubtful whether the poison can thus be cleared out of the interstices of the tissues. It should be remembered that the lethal dose of venom is very small, and the snake injects many times the lethal dose if it can bite well.

The Cobra injects about 1 c. c. of venom containing about 370 mg. (5¾ grains) of solid matter. It is equal to about 20 lethal doses (¼ grain each). MAJOR KNOWLES found in an experiment that the amount of the cobra venom injected at a successful bite averages from 172 to 211 mgs. The daboia can inject about 100 mgs. (1½ grains) at a bite. This is about three lethal doses (3/5 grain each). The estimated minimum lethal dose of echis venom, according to ACTON and KNOWLES, for man is about 10 mgs. whilst the dose given at a bite varies from 1 to 50 mgs., with a mean of 13·3 mgs. estimated in reference to desiccated venom. The chances of natural recovery after echis bite are therefore some 40 per cent. The venom in this case tends to cause more hæmorrhage and less thrombosis than is the case with Russell's viper venom.

Snakes seldom get the chance to inject to their hearts content. In the case of the colubrines the ligature probably has little effect, as the neurotoxins may act whenever it is loosened. But in viperine poisoning the fibrin ferments cause intravascular clotting in the bitten part and the poison is thus localised to some extent. It is a pity that the ligature cannot be left in situ indefinitely, as closed circulation leads on to gangrene. In the great majority of cases after half an hour the ligature begins to give so much pain to the patient that he writhes in agony, and demands its removal even at the risk of losing his life. In such a circumstance it has to be loosened and a fresh one applied next higher up. This procedure eases matters for a few minutes only. Local treatment of the wound must therefore be promptly and thoroughly carried out and the ligature gradually and cautiously loosened, watching for symptoms all the while. At first circulation should be allowed for a few seconds only and the ligature tightened again. Then after half an hour, for a longer while, and so on and so forth till the patient gets out of danger.

As for local treatment of the wound the puncture area should be thoroughly opened up, encouraging free bleeding and washed with warm Potass. Permanganate solution 2 to 5 per cent. Then a suitable quantity, according to the site of operation, of the solution or 2 to 5 per cent. Gold Chloride solution or Antivenene, should be injected to infiltrate the soft parts around the injury, with a view to neutralizing any poison that may have escaped in the above procedure. But Gold Chloride almost invariably, and Potass. Permanganate to a much less extent, give trouble afterwards by producing necrosis and tissue destruction. The application of Potass. Permanganate powder or crystals does no good.

The part below the lowest ligature should be scarified freely by superficial incisions to let off congested venom-carrying venous blood. The part should then be dipped in hot Potass. Permangnate solution, or hot water poured on the scarified area to promote free flow of blood out of the area of operation. Brisk bleeding may be provoked by rubbing the scarified area with Ammon Carb. powder at intervals. When bright red blood flows no further local treatment is necessary. The part may then be dressed antiseptically. Now comes the time of loosening the ligatures with caution as described above.

The great antidote to be employed at the slightest sign of toxaemia, is the prompt injection intravenous of the Polyvalent Antivenine in heroic doses ; up to 100 c. c. at a sitting is recommended. This should be done as very first step in cases where poisoning symptoms have already appeared.

The Polyvalent Serum used to be prepared before by mixing eighty parts of Anticolubrine with twenty parts of Antiviperine Serum. Work on concentration and standardisation of anti-venom serums is steadily progressing in the continent as well as in India. G. C. MOITRA, B. P. B. NAIDU and M. L. AHUJA have effected a three-fold, instead of the former two fold concentration, and they hope to obtain still better results in time. In the continent equal concentrations of the Anticolubrine and Antiviperine elements have been obtained to four-fold the original strength, and by employing in their preparation detoxicated venoms or 'ana-venoms', stronger serums have been obtained in horses in four to six weeks while formerly it was in twelve to sixteen months. About half the previous doses are now required of the concentrated serums. Delay in treatment requires greater amounts. It is estimated that each 10 c. c. ampoule would neutralise about 20 mgs. of dried venom. Relatively larger doses are necessary in children on account of their lower body weight.

In cases where there is proof that the wound is undoubtedly poisoned, but general symptoms are in abeyance due to the ligatures, it is safe after local treatment, to inject a fair dose of Antivenene and then watch the effect of loosening the ligatures as detailed before. The poison requires about 10 to 15 minutes to find its way into the circulation. The Antivenene to be effective should be in the circulation before the minimum lethal dose of venom has been absorbed. It is often necessary to repeat the injection as the case progresses. Unfortunately, Antivenene is a costly medicine, and is not readily available except in big hospitals or big cities. It often falls to the lot of the victim to be treated without the specific medicine.

The following symptomatic remedies are useful :—

In Colubrine Poisoning :—To counteract paralysis and respiratory failure—Strychnine, Atropine, Lobeline, Coramine. The last may be given intravenously in desperate cases in big doses.

In Viperine Poisoning :—If there be no symptom of general paresis, strychnine is contraindicated, as there is risk of sudden convulsions. When the danger of immediate thrombosis is fairly over, haemostasis may be tried with haemostatic Sera, Normal Horse Serum, Calcium intravenous or intramuscular. HAZRA advises intravenous Iodine treatment to stop haemorrhage and other complications in viperine bites.

One form of indigenous treatment in viper bite is to induce sweating by an improvised Turkish bath arrangment. A long trench-like pit is dug in the open yard. On this a flat frame of split bamboos is set. A bed of stalks of plantain leaves is prepared. The patient is laid on this and well covered by blankets. Now a big fire is lit within the trench and incantations are chanted for some time. The result is that the patient is drenched in his own sweat. This probably serves to draw off much of the venom from the circulation and hence helps in cure.

In all cases, general diffusable stimulants often do good, but it should be remembered that they also serve to circulate the poison freely. Cardiazol, Adrenalin, Pituitrin, etc, all serve useful purposes. Intravenous persistent and brisk, repeated transfusions of Saline should be resorted to. Artificial respiration should be tried when necessary. Big city hospitals are provided with the useful iron lung apparatus.

VI. The Common Poisonous Snakes of India : Colubridae.—

(*A*) Neck can be dilated to form a hood-Naja-Cobras.

(1) Naja Tripudians : The common cobra. Vern.—Naga, Keutia, Gokhura,—a pair of spectacles or a circular shield or no mark on head-length up to 6 ft.

(2) Naja Bangarus :—King Cobra or Hamadryad. Vern.—Sankerchoor a pair of large shields on top of head-length up to 15 ft.

(*B*) NONHOODED :—Row of enlarged scales along the mid-line of the back-Bangarus-Kraits (See Fig. 10).

(1) B. Candidus:—Common Krait—White arches across back, most distinct across the tail, and irregular towards the head, shields on under surface of tail arranged in single row. (Fig. 12 vide page 122). Length up to 4 ft.

(2) B. Fasciatus:—Banded Krait—bright yellow with black rings-length up to 6 ft. or more. Vern.—Sankni or Rajsnap.

(3) B. Coeruleus:—Blue Krait Attaining 4½ ft.

(*C*) SEA SNAKES: Hydrophidae. These are found chiefly in the Indian and Chinese Sea, often frequenting the mouths of rivers, though sometimes ranging far from land. They are adapted for swimming by having the tail vertically compressed and broadened out. These are extremely poisonous.

Viperidae.—These are divided into Vipers proper—Viperinae and Pit Vipers or Crotalinae. The notorious rattlesnake of America belongs to the latter class. The name Pit Vipers means that they have a deep pit between the eye and the nostril.

(*a*) VIPERINAE:—(1) *Russell's Viper*—Daboia Russelli Vern.—Bora, Tick-polonga, Gunus, growing to 5½ ft. usually reddish brown, with three longitudinal series of diamond shaped, white edged markings on back and sides.

(2) *Echis Carinata*:—Vern. Phoorsa, length upto 2 ft. scales on sides of the body have serrated keels; shields on under surface of tail arranged in single row. A dark shaped whitish dark edged mark on the head.

(*b*) CROTALINAE:—(1) *Ancistrodon*—head covered in front with nine large symmetrical shields. Length up to 3 ft. Vern.—Karawala.

(2) *Lachesis*:—Head covered uniformly with small scales. Length up to 3½ ft.

Sea snake are credited to be the most poisonous of all. Of land snakes, the hooded colubrines head headed the list; next come the great Russell's viper and the krait, especially the blue krait. The cobra, the daboia, the krait, and the phoorsa, are the four commonest assailants. The cobra, after having bitten, remains attached to its prey for an appreciable time, whilst the daboia darts with incredible rapidity and then releases its victim immediately. But occasionally the latter fails altogether in its strike. In daylight the cobra may strike with closed mouth without biting at all, and even when it does bite, it often mistakes the distance and thus fails. Snakes which are non-poisonous or slightly poisonous often bite freely and ferociously when disturbed. Both the great snakes, when enraged, emit a gruff sound which is much harsher than the ordinary hiss. In the daboia it is like a roar, and one can flee from its presence, thus cautioned. The cobra in spreading its hood raises its head upto one-third of its whole length. It lives in and near human habitations. The keutia (Cobra without spec-tacles) is of an angry nature and lives in jungles and corn fields. It is blackish or greyish while the spectacled cobra is brownish in colour. The king cobra attains a very large size and is very ferocious, attacking any living creature on the slightest pretext. Luckily they live in deep jungles and feed chiefly on snakes They are grey in colour and have whitish bands near their tails. They have eleven shields on their heads instead of nine. The krait is very mild natured, and does not bite unless trampled on, but it is deadly to the extreme.

Snake venom is not a secretion of offence only. It has its physiological use in overpowering the prey and aiding in its digestion. Venom is only a special form of the saliva. A snake is probably naturally immune to its own poison. Logically, therefore, snakes of the same species should be able to withstand bites by their fellows. But it is also a fact that snakes die by snake bite. It is difficult to understand what happens in their natural state. But in captivity snakes of the same species do not quarrel. It stands to reason that if an animal be immune to its own poison or to the

poison of a fellow animal, its serum should have the protective value if injected into some other animal. Those who possess the facility may prepare snake serum and try the effect of injecting it into warm blooded animals, both subcutaneously and intravenously. Experiments may be taken up to try to decide whether and to what extent snakes can withstand the injections of snake venom. All varieties of snakes, both poisonous and nonpoisonous may be used for the experiment. And if naturally immune snake serum be found or if immunity can be built up in snakes easily, snake serum will one day be a great aid in treatment, if it be not antagonistic to human blood and tissues.

Summary.—SECTION I.—Case Incidence :—(1) More than twenty thousand deaths take place in India annually by snake bite. To this death roll Bengal contributes half the number; and in Bengal the district of Burdwan is the foremost in snake bite mortality. (2) About twenty-five per cent of all snake bite cases are by poisonous snakes, and about 50 per cent. of Poisonous bites succumb. Thus the case incidence in the year all over India would amount to one hundred and sixty thousand.

SECTION II.—About Snakes :—Within Indian Limits, including Burma, there are about three hundred and thirty species of snakes, of which about seventy are venomous, comprising forty land species and thirty sea species. Of the poisonous snakes, colubridae form about nine-tenths of all living species and viperidae, the remaining one-tenth. Their subdivisions are given together with some anatomical peculiarities of snakes in general.

SECTION III.—The Poison :—Venom is the secretion of poison glands that are analogous to salivary glands. Colubrine venom contains a neurotoxin, a hæmolysin and a cardiac stimulant. Viperine venom contains a hæmolysin, a cytolysin and a coagulin. Other characteristics of snake venom are detailed. The local and remote actions of the two types of venom are described.

SECTION IV.—Diagnosis :—There is no definite way of knowing whether venom has been deposited within the tissues. A popular method of employing small-sized chickens for the purpose is described. Notes are given to help the identification of a poisonous snake by examining its scales and teeth.

SECTION V.—Treatment :—Ligature, local treatment, antivenine, and other general treatment are described in detail.

SECTION VI.—The common poisonous snakes of India and their habits are described. The author has hinted on experiments that may be advantageously undertaken to find out if snake serum can be prepared and used as a medicine against snake bite.

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Glossary

Neurotoxin—Nerve Poison.

Haemolysin—Organic substances which destroy red blood cells, setting the hœmoglobin free in the plasma.

Cytolysin—A substance that detroys cells.

Coagulin—A substance which coagulates or clots blood.—*The Editor.*