

## Poisonous and Non poisonous Snakes

### Introduction

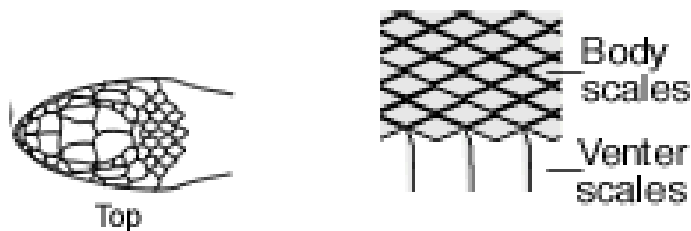
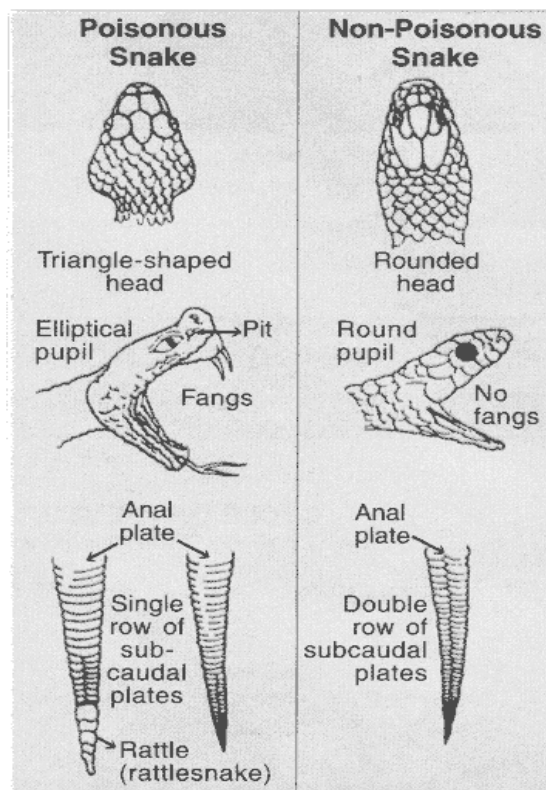
Snakes are the reptiles without limbs. They belong to order Ohidia- the snakes. In the classification we have studied that vertebrates are having two pairs of pentadactile limbs. The presence of limbs is governed by Hox genes. In snakes the hox genes governing limbs are already lost. This is having environmental stress. The snake habitat belongs to crevices and holes. It was difficult to enter the holes in presence of limbs. During the course of evolution the limbs are lost.

### Identification of Snakes:

In India, snakes are represented by over 200 species distributed in 11 families. Mostly the snakes are non-poisons or harmless animals. The exoskeleton of snakes is in the form of scales and shields. Taxonomically the arrangement of scales & shields is peculiar in different species & forms an important basis for their identification.

#### *Identification of Poisonous & non-poisonous snakes*

Chart showing key to identification of non-poisonous & poisonous snakes  
Observing & comparing following characters can distinguish the poisonous & non-poisonous snakes of India.



Identification of poisonous and non poisonous snake

**1. Type of the tail:** Type of the tail is an important criterion, where all marine snakes can be separated.

- a. Tail laterally compressed: If the tail is flat, laterally compressed, it is a marine & highly poisonous snake.
- b. Tail cylindrical: Or rounded- terrestrial or land snakes may be poisonous or non-poisonous.
- c) In North America is found most poisonous snake the Diamondback Rattle snake. Small portion of the skin after molting is not cast off from tail of the rattle snake. After five to six seasons it forms loose rings and makes a rattle like sound when shivered. This apparatus is known as rattle, and bears the name the rattle snake. Before strike the snake shakes the rattle for alarming the victim. Its jaw opens wide and the snake strikes making a jump especially on the face of the victim.

**2. Type of ventral scales:** The scales on ventral side of the trunk are called ventral scales. If the tail is cylindrical, then observe the ventral scales.

- a. The ventral scales are small & continuous with the dorsal scales- the snake is non-poisonous.
- b. The ventral scale is broad but not cover the belly completely – the snake is non-poisonous & land snake. Ex. Python.
- c. The ventral scales are broad & run completely across the belly – it may be a poisonous or non-poisonous snake.

**3. Type of the head, shields/ scales:** Now observe the head shields.

- a. If shields are absent on heads & instead it is covered with small scales- the snake is poisonous & it is a viper.
  - I. Presence of loreal pit between the nostril & eye – pit viper, poisonous.
  - ii. Absence of pit & sub-caudals are divided – Russell’s viper, poisonous.
  - iii. Loreal pit absent, sub-caudals are undivided- Indian viper, *Echis carinatus*, poisonous.
- b. Head is covered with large shields- the snake may be poisonous or non-poisonous. Then observe the arrangement of shields and scales of the body.
  - 1. The third supra labial shield touches eye & nasal shield- may be cobra or coral snake. Both are poisonous.
    - i. Neck with hood – cobra.
    - ii. Hood absent, coral strips on the body – coral snake.
  - 2. The middle row of body scales on the back are called vertebrals. The vertebrals are large & hexagonal – the snake is poisonous & it is a Krait.
  - 3. Presence of large shields on head but absence of hood, coral strips, and large vertebrals – then the snake is non-poisonous.

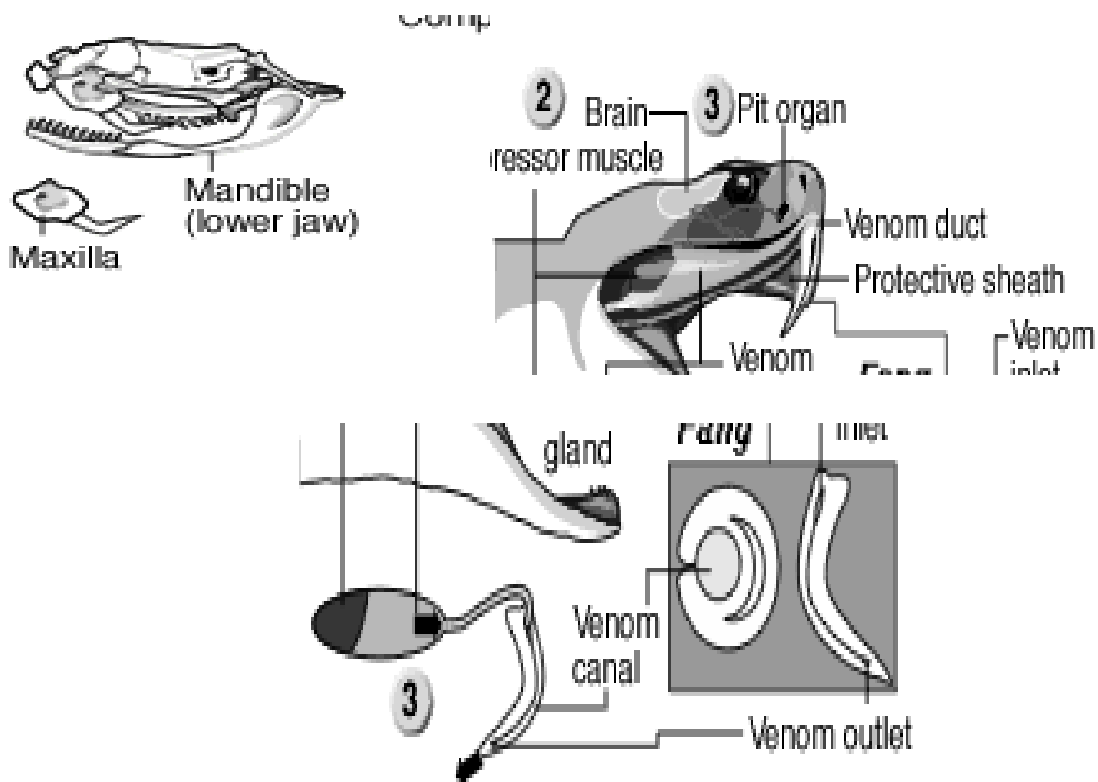
Presence of scales and the type of head or tail for identification is having academic value only. The common man faces snake accidentally. This accidental visit of the snake does not give any clue for knowing the snake. Any person having knowledge of snake anatomy shall be able to identify the dead snake. The general tendency of people after the first site of the snake is to kill a snake. The method of killing the snake is smashing the head of the snake. The smashed head will not provide the clue for identification.

Apart from nature of scales & shields, the snakebite mark & the nature of blood flow also form important criteria to identify poisonous & non-poisonous snakes.

### **Poison Apparatus**

Most of the snakes are non-poisonous, but those, which are poisonous, possess a poison apparatus. The apparatus is present in the head region & includes

- i. a pair of poison glands, ii. Their ducts, iii. Fangs and iv. Muscles.

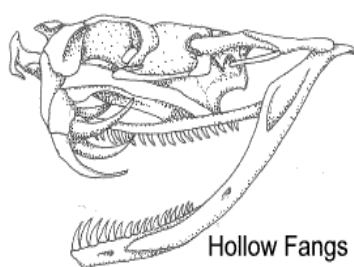


Poison apparatus

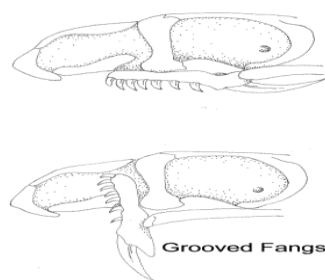
Poison gland of snake

- i. *Poisonous glands*: These are a pair of sac like glands, which are, modified parotid or labial salivary glands secreting poison or venom. These are situated one on either side of the head, below the eyes & somewhat behind it. The poison glands are small & oval in sea snakes but are large & tubular in vipers. The glands are enclosed in thick fibrous capsule of connective tissue and are connected with a fan-shaped constrictor muscles. The muscle is also called as masseter or temporal muscle.
- ii. *Poison ducts*: Each poison gland anteriorly narrows into a tubular duct that leads to the base of a poison fang.
- iii. *Fangs*: The fangs are formed by certain specialized maxillary teeth attached to the maxillary bones. These are long, curved, sharp & pointed. A sheath, which contains few reserved, covers the base of each fang & developing fangs, where a functional fang is damaged, it is replaced by one of the reserved fangs. In cobra the fangs are permanently erect while in vipers the fangs lie close to the roof of buccal cavity. They serve as hypodermic needles for injecting poison into the body of victim.

There is a hollow canal or groove of poison duct extending from the base to the tip of the fangs. Accordingly the fangs are of three types. These are as follows:



Fangs of Viper



Fangs of Cobra

- a. *Solenoglyphous*: The fang is with a hollow canal lined with enamel that runs from base to the tip. Such fangs are movable as in vipers & Rattle snakes.
- b. *Proteroglyphous*: These fangs are solid with a groove along their anterior surface. It passes from base to tip. Such type of fangs is small & permanently erect as in Cobra, Krait.
- c. *Opisthoglyphous*: These fangs are solid with a groove for poison present on their posterior surface. The groove passes from base to the tip. Ex. Colubrid snakes.
- iv *Muscles*: Following are the muscles associated with poison apparatus & biting.

- a. Digastrics muscles: It helps in opening the mouth.
- b. Sphenopterygoid or Protractor-ptyergoid muscle: Its contraction pulls the pterygoid forward.
- c. Anterior-middle & posterior temporal muscles: Its contraction closes the mouth & presses the body of poison gland.

### ***Mechanism of Snake Bite***

When the snake is disturbed or the prey is within a striking distance, the snake bites. The mechanism of snakebite is a complicated process, which is effected by loosely or movably articulated skull bones & muscles, which allow a considerable adjustment during the act of swallowing or biting. In Vipers, the fangs lie against the root of the mouth when closed. But in Cobra, the fangs are permanently erect. Therefore the biting mechanism involves two steps erection of fangs & injection of poison into the body of victim.

**a. Erection of fangs:** When a viper strikes, a series of movements occur in a chain. The digastric muscles, which connect the squamosal with the lower jaw contracts resulting in downward movement of the lower jaw, so that mouth opens. The quadrate is pushed forward which thrusts the pterygoid, palatine, & transverse bar or ectopterygoid forwards. This action is aided by contraction of the sphenopterygoid muscles. The upward movement of the ectopterygoid rotates the maxilla at an angle of  $90^{\circ}$  at the hinge joint with lacrimal. As a result the fangs become vertically erect & in the most effective position to strike.

**b. Injection of poison:** The prey is seized and at the same time the lower jaw is pulled up by the contraction of anterior temporal muscles. Due to upward movement of the lower jaw, the prey is tightly pressed against the fangs, which pierce deep into its body. Simultaneous stretching of constrictor muscles around the poison gland forces its poison through poison duct into the canal of fangs to be injected in to the victim.

All these activities i.e. lowering of lower jaw forward pushing of pterygoid, rotation of maxilla & returning to the normal position are completed automatically.

### **Snake Venom, Antivenin and First Aid after Snake bite.**

#### ***Venom***

Snake venom is a poison secreted by the venom gland. The secretion probably assists digestion & paralyses the prey. It is a clear sticky liquid of faint yellow or greenish colour. It is tasteless, odorless & acidic in reaction. Venom in general consists of a mixture of many proteins, some metallic ions & hydrolytic enzymes. The toxicity is due to the simultaneous effects of all these together. The cobra venom is faint transparent yellow & slightly viscous. The viscosity varies according to the season. It is thicker in winter. The pH of cobra, venom is 6.8. Viper's venom is sometimes white & sometimes yellow with 5.8 pH. The venom can be dried as crystal. The dried venom is easily soluble in water. According to Anima Devi (1968), nitrogen content in Cobra venom is 16.8% & 15.8% in Russell's viper. Similarly phosphorous content is 9.36/100 mg & 13.02/100 mg in cobra & Russell's respectively. The main protein factor is neurotoxin & consists of more than 17 amino acids in case of cobra venom. These proteins exert various types of effects on nervous tissues producing paralysis also. Its effect on diaphragm leads to heart failure.

The different enzymes present in the venom are proteases, phospholipase-A, cholinesterase, Ophio-Amino-oxidase, Nucleases, Hyaluronidase and Pyrophosphatase.

**Effects of Venom:** Nature has provided the snake with all the powerful enzymes. The effect produced by the venom varies considerably according to the composition of the venom, quantity injected, the site of the bite & the group to which the particular venom belongs.

Generally the effects of venom are neurotoxic, haemotoxic & cytotoxic affecting nervous system, blood system & tissue system respectively. All most all neurotoxins prevent the transmission of stimuli from nerves to muscles leading to paralysis. Haemotoxic venom causes destruction of red blood capillaries leading to leakage of blood from damaged vessels into internal organs & body cavity. The cytotoxic venom shows general cell damaging property. They also cause an irreversible change in the electric potential of cell membranes of nerve cells, & repress its sensitivity. The venom also causes muscular & renal necrosis & destruction of the capillary wall.

***Effect of snake venom:***

**1. Cobra/krait venom:** Following are the effects observed in a person bitten by a cobra.

- First feeling is a sensation of warmth & pain in the bitten part.
- A swollen red ring surrounds the site of the wound.
- It is followed by drowsiness & perspiration appears on face.
- A feeling of soothing pain in the anterior part of the forehead followed by chocking of the throat & suffocation.
- Then the patient loses the power in legs followed by paralysis of lips, tongue, larynx & pharynx, dribbling of saliva, inability in speaking, & swallowing, dropping of the eyelids.
- The respiratory system is remarkably affected leading to slow & noisy breathing & ultimately it stops & the person dies.
- The venom does not exert much effect on circulation. Heart remains functional for many hours even after the rest of the body functions have been suspended. Thus the venom acts chiefly on the brain & spinal cord causing death.

Following is a clue for the type of possible Cobra/Krait bite

- Mild- Local symptoms of burning, redness, swelling and superficial necrosis of the wound.
- Marked Neurotoxic effects- The earliest symptom of affecting nerves is Ptosis (inability to keep eyes open, or drooping eyelids even with attempts to open eyes)
- Giddiness, lethargy, muscle weakness.
- Spreading paralysis- difficulty in speaking and breathing, salivation, vomiting and frothing around mouth.

**2. Viper venom:**

- Bite of Russell's viper is quite fatal & produces a very deep wound leading to following effects.
- The bitten area swells, becomes red & develops severe pain, blood stained discharge.
- Further increase in swelling followed by severe hemorrhages from gums, nasal aperture, rectum, vagina, and ears.
- If large amount of venom is injected the blood loses the property of coagulation leading to severe bleeding from internal organs; the wound starts bleeding. Sometimes it also leads to heart failure.
- Nausea & vomiting occurs.
- Death may occur after some hours or even after one or two weeks.

**3. Bite of Little Viper:**

In hill areas of Western Maharashtra small variety of the Viper is found is known as little viper (*Echis carinata*: Phoorse)

Its bite is not fatal immediately. The poison glands of this snake are with little poison. The dose is not lethal. But it leads to tissue necrosis within days to weeks. Reports are there to have death followed after Phoorse bite late after fifteen days.

**4. Sea snake venom:**

- Venom of certain sea snakes is stronger than that of cobra. As the snakebite takes place in sea, the venom gets diluted. Therefore the death reported is less.
- There are no local symptoms.
- Severe pains while moving neck, trunk and limbs.
- Few hours later urine turns brown to black due to the presence of muscle protein Myoglobin.

**Antivenom: (Antivenin)**

Serum against various venoms can be produced by injecting animals such as horses with sub lethal doses and extracting the immune serum, or antivenin from the blood of horse. Haffkine

Institute, (Mumbai) produces anti- venom serum by hyper-immunizing horses against the venoms of the four common poisonous snakes. i.e. Cobra (*Naja naja*), Krait (*Banjurus caeruleus*), Russell's viper (*Vipera russelli*) & saw-scaled viper (*Echis carnatus*).

Antivenin can be stored in refrigerator or at room temperature if available in the form of freeze-dried powder. The refrigerated antivenin is potent for six months. Freeze dried powder can be kept for five years without losing potency. It can be given by mixing with normal saline or with injectible water.

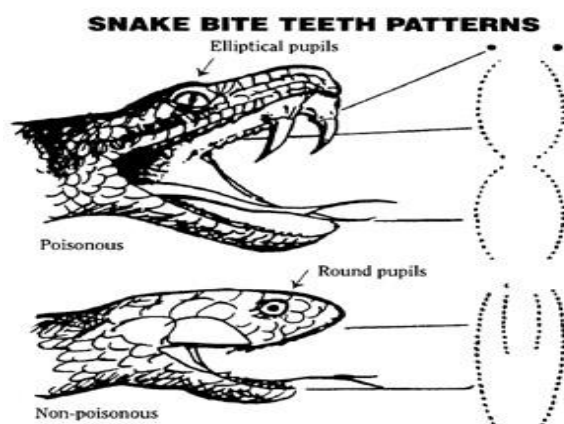
The antivenin of all poisonous terrestrial snakes is called polyvalent antivenin. There is **no antivenin** available against **bite of King cobra**. One Swiss company produces antivenin against Malaysian king cobra. But it is not effective against Indian king cobra.

Separate antivenin is marketed against Sea snake. It is available in government clinics of coastal region. The incidents of bite of sea snake are rare.

#### Little Statistics:

Annually throughout the world there are estimates of 1-2 million "incidences" of snakebites. The number includes bites by non- venomous species. The snake bite of non-venomous snake can also be fatal due to shock, infection or of allergic reaction of snake saliva (even in saliva of non-venomous snake, poisons are found. The only difference is non-venomous snake there are no fangs to inject the saliva).

Asian Cobra and Russell's viper probably kill most of the people who die of snakebite annually in the world. Neither of them are most deadly snakes.



Identification of poisonous and non poisonous by bite marks

#### Management of Snake Bite:

Deaths have been reported from shock due to fright even when the bites were by non-poisonous snakes. Hence it is vital to reassure patients.

- Not all snakes are poisonous
- Not all poisonous snakes are fully charged with venom
- Even those that are fully charged do not always inject the lethal dose.

Reassurance helps reduce anxiety related high blood pressure, palpitation (rapid heart beat), tremors, sweating and rapid breathing.

Check if the bite is due to a poisonous or a non-poisonous snake. Generally people who are bitten can't positively identify the snake. They should be treated promptly for any bite, though they may think the snake non-poisonous. Even a bite from a so-called "harmless" snake can cause infection or allergic reaction in some individuals.

In cases where the snake is killed and brought to the clinic, examination of the snake helps differentiate whether it is poisonous or non-poisonous. In the absence of the snake, the bite mark should be examined using a magnifying lens.

Following steps are to be taken for any snake bite-

- If possible try and keep bitten extremity at body level, when the person is lying. Raising it can cause venom to travel into the body. Holding it down can increase swelling.
- Go to the nearest hospital or medical facility as soon as possible.

- If possible try to identify the snake and if possible kill the snake and take the snake along to the hospital.
- Apply tourniquet immediately. Use handkerchief, cloth or cord around & above the bitten part. It should be firm but not too tight or too light. It is to obstruct the flow of blood towards heart. Keep the tourniquet for 20 to 60 minutes & relieve it for 10 minutes. Wound should be cleaned with normal saline or mild antiseptic lotion. Or soap.
- Under Medical supervision give patient polyvalent antivenin, provided symptoms of neurotoxic or hemotoxic effect is detected. Polyvalent antivenin contains antibodies against cobra, common krait and viper.
- Five vials are given if signs are mild primarily of local manifestations.
- Ten vials if signs are moderate bleeding from gums and or ptosis
- Fifteen vials if signs are severe vascular collapse and progressive paralysis.
- 1/3<sup>rd</sup> dose should be given subcutaneously near the bite but not in fingers or toes.
- 1/3<sup>rd</sup> intramuscularly
- 1/3<sup>rd</sup> intravenous
- Intravenous doses can be repeated every 6 hours till symptoms disappear.
- For sea snakes special antivenins are available.

#### **Further Management: Manage toxic signs and symptoms.**

- Antivenin acts only against circulating toxin, not toxin fixed to tissues. Therefore specific measures have to be taken
- In case of neuro-toxic signs and symptoms atropine (0.6 mg) subcutaneously should be followed by 5 injections of neostigmanine (0.5 mg) intravenously to be repeated every 2 hours depending on the response. This is to reverse muscle paralysis.
- In case of vasculotoxic signs and symptoms, fibrinogen along with heparin may be given.
- Extreme caution is to be taken while administering fibrinogen and constant monitoring, since heparin can intensify bleeding.

#### **Beyond Syllabus**

In general people are afraid of the snakes due to fear of death. It is indiscriminately killed when across. Many a times we invite snakes by keeping its food in our house. The favorite food of the snake is rat. The larger snakes feed on frogs, rats or smaller snakes. The smaller snakes feed on lizard insects, bird eggs, or smaller birds.

In villages the trash, fuel, cow dung cakes are stored just near house in a shade where cattle rest. Many a times the fodder is stacked in the place. All these are the favorite places of rats to hide. The snake follows the rat. The only sense snake relies is smell and sight. Snakes can detect movement better. In addition tongue can collect trails of smell particles. These are taken in the Jacobson's organ located in the roof of the buccal cavity. Even in dark a snake can follow the trail of rat smell. The snake following rat stays in the premises where rats are hiding.

Generally when housewife tries to collect fuel or fodder from the heaps they are easy victims. In fields the snakes in green fodder or the trash can bite the field workers. Actually snakes keep field rat population controlled.

The best policy to avoid snake bite is be careful while handling fodder and in work places especially where lot of trash material is stored. If at all the trash is to be removed or fuel is to be collected it should be done in daylight. Avoid harboring rats. If the house is in open field dig a small trench around the house. It is known as snake pit. Normal tendency of the snake is follow ditches. Do not sleep on open ground. If it is unavoidable your bed should be on a raised surface. Snake pit around your bed shall protect against snakes.

If you meet a snake do not panic. The snake if is not in the range of strike, shall move away slowly. Try to identify the snake with the help of head shape, presence of hood, and the coloured patches on the body. In Maharashtra common krait is difficult to identify. It rarely makes a sound. It is steel blue in colour. Hood of cobra is easy identification. Remember cobra can strike even if you are behind the snake. It can bite in the radius of its raised hood instantaneously. Run away as fast as possible. The maximum speed of any snake is twenty kilometers per hour. It is less than the speed of human being. If you run away snakes will not follow you. The snakes are also surprised when meet with the people.

While moving in dark places use torch, or hurricane. Keep a small balli of five feet in your hands. Use shoes while moving outside the house. Strike the balli on ground. The snakes can detect vibrations from ground. If snakes are there it shall go away. Accidentally if you step on the body of a snake there is no alternative with him to bite.

All snakes including poisonous snakes are important part of the ecosystem. It controls rats effectively. According to one estimate there are five rats in wild or house rats behind every person. If rats are effectively controlled, there will be saving of grains sufficient for twenty percent population more.

The snake venom is effective on some diseases for example Nyloxin is used in severe arthritic pain is prepared from cobra poison. Cobraxin is used to block nerve transmission of impulses.

#### **Questions:**

1. How poisonous snakes are identified? Describe the types of fangs in poisonous snakes with suitable examples.
2. Describe the jaw of non-poisonous snakes. How it differs from that of the poisonous snakes.
3. Write short notes on a) Poisonous apparatus, b) Snake toxins c) Bite management of poisonous snakes d) Antivenin
4. What are the symptoms of poisonous snakebite? How the snake identification is done from the bite marks? What are the measures taken for victim of snakebite?
5. How to identify neurotoxic and haemotoxic snakebite? What is the treatment given after confirming the snakebite as poisonous?
6. Are freshwater snakes poisonous? If a person is bitten by a bite of freshwater snake, what measures are to be taken?
7. If you come across a victim of snake bite what you will do to reassure the patient till complete medical treatment is given.