

VENOMOUS SNAKES AND SNAKEBITE

A TRAINING MANUAL FOR SNAKE RESCUERS IN INDIA



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FOREWORD

India's tropical climate is ideal for the c. 270 species of snake found here, of which only around 60 are venomous. Approximately 47,000 people each year are killed by venomous snakes. The "Big Four" venomous snake species are the most medically significant and include the Spectacled Cobra, Common Krait, Russell's viper and Saw-scaled viper. It is, however, a popular misconception that these are the only venomous snakes in India capable of killing humans. In fact, there are many other species of venomous snakes that may be quite common in certain parts of India, but currently there is no data on how much they contribute to deaths from snakebite as they are difficult to identify.

At the same time, harmless snake species can be confused with dangerously venomous species because of superficial similarities in their appearance. This can lead to unnecessary killing of harmless snakes and spreads the belief in the healing power of charms and traditional treatments for snakebite, but may also lead to accidents when venomous snakes are thought by rescuers to be harmless species. Even when the snake is correctly identified, poor handling techniques and lack of proper equipment can place rescuers in unnecessary danger. The increasing use of social media is also leading to a tragic increase in deaths among snake rescuers, many of whom attempt the job without proper advice and training.

We hope that the information contained in this manual will help to prevent these accidents by spreading knowledge of how to distinguish dangerous from harmless snakes, how to handle snakes in rescue situations safely, and how to advise householders on how to decrease the opportunities for snakes to come into conflict with them during their daily activities. We also address steps that should be taken (and also what should not be done) in case of snakebite occurring. We hope that this manual will help to reduce the huge number of snakebites occurring, and deaths resulting, in India every year.

Finally, we would like to thank Vishal Santra (Simultala Conservationists, West Bengal) who helped run the first workshop conducted by The Gerry Martin Project in Hunsur in November 2016, the 2016 Bangor undergraduates (listed below) who helped to develop the manual, and the snake rescuers who took part and gave valuable feedback.

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SNAKE BIOLOGY

Snakes (Serpentes) are reptiles with elongated bodies (Figure 1) without limbs, eyelids or external ears. They all possess scales that cover their body (which may be smooth or keeled, see Figure 2), and forked tongues. Most have jaws capable of expanding considerably to allow them to swallow large prey.

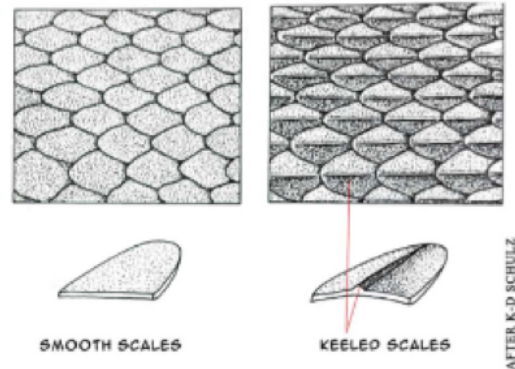
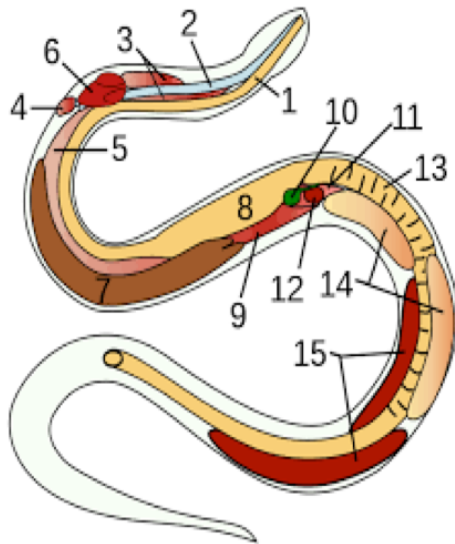


Figure 1 (left). Anatomy of a snake. 1 oesophagus, 2 trachea, 3 tracheal lungs, 4 rudimentary left lung, 5 right lung, 6 heart, 7 liver, 8 stomach, 9 air sac, 10 gallbladder, 11 Pancreas, 12 spleen, 13 intestine, 14 testicles, 15 kidneys.

SNAKES HAVE:

- * Poor hearing.
- * Good eyesight.
- * Jacobson's organ giving them directional sense of smell and taste by collecting odour particles on their forked tongues which are processed by the Jacobson's organ in the roof of the mouth.
- * Good sensitivity to vibrations carried by the substrate.
- * Many backward facing teeth to hold on to prey.
- * They may also have fangs in different positions in the mouth (Figure 3)

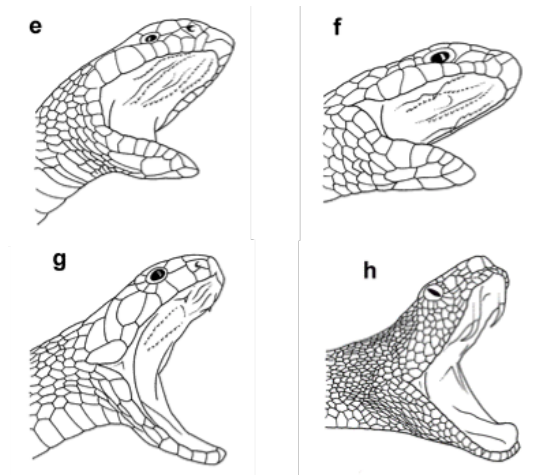


Figure 3. Different type of dentition in a) non-fanged, b) rear-fanged, c) front fixed fangs in elapids and d) front folding fang in vipers.

There are other species of lizards and also certain amphibians, that have snake-like features and can sometimes be confused with them, but are completely harmless. Figure 4 describes some key differences between them.

COMPARISON OF FEATURES BETWEEN SNAKES AND SNAKE LIKE SPECIES

Figure 4



SNAKE

- ✓ Well-developed eyes
- ✓ No eyelids
- ✓ No external ears
- ✓ Able to keep mouth shut when extending forked tongue



CAECILIAN

- ✓ Very small eyes
- ✓ Lacking eyelids
- ✓ Segmented body
- ✓ Sensory tentacles present on head
- ✓ Very short tail
- ✓ Tiny scales present in grooves of body



LEGLESS LIZARD

- ✓ Well-developed eyes
- ✓ Moveable eyelids
- ✓ External ear openings present
- ✓ Must open mouth to extend tongue
- ✓ Fixed jaws



COMMON KRAIT (*Bungarus caeruleus*)

ELAPIDAE

- ✓ Round pupils
- ✓ Slender, agile snakes
- ✓ Head not distinct from body

Figure 5: The 'Big Four' species of venomous snakes in India; against which antivenom is available



RUSSELL'S VIPER (*Daboia russelii*)

VIPERIDAE

- ✓ Elliptical pupils
- ✓ Stocky snakes, with triangular heads that are very distinct from the body
- ✓ Long foldable front fangs



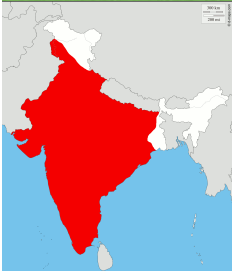
SPECTACLED COBRA (*Naja naja*)



SAW-SCALED VIPER (*Echis carinatus*)

SPECIES DESCRIPTIONS

BIOLOGY, BEHAVIOUR AND COMMONLY CONFUSED SPECIES



SAW-SCALED VIPER (*Echis carinatus*) can be confused with COMMON SAND BOA



SAW-SCALED VIPER (*Echis carinatus*)



COMMON SAND BOA (*Eryx conicus*)

- ☐ A small snake with a strong, thick body, a pear-shaped head that is distinct from the neck, and a short thin tail. Adults range in length from 30cm to 80cm.
- ☐ Various shades of brown, grey, or orange with darker patches on its back and spots on its sides. Their bellies are white in colour and have dark spots on all scales.
- ☐ Several rows of slanted serrated on both sides of the body are rubbed together when aggravated to make a sawing, rasping, noise.
- ☐ A nocturnal species active from late evening that may feed on rodents, lizards and frogs but largely eats insects and other invertebrates such as scorpions
- ☐ May bask during the day time. Usually terrestrial but can climb on vegetation.
- ☐ Has a very fast striking speed (under 1 second) and coil up when provoked, with head forward in the middle of the body.
- ☐ Venom is very potent, delivered in small quantities, and dry bites are uncommon.
- ☐ Found everywhere in India except west Bengal and the north-east states, mostly located on plains and up to 200m in northern hills.
- ☐ Can be found in a variety of forests, but generally prefer dry, sandy, or rocky plains. They conceal themselves in dry places such as under rocks, behind bark or in thorny plants.
- ☐ Unlikely to find in the house, however occasionally come in search of food or shelter. Most likely to be found in log or stone piles outside the house.



RUSSELL'S VIPER (*Daboia russelii*) can be confused with INDIAN ROCK PYTHON AND COMMON SAND BOA; small specimens also with SAW SCALED VIPERS



RUSSELL'S VIPER (*Daboia russelii*)



INDIAN ROCK PYTHON (*Python molurus*)

- ☐ Vipers with a strong thick body with rough, keeled scales. They are nocturnal snakes, spending most of the day under cover, although they may bask in the early morning and evening. Adults can reach large sizes (100cm – 180cm).
- ☐ When agitated, movement can be slow and jerky, forming an S shape with their body while raising the front third of their length off the floor, and producing a loud whistle-like hiss.
- ☐ They may strike randomly when provoked, but may not always inject venom.
- ☐ The upper surface is usually shades of greyish brown, red, orange or grey, with almond-shaped spots of dark brown in rows of three running down their backs, fainter nearer the tail. Pattern is fainter in adults and some lack any obvious pattern.
- ☐ White or light yellow underside with half-moon shaped dark spots on the edge of most scales, the tail part of the belly is generally darker than the rest.
- ☐ Distributed across the country except in the Indian islands, Himalayan hills, and most of the North-eastern States (although it has been recorded in Assam along the border with Bangladesh). Most commonly found on plains, but reported upto 1500 m.
- ☐ Found in a variety of forests, scrublands, grasslands, wetlands, dry open areas, agricultural fields and rocky terrains, however, they generally choose dry surroundings.
- ☐ Their diet is mostly rodents and small mammals but they also feed on birds, lizards and frogs.
- ☐ Will come into homes in search of food or shelter, commonly found in holes and cracks in walls or other hiding places. Also commonly found in mounds of leaves or dirt in gardens or outside areas.



SPECTACLED COBRA (*Naja naja*) is commonly confused with
INDIAN RAT SNAKE (*Ptyas mucosa*)



SPECTACLED COBRA (*Naja naja*)



INDIAN RAT SNAKE (*Ptyas mucosa*)

The neck of the Cobra is thicker than the head while the head of the Rat snake is thicker than the neck. Rat snakes inflate and flatten necks vertically when annoyed. The cobra also often has a spectacle mark on its horizontally flattened hood.

The underbelly of a Common cobra (right) is a yellowish to brown colour and when reared a hood is present. In contrast, the rat snake (left) has a black and white striped underbelly and when rearing, no hood is present (if it flattens its neck, the flattening is vertical rather than horizontal). The dark band behind the throat is characteristic for cobras and the black lip scale edges for rat snakes.

- ☐ Varies greatly in colour depending on where it is found: can range anywhere from yellow-brown, red-brown, dark brown, brown-black to bluish black or grey-black-lighter down south and darker further north.
- ☐ The spectacle mark at the rear of the hood is absent in some specimens.
- ☐ Adults are 1.5- 2m in length, and their diet is mostly rodents, but also frogs, toads, birds, other snakes and small mammals
- ☐ Easy to identify as they hood and hiss loudly when threatened, and may strike; however they do not always inject venom.
- ☐ Common across India, in farms, forests, grasslands, wetlands, deserts, and even urban settings, likely to hide in mounds, woodpiles, holes, caves, cracks and crevices in rocks. Also found inside buildings foraging or resting.
- ☐ Mostly active during evening and early morning.



COMMON KRAIT (*Bungarus caeruleus*) is commonly confused with COMMON WOLF SNAKE (*Lycodon aulicus*)



COMMON KRAIT (*Bungarus caeruleus*)



COMMON WOLF SNAKE (*Lycodon aulicus*)

The stripes on a common Wolf snake are broader than the common Krait snake and are unpaired unlike the krait. However, pairing not always obvious in krait, can be broader than shown in some areas

In the common wolf snake (left) the body is a rounded shape whereas the body of the krait (right) is a more triangular shape and is rigid along the vertebral line. The krait also has enlarged hexagonal dorsal scales.

The snout of the Wolf Snake is long and narrow whereas that of the krait is short and round.

- ☐ Black to bluish black in colour, with thin white bands (crossbars) along body, usually in pairs, although sometimes bands not distinctive.
- ☐ Average length around 1 m, may grow to nearly 2 m. Head flat and rounded with completely black eyes.
- ☐ Habitats include rainforests, deciduous forests, scrub forests, wetlands and grasslands, over a wide range of elevations.
- ☐ Very nocturnal and during the day remain hidden in darker places (e.g., rat holes, termite mounds, caves or under rocks). If disturbed during the day, can be docile, compared to evening when they can be more aggressive
- ☐ Usually terrestrial, occasionally found in homes climbing on rough surfaces in search of food or hiding places.
- ☐ Diet consists of mostly rodents or other snakes, often eat frogs, toads and lizards.
- ☐ Often confused with other species of Krait (not Banded Krait), Wolf Snake, Barred Wolf Snake, Banded Racer juvenile and sub adult.

OTHER VENOMOUS SNAKES



King Cobra (*Ophiophagus hannah*)

Very long slender snake, which an average length of around 3m.

It has a rounded head and round pupils in the eye.



Monocled Cobra (*Naja kaouthia*)

Average length of 1.5m.

When aggravated the hood expands to reveal round hood mark.



Central Asian Cobra (*Naja oxiana*)

Average length of 1.5m.



Banded Krait (*Bungarus fasciatus*)

A very distinctly patterned snake with alternating black and yellow bands extending along the body.

Average length of about 1.5m.



Sind Krait (*Bungarus sindanus*)

Mostly black with occasional white patterning and pale shiny yellow lower lip and neck.



Lesser Black Krait (*Bungarus lividus*)

Very similar in appearance to the Black Krait, with a uniformly black body and a yellowish underside, but slightly smaller with an average length of 70cm. Due to its lack of obvious markings and no enlarged vertebral scales it can be easily confused with many non-venomous snakes.



Black Krait (*Bungarus niger*)

Has a uniformly black body with a pale yellow underside. Average length of 90cm.



Castoe's Coral Snake (*Calliophis castoe*)

A recently described species of coral snake only known from the northern Western Ghats, previously thought to be a colour morph of *C. nigrescens*, which is distributed more widely throughout the Western Ghats. *Calliophis* species have extremely potent venom but are rarely seen except in the monsoon months as they are nocturnal and spend most of their time under dense leaf litter and other subsurface refuges. Shy in behaviour, seldom bite.



Bamboo Pit Viper (*Trimeresurus gramineus*)

Yellow-green green viper with triangular head that is much larger than its neck. Lives in trees but can be occasionally seen on the ground. Found in both the Eastern and Western Ghats.



Large-scaled Pit Viper (*T. macrolepis*)

Bright green coloration with a yellowish underside. The only green pitviper in the Western Ghats with large head scales.



Pope's Pit Viper (*Trimeresurus popeiorum*)

Marked sexual dimorphism. Females reach over 1m in length, are more heavy-bodied and plain green in colour. Males tend to be darker green with a bicolour lateral stripe (white above, bright red below) which may continue onto the head up to the eye, with a reversal in the order of the colour. Its distribution still requires confirmation, but it thought to occur from North Bengal through the northeastern states.



Spot Tail Pit Viper (*Trimeresurus erythrurus*)

Average length of 50cm with green or yellow upper body and black interstitial skin. In males a white line runs from the eyes to the base of the tail. West Bengal and northeast India. Exact distribution unknown.



Malabar Pit Viper (*Trimeresurus malabaricus*)

Very varied colouration with blue, yellow and brown morphs, but always with mottled patterning and a triangular shaped head that is broader than the neck. Throughout the Western Ghats.



Kaulback's Lance-Headed Pit Viper (*Protophops kaulbacki*)

Grey or olive green with dark blotches along the length of the body. Northeast India only.



Hump-Nosed Pit Viper (*Hypnale hypnale*)

Brown body with upper half of head having a similar colouration. Darker triangular markings on the body, snout slightly upturned. Western Ghats.



Mountain Pit Viper (*Ovophis monticola*)

Average length of 50 cm with short snout and stout body, but females can reach 1.2m. Himalayas and North-east, above 400 m.

Other viper species:

These vipers have restricted ranges and aren't likely to be encountered in most of India.

- 📌 Andaman Pit Viper (*Trimeresurus andersonii*)
- 📌 Brown Spotted Pit Viper (*Protobothrops mucrosquamatus*)
- 📌 Cantor's Pit Viper (*Trimeresurus cantori*)
- 📌 Himalayan Pit Viper (*Protobothrops himalayanus*)
- 📌 Jerdon's Pit Viper (*Protobothrops jerdonii*)
- 📌 Levantine Viper (*Macrovipera lebetina*)
- 📌 Nicobar Pit Viper (*Trimeresurus labialis*)
- 📌 Northern White-Lipped Pit Viper (*Trimeresurus septentrionalis*)
- 📌 Western Himalayan Pit Viper (*Gloydius himalayanus*)
- 📌 Medo Pit Viper (*Viridovipera medoensis*)

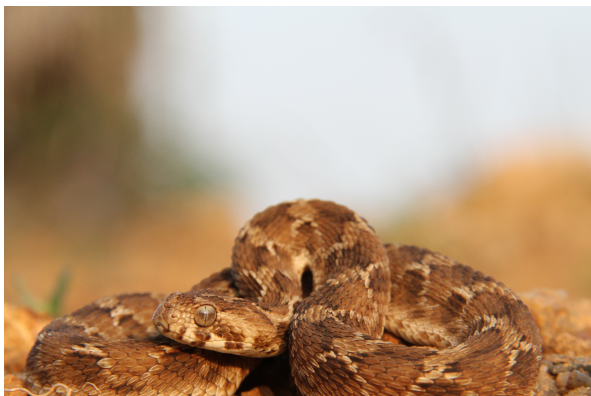
SNAKE BITES - TYPES OF VENOM



HAEMOTOXIC

Saw Scaled Viper and Russell's Viper
Causes haemolysis, tissue damage
and organ failure.

Fast onset and symptoms worsen over
time.



Saw-scaled Viper (*Echis carinatus*)



Common Krait (Neurotoxic)

NEUROTOXIC

Spectacled Cobra and Common Krait
Neurotoxic venom causes muscle
paralysis, leading to respiratory failure.

Cobras may also produce necrosis
(destruction of tissue)

Symptoms may occur 15 minutes to 2
hours after initial bite, but can be much
slower in onset, which can complicate
diagnosis.



Russell's viper (Haemotoxic)

SNAKE RESCUE PROTOCOL

EQUIPMENT CHECKLIST FOR SNAKE HANDLERS

- ✓ Snake hook (at least one, but two will allow better control of heavy snakes)
- ✓ Snake bag or container that is large, dark and secure. If a bag is used make sure a hard-shell container is also present to protect from bites through the bag.
- ✓ Headlamp or torch for locating snakes in dark.
- ✓ Good sturdy footwear.
- ✓ Where the monocled cobra is present, glasses or goggles to protect eyes from spitting.



Recommended snake rescue equipment and how to use them to bag a venomous snake.

- ☐ Upon arrival, communicate clearly and effectively with the person who has requested help, to establish location and possible identity of the snake.
- ☐ Clear all unnecessary people and objects away from the area. It is essential to have a secure and safe environment. Remove any trip hazards from the ground.
- ☐ Livestock and pets also need to be moved out of the way.
- ☐ Check that a clear retreat route is present
- ☐ Ensure equipment for snake removal is prepared: have a snake bag (or other suitable container) open and within reach, wear appropriate safety gear, have snake hook in hand.
- ☐ When removing the snake make sure that no handlers or bystanders are within striking distance of the snake.
- ☐ DO NOT assume that the behaviour of the snake will be predictable as even an apparently calm snake may strike out.
- ☐ Make sure that the snake bag is sealed at all times once the snake is within the bag e.g. Place a snake hook across the bag between the snake and the opening of the bag while the bag is tied securely.
- ☐ Block off the entrance to the container and close it firmly and securely making sure you are in no risk of getting bitten by the snake.
- ☐ If you are using a bag place it carefully in your hard-shell container for safe transport.
- ☐ The snake removal should take no longer than 1-2 minutes. Once the snake has been located and captured, remove it from the site.
- ☐ DO NOT create any entertainment from the snake as this will only increase the risk of injury.
- ☐ Suggest to locals that unless snake is an immediate danger to leave it in place e.g. Rat Snakes are useful to inhabitants as they may predate on venomous snakes and vermin such as rats which are also a food source for the venomous snakes.
- ☐ Removal of harmless snakes may increase the chance of a venomous snake moving into the area.
- ☐ If this is not agreed to, relocate the snake at a site that will allow the highest possibility of survival for the snake.

SNAKE BITE PREVENTION

This section includes advice for rescuers to reduce risk during rescues and advice that rescuers can give to people and communities about measures that can be taken to reduce the risk of snakebite inside their homes and during other daily activities.

ADVISE FOR SNAKE RESCUERS

- ☐ Do not try to catch snakes after drinking alcohol or when tired or ill – you must always be alert.
- ☐ Ensure that correct equipment is used such as snake hooks, long trousers, tough boots, containers/snake bag, and torches.
- ☐ Transport the bagged snakes in a hard-shell container e.g. plastic / cardboard box.
- ☐ Confirm snake i.d. before handling to ensure the correct technique is used.
- ☐ If a snake is found, ensure it has an escape route. Do not disturb or provoke it as it may feel threatened and strike.
- ☐ Ensure your clothes and equipment are suitably washed and sanitised between each rescue, especially, to remove rodent and other snake scents.

ADVICE TO GIVE RESIDENTS

Reduce the incentive for snakes to come into the house, E.g. keep rodents out of food grain stores and do not provide shelter for snakes such as rubbish, building materials and firewood stacked near the house.

Avoid placing hands where you can't see, E.g. when digging in rubbish piles, gathering crops, lifting rocks or getting firewood.

When walking around in any area at night, use torches or any available light source to see the path.

If a snake is found that does not move away on its own, call a snake rescuer. Do not attempt to catch it yourself or to kill it.

Keep a safe distance away from snake until ID is confirmed.

During agricultural activities, check crop piles with a long stick or a rake before picking them up as Russell's Vipers are prone to hiding in them

WHAT TO DO IN THE CASE OF A SNAKE BITE

RECOGNISING EARLY SYMPTOMS OF ENVENOMATION

If an individual is bitten by a venomous snake, the symptoms differ depending on species. Any of these symptoms confirm envenomation, but **LACK OF SYMPTOMS DOES NOT EXCLUDE ENVENOMATION**

- ☐ Puncture marks from the fangs of the snake (not always visible)
- ☐ Abnormal bleeding from bite site or elsewhere (eg. gums)
- ☐ Swelling around the site of the bite.
- ☐ Headaches, vomiting, stomach ache and nausea.
- ☐ Droopy eyelids, facial weakness, impaired vision, slurred speech.
- ☐ Red or brown urine.

Particular species of snake are more likely to produce certain symptoms in the bitten person, some of which indicate the onset of life-threatening syndromes.



Fang marks from a large Russell's viper (centre)
Droopy eyelids (Left and right) resulting from the bite of a common krait and Russell's viper.

SYMPTOMS OF A SPECTACLED COBRA BITE

Swelling.

Facial weakness, droopy eyelids, excessive dribbling, blurred vision
Weakness of limbs, lethargy.

May lead to death by respiratory muscle paralysis or airway compromise.

SYMPTOMS OF A COMMON KRAIT BITE

Usually show do not produce local symptoms, eg, swelling and bleeding.

Fang marks may be imperceptible.

Facial weakness, droopy eyelids, excessive dribbling, blurred vision.

Severe abdominal pain.

May lead to death by respiratory muscle paralysis or airway compromise.

SYMPTOMS OF A SAW SCALED VIPER BITE

Swelling and pain from bite site.

Bleeding from gums/tear ducts.

Non-clotting blood.

Discolouration around bite site.

SYMPTOMS OF A RUSSELL'S VIPER BITE

Pain and swelling at bite site

Bleeding from gums/tear ducts

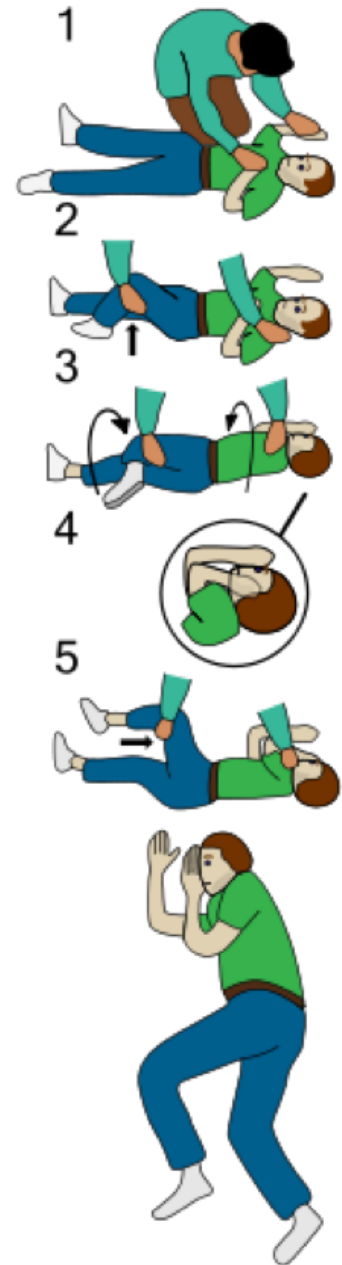
Non-clotting blood

Discolouration around bite site

Sometimes produces facial weakness, droopy eyelids, excessive dribbling, blurred vision

Inability to urinate

Lower back ache



Five steps to the recovery position.

IMPORTANT DO'S AND DON'TS OF SNAKE BITES

DON'TS	DO'S
<p>Don't cut and suck</p> <ul style="list-style-type: none"> ▶ Increases risk of infection ▶ Does not remove venom ▶ Increases local tissue damage ▶ Increases blood loss <p>Don't apply tourniquets</p> <p>Don't apply ice</p> <ul style="list-style-type: none"> ▶ Ineffective and may increase local tissue damage <p>Don't burn the wound</p> <p>Don't rely on traditional treatments</p> <ul style="list-style-type: none"> ▶ Snake stones ▶ Mantras and spells ▶ Urinating on the wound <p>None of these will help. In fact, they will only delay obtaining the medical treatment for the victim</p>	<ul style="list-style-type: none"> ✓ Do get to hospital immediately. ✓ Antivenom is the only effective treatment and is more effective. ✓ Do keep the victim calm and still as this will slow the spread of the venom. ✓ Do loosen tight clothing. ✓ Do remove any jewellery and accessories, especially rings, bangles, necklaces and watches. ✓ Do record the location of the bite. ✓ Do record progress the swelling. ✓ Do put an unconscious victim in the recovery position ✓ Do treat every bite as serious, even if no symptoms are present ✓ Do seek immediate medical assistance

Call the emergency number ____ but time should not be wasted in getting the victim to the nearest hospital or medical centre, by the fastest and safest means possible.

THIS IS THE NUMBER ONE PRIORITY

Obtaining anti-venom in hospital is the only treatment.

APPENDIX 1: HOW TO COUNT SCALES AS AN AID TO SNAKE IDENTIFICATION

Some scale counts are very useful in identifying species that you are not quite sure about, especially in regions of India where the snakes are less well studied. This guide shows you how to take some standard scale counts, but bear in mind that they are not useful for all groups of snakes.

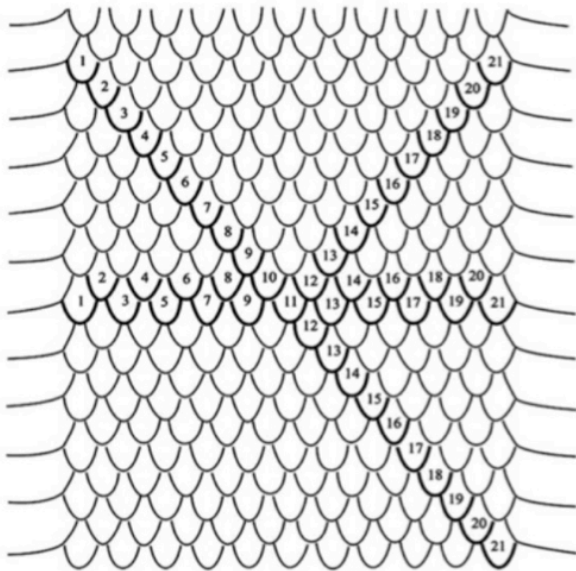
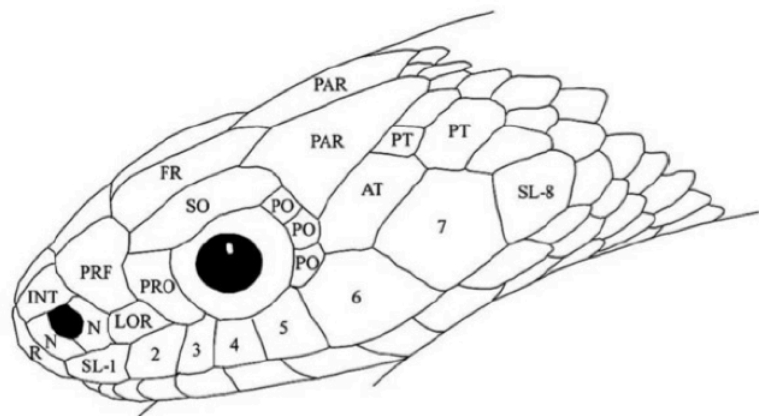
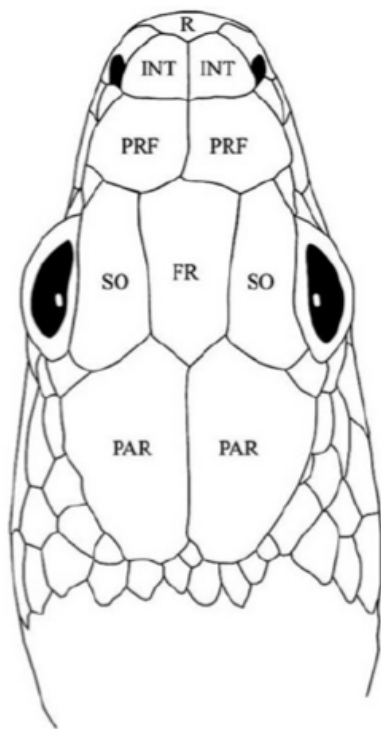


Figure A1. Counting body scale rows. Imagine that the snake has been cut open along the belly and its skin spread out flat. The first dorsal scale row is the one that touches a belly scale on one side. Scale rows can be counted along a diagonal line, in a V-shape or in a zig-zag line but all these methods should give the same count. It is usual to count scales at mid-body (halfway between the tip of the snout and the vent, not the end of the tail), one the neck one head length behind the back of the head, and one head length in front of the vent. For vipers, it is not very useful or easy to count the scales behind the head because they are changing in number at this point.



R - rostral INT - internasal N - nasal LOR - loreal PRF - prefrontal FR - frontal SO - supraocular
PO - postocular SL - supralabial PAR - parietal AT - anterior temporal PT - posterior temporal

Figure A2. Head scales typical of colubrid and elapid snakes. Note that some head shields may be fused in some species (e.g. the nostril may appear to be present in the middle of a single nasal scale).

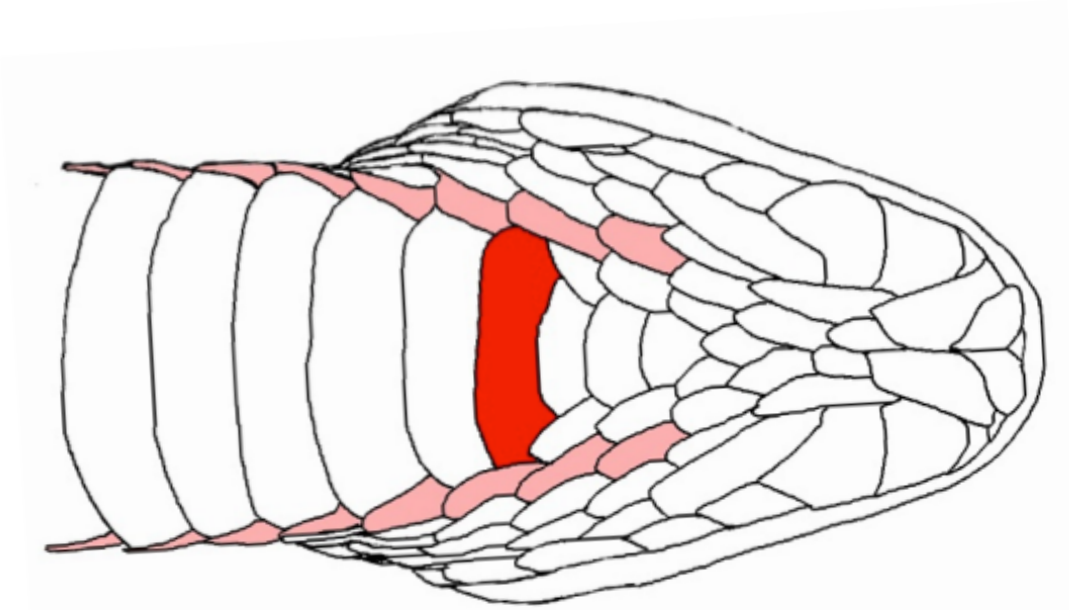


Figure A4. The head of a cobra in ventral view. The red scale marks the first ventral scale determined according to the Dowling method, defined as the first belly scale that touches the first dorsal scale row (in pale red) on both sides.

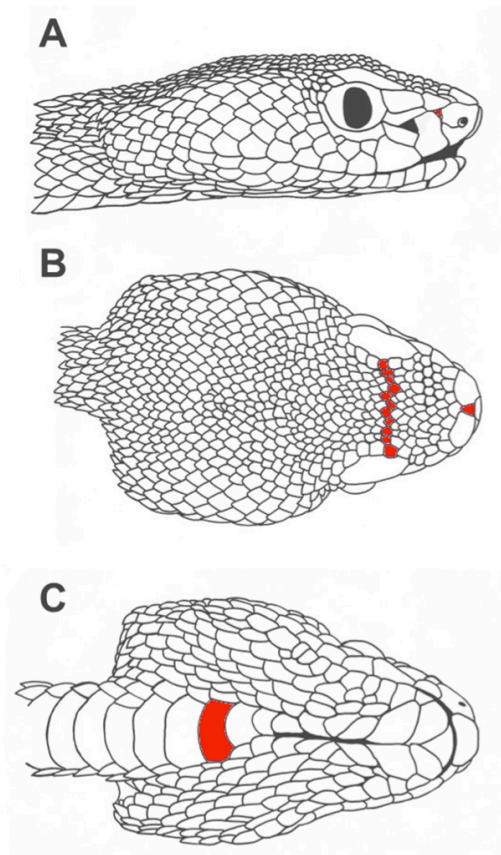


Figure A3. Head scales typical of pit vipers. Vipers tend to have small irregular scales on the top of their heads, retaining only some of the larger head shields such as the scales around the eyes, lips and front of the head. Pitvipers also have another opening on the head between the eye and the nostril for the heat-sensing pit. Note that both the nasals and the first supralabial scale is fused together, at least partially, in this example, while the second supralabial is fused with the loreal scale and forms the anterior border of the pit. The number of scales between the major head shields (A and B, in red) can be important in identifying species. The red scale in C marks the first ventral scale, which is the first unpaired large shield on the head. This is defined differently in snakes without enlarged heads, where Dowling's method is used instead.

APPENDIX 2.

FROM SNAKE RESCUER TO CITIZEN SCIENTIST: CONTRIBUTING TO THE MAPPING OF INDIA'S SNAKES

Snake rescuers and relocators are in a unique position to contribute data to our knowledge of the distribution of snakes in India. This is of key importance for many reasons:

- We urgently need better data on the distribution of venomous species to plan improvements to snakebite therapy (e.g., design and distribution of new regional antivenoms, training of health workers and doctors)
- We need to know which venomous species are most frequently encountered by people, and thus most likely to be medically important
- A constant stream of occurrence records is important to conservation, as it allows us to monitor population trends across the country.

HERPMAPPER

(www.herpmapper.org) is a web platform that collates reptile and amphibian occurrence records from the whole world. HerpMapper allows recordings of specimens using the MobileMapper smartphone app (iOS or Android) or via a web interface. All records must be vouchered with a photo of the exact specimen, so that identifications can later be verified. All records are available to the general public at the district level only. Researchers or agencies can apply to access precise GPS localities if necessary.

Starting with HerpMapper. To start using HerpMapper, register on the herpmapper.org website to set up an account, and download the MobileMapper app for your smartphone. *Recording your finds.* Full instructions are given on the HerpMapper website. You can either record snakes on your smartphone as you find them, or you can upload photos and information (especially GPS locations) afterwards via the web interface.

KEY POINTS

- You do NOT need to have a phone or WiFi signal when you collect records! Records are stored, and these pending records can be edited later, and then synced with the database when you have good internet access.
- All records MUST be accompanied by photos of the **actual specimen** you are recording, NOT just any photo of the same species.
- It's not a photo contest: any photo that shows major identifying features (e.g. just a body coil sticking out from under a cupboard) is OK, it does not have to be an artistic shot!

- If you are using the smartphone app, you **MUST** start the record at the actual place where you found the snake, so that the app records the correct GPS coordinates. If you cannot take a photo of the snake at the time, take a photo of something else at the site, and save the record with that. You can then take a photo of the snake when you release it and then edit the record to add the photo of the snake later.
- Don't worry about misidentifying a snake – records submitted to HerpMapper are checked regularly, and can be corrected. If you don't know the species of snake, you can also submit records with "Unknown ID" as a label.
- Records of other reptiles and amphibians are also welcome!

SAFETY FIRST

- **ONLY** take a photo of the snake at the site of capture if it safe to do so (definitely harmless snake, or snake confined so it cannot escape or do harm). If in doubt, take a photo of the location, save the record with that, and then take a photo of the snake when you release it and add it to the record later.
- **NEVER** take a venomous snakes out of the bag after catching it to take a photo, except when releasing it.



Avoid clutter and piles of rubbish near the house.

Keep firewood piles away from the house and preferably on a platform elevated at least 3 m off the ground.

Check and maintain roofs and doorways regularly to avoid gaps that give access to the house. Drainage pipes should be covered with wire mesh.



Keep utensils in a well-lit and visible area to prevent them becoming a home for snakes that enter the house.

Keep livestock away from the house as their manure, feed and bedding attract rats which in turn attract snakes.





LIST OF CONTRIBUTORS OF PHOTOGRAPHS AND OTHER IMAGES.

Front page. Russell's viper: Anita Malhotra.

Figure 1. Anatomy of a snake, licensed under the [Creative Commons Attribution 2.5 Generic](#) license.

Figure 2. Smooth and keeled dorsal body scales. Taken from previous manual,

Figure 3. Adapted from Table 4.10, www.vapaguide.info, Dr. Lukas Stammer

Figure 4. Snake (*Lycodon jara*), legless lizard (*Dopasia gracilis*): Vishal Santra) and caecilian: (?).

Figure 5. The "Big Four" species of venomous snakes: Wolfgang Wüster).

Figure 6. All photos by Wolfgang Wüster, pit viper head drawings by Anita Malhotra

Figure 7. Snake rescue equipment: Anita Malhotra

Figure 8. Potential risks in a typical village: Bethany Lyons

Figure 9. Symptoms of snakebite. Photos by David A Warrell.

Figure 10. Recovery position. By sv>User:Hibernate (Leone & Own work) [GFDL (<http://www.gnu.org/copyleft/fdl.html>), CC-BY-SA-3.0 (<http://creativecommons.org/licenses/by-sa/3.0/>) or FAL], via Wikimedia Commons

Other pictures (Big Four snake descriptions): *Gonglyophis conicus*, *Lycodon aulicus*, *Ptyas mucosa*: Wolfgang Wüster; *Python bivittatus*, *Boiga trigonata*, common krait in main picture: Vishal Santra