CHAPTER-I

ORIGINS

1. Why are snakes called reptiles? What is a reptile?

Classification of animals is essential for their scientific study. Land-dwelling animal groups with backbone have been split into four classes: amphibians, reptiles, birds and mammals. Generally speaking, reptiles differ from amphibians by their dry, scaly skin; from birds by absence of feathers; and from mammals by absence of fur or hair. The class 'reptiles' consists of lizards, crocodiles, turtles and tortoises and snakes. There are about 6032 living species of reptiles, almost double the number of living species of mammals.

2. How many species of reptiles are there worldwide?

Crocodiles	: 22
Turtles and Tortoises	: 242
Lizards	: 2800
Snakes	: 2968

	: 6032

(The numbers are approximate).

3. How many species of reptiles are found in India?

Crocodiles	: 3
Turtles and Tortoises	: 32
Lizards	: 155
Snakes	: 276 (It is not unlikely that a few more may be discovered).

	: 466
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4. How did snakes evolve?

The evolution of snakes has been difficult to study because of the rarity of fossil evidence and the highly damaged condition of these fossils which are very fragile (See Q & A 10). Scientists, generally, believe that snakes evolved from lizards. But some scientists believe that snakes and lizards evolved independently of each other from a common ancestor.

5. Which is the nearest relative of snakes among lizards?

According to current scientific opinion, the monitor lizards of the family varanidae are the nearest relatives of snakes. There are many species world-wide. Indian species: common Indian monitor (*Varanus bengalensis*), desert monitor (*V.*

griseus), yellow monitor (*V. flavescens*), water monitor (*V. salvator*). The tongue of the monitor is distinctive in that it is forked as in snakes. The monitor flickers its tongue just like a snake does to smell (See Q & A 32). The progressive stages in evolution from monitors to snakes are not known.

6. When did the first snake appear and where?

A land-dwelling snake named *Lapparentophis deferenni* evolved most probably about 130 million years ago, during the early cretaceous period, in what is now north Africa. (The first humanoids, our ancestors, evolved less than six million years ago).

7. Which is the next oldest species known and from where?

A marine species, *Simoliophis,* found in parts of Europe and north Africa that were once under the sea. This is believed to have evolved at the beginning of the late cretaceous period, 100 million years ago.

8. Which are the earliest known snakes still found?

The two families to which *Lapparentophis* and *Simoliophis* (See Q & A 6 & 7) belonged became extinct by the end of the cretaceous period, 65 million years ago. Among the snakes that evolved soon thereafter, we still have with us the boas (family: Boidae) and the South American pipe snake (family : Aniliidae).

9. Which are the most primitive families of snakes that now survive?

Aniliidae, South American pipe snake. Only a single species.

Boidae: In this are included the boa constrictors, the sand boas and, till sometime back, the pythons. Pythons are now classified as another family, the Pythonidae.

Another of the oldest groups of snakes consists of the families Typhlopidae, Leptotyphlopidae and Anomalephidae under which come the worm snakes.

Interestingly, sizewise, the boas and pythons are at one end of the scale and the typhlops and their relatives at the other end. The longest snake in the world is a python; the smallest is a typhlop. See Q & A 101 & 102.

10. Why is there no dependable fossil record of snakes?

The simplified and fragile body skeleton, the slender teeth and the delicate skull with many of its bones only loosely joined together have been responsible for a clear fossil not emerging. It has been said that the evolutionary tree of the extinct groups of snakes will never be reconstructed in detail.

11. What is the latest fossil evidence for snakes with legs?

According to a 2006 report in *Nature*, a 90-million year old fossil snake has been discovered in the Patagonia region of Argentina. This is the most primitive snake fossil known so far. This snake had two legs. It has been named *Najash rionegrina*. Najash is Hebrew for 'snake'; Rio Negro is the province of Argentina where the discovery was made.

12. How many families, genera and species of snakes are there worldwide?

Taxonomy of snakes has been an uncertain field and there are frequent revisions in the classifications into families, genera and species. Snakes, hitherto unknown or undescribed, are also discovered and are described from time to time. An authoritative account is thus difficult to obtain. There is little possibility for any finality in the matter at any time. The following table has been prepared based on Chris Mattison's *The New Encyclopedia of Snakes*, 2007. Even in this book, there are discrepancies between the figures in the tabular statement and in the narrative portions. The details in the narrative portions have been adopted in preparing the table below:

Families : 20 **Genera : 465** **Species : 2968**

Sl. No.	Family	Kind of snakes	Distribution	Genus	Species
1	Anomalepidae	Primitive blind snakes	Central America and Northern and eastern South America	4	16
2	Leptotyphlopidae	Thread snakes	Southern parts of North America, Central and South America, Africa, Arabian Peninsula and Parts of Middle East	2	95
3	Typhlopidae	Blind snakes	Tropical andsubtropical world Australia	5	235
4	Anomochilidae	Dwarf pipe snakes	Southeast Asia	1	2
5	Aniliidae	South American pipe snake	South America	1	1

6	Cylindrophiidae	Pipe snakes	Sri Lanka / South East Asia	1	10
7	Uropeltidae	Shield tails	South India and Sri Lanka	8	47
8	Loxocemidae	Mexican burrowing snake	Mexico and adjacent parts of Central America	1	1
9	Xenopeltidae	Sun beam snake	Nicobar Islands, South east Asia and Southern China	1	2
10	Boidae	Boas	North, Central and South America Madagascar and Asia, South eastern Europe	11	44
11	Pythonidae	Pythons	South East Asia	7	37
12	Bolyeriidae	Round Island boas	Round Island in the Indian Ocean	2	2
13	Tropidophiidae	Wood snakes or West Indian boas	Central and South America and West Indies	4	26
14	Acrochordidae	Wart snakes	India to N. Australia	1	3
15	Viperidae	Vipers	Most parts of the world	36	259
16	Atractaspididae	Burrowing asps	Africa and the Middle East	11	68
17	Colubridae	Non-venomous and mildly venomous snakes	Most parts of the world	309	1807
18	Elapidae	Coral snakes, cobras, kraits and mambas	Most parts of the world	42	246
19	Hydrophidae	Sea snakes	Seas except the Atlantic ocean	17	65
20	Xenophidiidae		Old world except Madagascar	1	2

13. How many families, genera and species of snakes are there in India?

Families:11 Genera:82 Species:276

Sl. No.	Family	Kind of snakes	Genus	Species
1	Typhlopidae	Worm snakes Non-venomous	3	18
2	Leptotyphlopidae	Worm snakes Non-venomous	1	1
3	Uropeltidae	Shield tails Non-venomous	7	34
4	Xenopeltidae	Burrower Non-venomous	1	1
5	Pythonidae	Large constrictors Non-venomous	1	2

6	Boidae	Small constrictors Non-venomous	2	3
7	Acrochordidae	Coastal / estuarine Non-venomous	1	1
8	Colubridae	The largest group worldwide and in India. Mostly non-venomous. A few rear-fanged venomous.	46	156
9	Elapidae	Similar to Colubridae in many respects, but front-fanged and venomous.	5	17
10	Hydrophidae	Sea snakes Front fanged and venomous	7	20
11	Viperidae	Vipers Front fanged and venomous	8	23

14. Could the rattlesnakes of the Americas have evolved from the pit vipers of south and south-east Asia?

Yes, in all probability. In the distant past, during the Ice Age, the Asian and the American continents were connected by an ice bridge which stretched from the eastern tip of Siberia to Alaska. Animals and plants had a passage from the Asian continent to the American continent through this land bridge (This accounted also for the earliest human arrivals in the Americas 30,000 years ago. Their descendents, the Inuit and Aleut peoples, still inhabit the remoter parts of Alaska). Many snake species including the boas and the pit vipers are believed to have taken this route from Asia to America. Some 10 million years ago, when the last Ice Age ended, the ice bridge disappeared and the waters took over. This stretch of ocean is now called the Bering Strait. (After Vitus Bering (1681-1741), Danish Russian navigator, who led the Russian expedition to determine whether Asia and N. America were at any time connected by land).

The pit vipers from Asia which so migrated to the Americas are believed to have evolved into the rattlesnakes. Interestingly, the habit of vibrating the tail as the rattlesnakes do is found in many of the pit vipers of Asia though they do not have any rattles. E.g. The bamboo pit viper (*Trimeresurus gramineus*), the hump-nosed pit viper (*Hypnale hypnale*), the Himalayan pit viper (*Gloydius himalayanus*) – all found in India and elsewhere in South and South-east Asia. This habit must have marked the beginning of the evolution of the rattle.

The habit of vibrating the tail is found in some species other than pit vipers also. Examples from India: Himalayan keelback (*Rhabdophis himlayanus*), cat

snakes (*Boiga* spp.), striped trinket snake (*Orthriophis taeniurus*), sunbeam snake (X*enopeltis unicolor*).

15. What is special about the snake family colubridae?

The largest family of living snakes, the colubridae, has 1807 species in 309 genera i.e. more than 60 % of the total snake species of the world. Its members have evolved to occupy every possible ecological niche. They are found on trees, on the ground, under the ground and in water. Though there are no sea snakes in the family, some members of the sub family Hamalopsinae are found in coastal and estuarine waters around South East Asia and certain races of *Nerodia fasciata* are found in the coastal and estuarine waters in the Gulf of Mexico. Colubrids have a worldwide distribution and constitute the dominant family wherever they are found except in Australia where they are poorly represented, viperidae being the dominant family. Colubrids have slender, elongated bodies, large scales on the head and large eyes. They are mostly non-venomous, but some are mildly venomous. The mildly venomous secretion from the Duvernoy's gland does no serious harm to humans (See Q & A 224). But, a few of them are dangerous e.g. Twig snake (*Theletornis* spp.) and boomslang (*Dispholidus typus*) found in Africa. Red-necked keelback (*Rhabdophis subminiatus)* in Northeast India and elsewhere). Some of the colubrids lay eggs, some bear live young. They are often referred to as "typical snakes". The colubrids probably had their origin in Asia.

16. Which family of snakes is the most advanced in evolution?

Viperidae. Pit vipers and pitless vipers. They have also the most highly developed venom delivery system. They probably had their origin in Asia.

17. Name some snakes which are known to have become extinct ?

We do not know the full story of the extinction of snake species. Some may have become extinct even before they were known to exist. (The same is the case with many other life forms, particularly the amphibians and insects).

In *The Encyclopaedia of Vanished Species*, 1989, David Day says: "One of the most successful of reptilian orders is the Serpentes, but even here we find Man's activities have resulted in five extinctions during the last few decades". Four of these were West Indian colubrids and these are known to have become extinct atleast by 1975. Apart from direct human persecution, the ravages wrought by the introduced

mongoose was the prime reason. The Jamaican tree snake (*Alsophis ater*) and the related St. Croix tree snake (*A. santicrucis*) of the American Virgin Islands became extinct sometime after the 1960s. The Martinique racer (*Dromicus cursor*) and the St. Lucia racer (*D.ornatus*) which occurred in different islands of the West Indies have not been seen after 1962 and 1973 respectively. The Round Island boa (*Bolyeria multocarinata*) that occurred in the Round Island, off Mauritius, had become 'effectively extinct' by 1974, leaving a single individual with no hope of reproduction (It is not known whether this still survives).

The reason for the destruction of the many endemic species of flora and fauna on this tiny island formed of volcanic tuff (basalt) was the destruction of vegetation caused by the introduction of rabbits and goats in 1844 and the consequent massive erosion of soil.

In some cases of presumed extinction, there is, sometimes, a possibility of the snake surfacing later. A recent example is the Indian egg-eating snake. See Q & A 249.

CHAPTER-II

FORM, STRUCTURE & FUNCTION

18. Why is a snake called 'cold blooded'?

Mammals, birds and reptiles have to maintain their body temperatures within an optimum range to sustain their biological functions and meet behavioural requirements. This is called thermo-regulation.

Snakes, like other reptiles, are 'cold blooded'. This does not mean that the blood is cold but that there is no internal mechanism for regulating the body temperature as in the case of birds and mammals including humans. Snakes and other reptiles regulate their body temperature by choosing their environment. The technical term for this is exo-thermic as opposed to endo-thermic.

While the snake has been able to surmount almost all its handicaps and, indeed, turn some of them like its leglessness to its advantage (See Q & A 57), cold-bloodedness is one handicap that it would have preferred to do without. Its temperature tolerance limit is between 2º C and 44º C. But, because it is cold-blooded and cannot regulate its body temperature internally as birds and mammals do, it becomes necessary for it to frequently choose different temperature gradients in the environment, go into hibernation or aestivation for long periods and so on. Extremes of temperature at either end, i.e. less than 2º C or more than 44º C, may even prove fatal to it (See also Q & A 144). Cold-bloodedness is, however, not entirely without its advantages: it drastically reduces food requirements.

19. What are the main external physical characteristics of snakes?

As mentioned in Q & A 335 there are some other animals that may appear like snakes. But the main external physical characteristics of snakes, as listed below, will help to avoid confusion.

i. All snakes have backbones.
ii. No snake has limbs. (In some primitive snakes like boas and pythons, short spur-like vestiges of the hind limbs can be seen. These serve no purpose in locomotion).
iii. No snake has a pectoral girdle.
iv. No snake has a pelvic girdle. (In some primitive snakes like boas and pythons, vestiges of the pelvic girdle are present).
v. Most snakes have scales on their underside, the ventrals, arranged in a single

row. (Lizards too have ventrals but these are not in a single row. The scales of amphisbaenians are arranged in rings).

vi. No snake has external ear openings

vii. In the skull of the snake, the bones of the upper jaw and lower jaw are not united at the snout, but can move apart sideways.

viii. When handled, snakes are supple and muscular; legless lizards tend to be more rigid.

20. How well do snakes see?

Some snakes have good and far-reaching vision e.g. king cobra, rat snakes, tree snakes. Many snakes are near-sighted, particularly the vipers and the burrowing snakes like the shieldtails and worm snakes. Nocturnal species like vipers have highly sensitive retinas and their vertically elliptical pupils can open widely, enabling good vision even in dim light. The eyes of most snakes are on the sides of the head giving a good lateral view of the surroundings but not much of a forward or binocular (i.e. using both eyes) view. Their binocular view is restricted to about 20º, but there are exceptions, the outstanding one being the green vine snake (*Ahaetulla nasuta*) which has a vision of 330º (See Q & A 26), that is, just 30º short of a full circle. Snakes probably cannot distinguish colours and shapes. This could be more so in nocturnal snakes. While their perception of stationary objects is limited, they respond well to moving objects.

21. Can some snakes see in pitch darkness?

Yes, but this is not exactly 'sight' as we know it. The pit vipers and the pythons have heat-sensitive 'pits' on their faces. These pits evolved independently in the two groups. The infra-red sensitive membrane in the pit can detect a difference of as little as 0.003º C from the ambient temperature or surface temperature and, thus, the night-hunting snake can locate its warm-blooded prey even in pitch darkness and, what is more, strike at it with unerring precision. According to one source, in some species of pit vipers, this may even be as low as 0.001˚C. The 'pit' in the pit vipers is between the nostril and the eye and in the pythons on the upper lip. How exactly the membrane functions is a subject matter of continuing research.

22. Which snakes other than the pythons and pit vipers have facial pits?

The four species of *Corallus*, South American arboreal boas, have large heat-sensitive pits in the labial and rostral scales. The egg-eaters, all belonging to the genus *Dasypeltis*, are represented by three species in Africa and one species – *Elachistodon westermanni* – in India. These have a large pit in the posterior part of their nasal shield. Its function is not known for certain unlike in the case of pythons and pit vipers, namely as thermo-receptors for locating warm-blooded prey in the dark. See discussion in Ch.X 'Questions Awaiting Answers'.

23. Are there pythons which have no heat sensing pits?

Pythons prey on warm-blooded animals like rats and birds and, therefore, the thermo-receptor pits on their upper lips help them to detect and strike at the prey in the dark. But, there is one genus of Australian pythons which includes the black-headed python (*Aspidites melanocephalus*) which has no such sensory pits. One explanation is that these snakes feed on snakes and other reptiles which are cold-blooded and, therefore, a heat-sensitive organ will serve no purpose. But a cold-blooded animal need not always have a cold skin (See Q & A 18).

24. What do the different shapes of the pupil of the eye in a snake signify?

Those with round pupils usually hunt their prey by day. Those with vertical pupils usually hunt by night. But there are exceptions. The cobra and the krait which usually hunt at night or at dusk have round pupils. Many vipers which have vertical pupils also hunt by day. The vine snakes have horizontal pupils. This gives these snakes which hunt by day in foliages a good perception of depth (See Q & A 26).

25. Can snakes turn their eyes in different directions?

Most snakes cannot swivel their eyes, that is, turn them in different directions (independent of the direction of the snout) to search for prey, predators, etc. There are a few exceptions e.g. the south American vine snakes (*Oxybelis* spp.), not to be confused with the Asian vine snakes: (*Ahaetulla* spp.), and the short-tailed python (*Python curtus*) of south east Asia.

26. What are the peculiarities of vision in the vine snakes (*Ahaetulla* spp.)?

The common vine snake (*Ahaetulla nasuta*) or the whip snake is one of the familiar snakes of India, found on trees and bushes and in gardens and even in urban areas.

This slender, long, green snake occurs throughout India except in the Northwest and the Gangetic basin. It has also five relatives in the same genus in India though found in restricted areas. (Four species of 'vine snakes' found in South America belong to a different genus: *Oxybelis*. There is also a 'vine snake' belonging to the genus *Xylodontophis*, called the dog-toothed vine snake, described in 2002 from Tanzania).

The eyes of the *Ahaetulla* species which are all arboreal have many peculiarities not found in most other snakes and, in some respects, in no other snakes.

- The *Ahaetulla* spp. have large horizontally elongated eyes while, in other snakes, the eyes are round. The only other exceptions are the three species of the similarly arboreal twig snakes (*Thelatornis* spp.) of Africa.
- They have horizontal or horizontally elliptical pupils while other species, again with the exception of *Thelatornis* spp, have pupils that are round (in diurnal species) or elliptical-vertical (in nocturnal species) (See Q & A 24). This gives the *Ahaetulla* spp. a three-dimensional vision which helps them in hunting their prey among the foliage. Other snakes have only a two-dimensional vision.
- The eyes of *Ahaetulla* species have a range of vision considerably more than in other snakes -- something like 330º which is just 30 º short of a full circle.
- The eyes are focused by them along their long narrow snout which helps them to judge distance.
- *Ahaetulla nasuta* has a horizontal groove in front of the eyes. This cheek-groove permits straight-forward vision and helps to focus the eyes better. Not all *Ahaetulla* species have this.
- Among snakes, only the *Ahaetulla* spp. can focus the eyes by changing the shape of the lens as birds and mammals do. All other snakes focus by moving the lens forwards or backwards.
- The *Ahaetulla* spp. are, among the very few snakes whose eye has a fovea or fovea centralis. It is present in a few other snake species also, like *Thelotornis* sp. of Africa. The fovea is part of the eye in some diurnal lizards,

one species of turtles and, birds and mammals, including humans. It is located in the centre of the retina in a depression where the retina is thinnest. It is responsible for acuity of vision.

- While watching their prey or predator, the *Ahaetulla* species may be seen to sway their head form side to side. This is in order to bring the image of the object viewed on to the fovea.

27. Are 'blind snakes' really blind?

Not really. Blind snakes, belong to the families Typhlopidae, Leptotyphlopidae and Anomalopidae. They are small, burrowing snakes and mostly lead their lives under the ground and, therefore, eyes are of no use. Consequently, their eyes have degenerated so much that they are more like the eye-spots in primitive organisms (See Q & A 81) which can distinguish between light and dark but nothing more. India has 19 species.

28. The snake has no eye-lids. Yet no dust gets into its eyes. Why?

The snake's eyes are covered by a fixed, transparent, lens, called the 'brille' which is renewed every time the snake renews its skin. Some lizards and some turtles also have this feature.

29. Can snakes hear sounds?

Since the snake does not have the external ear or the tympanum (ear drum) or the tympanic cavity, they are generally believed to be deaf. This is not correct. It has been established that they can hear certain air-borne vibrations. They can also hear (yes, 'hear', not merely sense) certain ground-borne vibrations. How exactly these air-borne and ground-borne vibrations are heard is still being studied. But some facts are known. The snake possesses parts of the middle ear and the inner ear. Sound waves hitting the surface of the temporal area on the sides of the skull are transferred through the jaw muscle to the quadrate bone and the bone columella auris attached to the underside of the cranium, and the vibrations are transmitted to the inner ear. And thus the snake hears the sound.

The snake also has a sensory system along its body which has an auditory function, though how this functions is not clear.

There are also indications that the lungs play a role in the detection of sound vibrations that strike the body and this too is a subject for research. Some scientists believe that the tongue also picks up vibrations.

Generally speaking, snakes can hear vibrations in the range of 200 -500 Hertz or cycles per second both on the ground and in the air. As against this, humans can hear vibrations in the range of 20 – 20,000 Hertz. This means that snakes can hear only some sounds that humans can hear and these are in the low frequencies.

There is a curious expression in Tamil: *Pāmbu sevi*, literally meaning snake ears – and referring to a person with sharp ears, adept at listening into a private conversation. Did the early Tamils know that the snake, through apparently lacking ears, was capable of hearing low-decibel sounds?

30. What sounds do snakes make?

Snakes are generally silent, but not all. Some snakes make a sound from their mouth. Even though snakes have a voice box or larynx just like birds and mammals, they cannot make sounds using it (or vocalize) as birds and mammals do. Some like the cobras and the Russell's viper hiss by forcing out air through the glottis i.e. the vocal chords and the opening in between in the larynx. The royal snakes (*Spalerasophis* spp.), found in parts of N. India, will hiss when threatened. The American gopher snakes (*Pituophis*) and hognose snakes *Heterodon*) can produce very loud hissing sounds by forcefully expelling are from the lungs through the glottis.

The king cobra has occasionally been heard to 'growl' and the sound probably originates from the lung.

The rat snake may sometimes emit a sibilant hiss. When agitated, it may make a groaning or moaning sound.

Pythons have sometimes been heard to utter a low sibilant hiss.

Referring to sea snakes in general and without mentioning any particular species, Wall in his *Snakes of Ceylon*, 1921 quotes Annandale to the effect that they utter "a low gurgling note".

Anslem de Silva in his *Snakes of Sri Lanka*, 2009 refers to a single instance of a common krait hissing when prodded.

Richard Shine (*Australian snakes: A Natural History*, 1993) says about an experience of his in Australia: "One night, having disabled a tiger snake with a blow,

I lifted it to a bare spot alongside a hurricane lamp I was carrying. This snake uttered a shrill call – a succession of high-pitched staccato notes – and was answered from a point perhaps 20 or 30 yards away. I have several times heard the call, but only this time was sure that it came from a snake". Ordinarily, this would be readily dismissed as one of those many tall stories involving snakes. In fact, there is an Australian slang: 'snake yarn'. But, the fact is that Richard Shine is not a name to be slighted. He is an acknowledged authority on Australian snakes, author of many scientific papers and books on snakes and professor of evolutionary biology at the University of Sydney.

Mark O'Shea (*Venomous snakes of the World*, 2005) says about a species of bushmaster (*Lachesis* sp.*)* in Brazil that it is feared so much that if the workers in the field hear its 'whistle', they will abandon work and go back to camp. But he does not confirm whether the 'whistling' is a fact.

Some snakes make a sound with their body. e.g. the rattlesnake 'rattles' with its specially equipped tail. The saw-scaled viper produces a rasping sound by inflating its lungs and rubbing its saw-edged scales together.

Some snakes are known to produce a popping sound from their cloaca.

31. How does a snake smell?

Even though the snake has nostrils and the olfactory system as in many animals, it primarily uses the vomero-nasal system for smelling. The flicking tongue, which is protruded through a groove in front of the mouth, collects scent particles from the ground or air or other surfaces it touches. When the tongue is withdrawn into the mouth, the scent particles are deposited on a structure in the roof of the mouth known as 'Jacobson's organ' where the particles are analysed and the smell is interpreted. This organ was first described in 1809 (in mammals) by the Dutch anatomist Ludwig Levin Jacobson. Some mammals including the elephant have this organ and this special faculty to smell.

(For more on this subject, see Lyall Watson: *Jacobson's organ and the Remarkable Nature of Smell,* 1999).

32. Why is a snake's tongue forked?

This helps in detecting the direction of the scent. The Jacobson's organ inside the mouth on which the forked tongue deposits the scent particles for interpretation is

paired (See Q & A 31). Some lizards like the monitor lizards, also have forked tongues. The paired nostrils in animals including humans also serve the same purpose.

In popular imagination the forked tongue has been considered the most distinctive mark of the snake. In many of the depictions of the snake from prehistoric times, this is its indispensable feature.

33. Can snakes taste food?

As explained in Q & A 32, the tongue in snakes is primarily an organ of smell. In lizards and turtles, reptiles which preceded snakes on the path of evolution, the tongue has many taste receptors. But in snakes, with the modification of the tongue as an ancillary organ of smell, most of the taste receptors have disappeared though some of these still remain. The condition varies from species to species.

34. What is special about the lungs of snakes?

The lungs which are paired and flat in other vertebrates have to be special in snakes because of their elongated, cylindrical body. Most snakes have only one lung—the right lung. In those with a left lung, as in the boas and pythons, it is vestigial and non-functional. The functional lung is very long, sometimes extending to the vent.

35. Can sea snakes breathe under water like fishes?

No. They have to come to the surface to breathe. They remain under water only for about half-an-hour at a time. The lung is the principal organ of respiration as in the land snakes. (However, see Q & A : 36 also). Sometimes, they may remain submerged for upto two hours.

36. Can sea snakes also breathe through their skin?

They can, to a limited extent. Despite their scaly covering, some sea snakes absorb upto one-fifth of their oxygen requirement through their skin, a far greater proportion than any land-dwelling species.

37. Is the lung in the sea snakes anything more than an organ for breathing?

In sea snakes, while the lung is principally an organ of respiration, as in the case of land snakes, it also functions as a hydrostatic organ to help the snake float or submerge as the swim-bladder in fish does.

38. What is the tracheal lung found in some snakes?

Apart from the lungs which all snakes have, some have an additional respiratory organ around the windpipe which is known as the tracheal lung. This gives additional respiratory capacity and has a vital role in sea snakes and in some other species like the snail-eating snakes of genera *Dipsas* and *Sibon* in which the feeding behaviour reduces normal breathing ability.

39. Are snakes slimy to the touch?

No, this is one of the commonest misbeliefs about snakes. Snakes have dry skins. Curiously, even the scientific name of one species embodies this error: *Ptyas mucosa*, the Latin name for the Indian rat snake. *Mucosa* means 'slimy'.

40. What is ecdysis? What is dysecdysis?

Ecdysis is the technical term for skin-shedding in snakes. Dysecdysis is improper or incomplete shedding and happens because of mite infestation, incorrect humidity, malnutrition, dermatitis, trauma or improper handling if in captivity.

41. Why does a snake shed its skin and how often does it do so?

The snake's lifestyle being what it is, the skin is subjected to much wear and tear and, therefore, has to be replaced at periodic intervals. Further, unlike in the case of other animals, the skin of the snake does not 'grow' to accommodate the growth of the body within. Shedding also helps the snake to get rid of the ectoparasites such as ticks and mites attached to the body.

The snake does not actually shed its skin as such. The skin has two layers – the inner dermis and a thinner outer epidermis which is a layer that protects the inner dermis. It is the epidermis that is shed and not the skin as such.

The shedding may be 10 to 15 times in a year in the case of juveniles and 2 to 4 times a year in the case of adults. The first shedding may take place within the first week of their birth. The snake takes about 10 days to complete the shedding. Usually, the skin is shed in one piece but it may be in more than one piece sometimes. This is also known as moulting.

Shed skins are inverted and colourless with the patterns showing faintly.

42. How does a snake shed its skin?

When it is ready to shed its old skin, it rubs its head (beginning with the mouth portion) against a rough surface. The skin gets loosened around the mouth and nose. The snake continues to drag itself through or over rough objects and this pushes the skin from the mouth back over its head. An oily secretion in between the two layers provides lubrication. Slowly, the snake crawls out through the 'mouth' of the skin being shed. The old skin separated from the body will get left behind, inside out.

43. Do snakes shed skin from their tongues?

Yes. This is important for the snake since the tongue has always to remain sensitive to scent particles in the air (See Q & A 31).

44. Why does a snake's colour become dull and the snake become near-blind when it is about to shed its skin?

When the snake is about to shed its skin along with the transparent brille that covers its eyes, an oily substance gets secreted between the old and the new layers of skin (and the old and the new brille). This lubrication facilitates the shedding process. Because of this secretion underneath, the colour and markings on the old skin become dull and the brille becomes opaque.

45. What is the difference between scales and shields on the skin of a snake?

This is a matter of size. The large plate- like epidermal discs on the heads and underparts of most snakes are called shields. The small epidermal discs on the upper part of the body in all snakes and on the heads of some snakes are known as scales.

46. Do the number of scales on a snake's body vary with age or sex?

No. The number of scales counted diagonally along the axis of the body is constant in a species irrespective of age or sex. It will vary in different parts of the body– dorsal, ventral, subcaudal (under the tail). The scale count is important in identifying the snake species (See Q & A 104).

47. Can water seep through the skins of snakes?

Yes. Some species of snakes have permeable skins. Particularly so in snakes like the file snake (*Acrochordus granulatus*) living in the coastal waters and estuaries

and found in India and in neighbouring countries. This has, perhaps, the most permeable skin. This helps to prevent dehydration if the snake gets stranded on dry land at low tide. The semi-aquatic queen snake (*Regina septemvittata*), found in the temperate regions of N. America has a very permeable skin. Different species of sea snakes have skins with different levels of permeability. The skins of most snakes found in dry environments have little permeability.

48. Why are the scales of seasnakes small compared to landsnakes?

This is an adaptation to reduce friction in water.

49. How are the scales of a snake different from that of a fish?

Superficially, both may look somewhat similar, but there is a basic difference. In a snake, the scales are the thickened areas of the skin and an integral part of the skin, that is fused with the skin whereas in a fish, the scales are separate from the skin. The scales of a snake cannot be picked off or scraped off as the scales of a fish.

50. Are there snakes that can change colour?

There are quite a few cases of snakes changing colour with age or in accordance with changes in seasons or for other reasons.

The green python, *Chondropython viridis* of Australia is bright yellow when a juvenile. The reason for the abrupt change in colour from yellow to green is not known.

Australian elapids are known to change colour slightly depending on the seasons. During winter, they take on a darker colour to absorb more heat.

Female Madagascar tree boa, *Sanzinia medagascariensis*, becomes darker in colour when it is gravid in order to absorb more warmth to facilitate quicker development of the embryo.

But the question here is about snakes adjusting colour to their backgrounds, in the manner of the chamaeleon, for instance. Such behaviour is extremely rare. Ernest & Zug (*Snakes in Question*, 1996) say that "only the western rattlesnake (*Crotalus viridis*) has been reliably reported to change quickly (one or two minutes) from light to dark or the reverse".

Little is known also of slow colour changes. The dwarf boas (*Tropidophis*) darken and lighten in response to activity or the daily cycle of dark and light. These colour changes take 60 to 90 minutes.

Whitaker & Captain (*Snakes of India : The Field Guide*, 2004) report one incident involving an Afro-Asian sand snake (*Psammophis schokaki*), a snake uncommonly found in Rajasthan, India. One such snake which was lightly coloured when caught became darker after being kept for three days on a dark verandah.

Reports appeared in June 2006 about the discovery of a colour-changing snake in the swamp forests of Betung National Park in the Indonesia part of Borneo. The venomous snake, half-a-metre long, has been named Kapuas mud snake with the scientific name *Enhydris gyii*. The time taken for the colour-change had not been mentioned.

51. Are there snakes where the young are differently coloured / marked from adults?

Yes. Examples from India: The banded trinket snake (*Elaphe porphyracea*), banded racer (*Argyrogena fasciolata*), black-headed royal snake (*Spalerosophis atriceps*).

52. How are some snakes iridescent?

Some snakes are iridescent, that is, they show constantly changing luminous colours when seen from different angles. Also called 'interference colour'. But this is not a colour. The outer layer of a snake's scale is thin and transparent. When light strikes at it from an angle, the light is split into its spectral components showing different colours and these colours seem to change when the observer's line of vision changes. All snakes with smooth scales have this property to minor and different extents. But the outstanding examples are the two species of the genus *Xenopeltis* found in South and Southeast Asia. The Indian species is the sunbeam snake (*Xenopeltis unicolor*) found only in the Nicobar islands. Another example is the rainbow snake (*Farancia erytrogramma*) found in S. Carolina, U.S.

53. How good are snakes at camouflage ?

Animals have to conceal themselves, atleast on occasions, if they have to effectively escape their predators or successfully capture their prey. If they cannot conceal themselves by the overt act of hiding in their surroundings, they have to make themselves difficult to be noticed. For this, their characteristic form or the outline of the body, and the colour and markings on the body have to be made as

indistinguishable as possible from the surroundings. This is camouflage. Also called cryptic coloration / markings.

Most snakes, like many other animal species, are experts at camouflage. In fact, snakes are more so than most other animals because of their not having a static form or body outline. When a predator searches for a prey or when a prey is on the look-out for a predator, it usually has a visual image in its brain of what it is looking for or trying to avoid (just as we, humans, have when we are searching for a missing article). But a snake assumes different forms depending on whether it is lying coiled up or partly curled up or moving about or lying partly concealed and so on and the predator or prey, as the case may be, fails, therefore, to notice it easily since it does not conform to any particular visual image in the brain.

In some, the colouration itself is such that they merge with the background. They are said to 'hide in full view'. This is particularly true of tree dwelling snakes like the green vine snake, green mamba, etc. whose predominant colour is green. These are also long and slender which, apart from helping their movement in the foliage, help to hide their body, making them resemble branches and vines. In ground-dwelling species, the markings easily merge with the leaf litter around. e.g. Russell's viper and other carpet vipers.

Many snakes have disruptive markings on their body ---- lines, spots, blotches, etc. which break up the body outline so that they become inconspicuous. e.g. Russell's viper.

One of the interesting aspects of camouflage is that, sometimes, an animal may be gorgeously coloured and may be prominently visible against a plain background but will become inconspicuous in its natural surroundings. For instance, the rhinoceros viper (*Bitis nascicornis*) is a flamboyantly coloured snake but becomes almost invisible when lying among the leaf-litter of its natural habitat in the African rainforests.

Some snakes may employ the "psychological trick" (not an apt term because of its anthropomorphic connotation) known as the 'harlequin principle'. In a snake covered by patches and blotches and bands and lines, if some of these have very bright colours, they will stand out from the background skin colour. The intruding animal or the prey will notice the very bright colours readily and, while staring perplexed at such spots, blotches, lines, etc. may fail to notice the rest of the body or the general outline of the snake. Truly, a case of missing the wood for the trees!. The

harlequin snake (*Homeroselaps* spp.) of South Africa and the copperhead (*Agkistrodon contortrix*) of eastern U.S. fall in this category. Among Indian species, this type of camouflage may be seen in the coral snakes.

Another feature that some snakes have, just as is the case with some fishes and frogs, is the "eye-mask". The eye is a most prominent feature of an animal and is easily noticed by prey and predator alike. But, if the eye is made inconspicuous by disruptive markings around or across, it helps to escape detection. Among Indian snakes, many species of trinket snakes (*Coelognathus*, *Elaphe* and *Orthriophis* spp., Gunther's stripe-necked snake (*Liopeltis frenata*), species of bronzeback tree snakes (*Dendrelaphis* spp.) etc. have this feature.

Then there is camouflage by "counter-shading". In many snakes as in many other animal species, the top of the body (dorsal side) is dark or coloured while the underside (or ventral side) is of a light shade. When the snake is in the open, the bright sunlight which shines on the top but not on the underside minimises the colour differentiation of the body as a whole making the three-dimensional effect into a two-dimensional effect and thus the snake becomes less conspicuous.

54. What is polymorphism?

This denotes occurrence of two or more forms in a population of the same species. This may be in colour or in patterns or in size or shape. Examples among Indian snakes: White-barred kukri snake (*Oligodon albocinctus*) Whitaker & Captain (*Snakes of India : The Field Guide*, 2004) say: "Two colour forms (i) Typical form reddish or pinkish – brown back with white, yellow or pale-brown cross-bands outlined in black… (ii) Brown with black or darker brown black-edged cross bands or big, rounded spots… Adults of this form may almost entirely be patternless". Russell's kukri snake (*Oligoden taeniolatus*) has atleast four forms with different markings. Gunther's vine snake (*Ahaetulla dispar*) occurs in two distinct colour phases: bright green and brownish-green.

It is believed that this could be a defence stratagem especially where colour or patterns are involved. Many predators have a mental picture of their prey and when an individual occurs with colours and / or patterns different from such 'search-image' it fails to be noticed and thus escapes predation (see Q & A 53).

55. What is sexual dimorphism?

This denotes cases where the male and female of a species have different colours or patterns or shape or size, etc.

Only in very few snakes does this occur (see Q & A 97). In animal species, this generally plays a role in sexual selection between males and females. Snakes show this phenomenon less than in lizards and much lesser than in birds. Atleast in case of colour this could be because snakes have very limited colour vision (See Q & A 20) and, therefore, colour differentiation may have only a very limited role to play in interaction between the sexes.

56. What are the important skeletal changes that took place during the evolution of the snakes?

The forelimbs, the shoulder (or pectoral) girdle and the breast bone (or sternum) were lost completely. Most snakes also lost the pelvic girdle and the hind-limbs. The primitive snake groups (boas, pythons, wormsnakes) still have remnants of the pelvis and the hind-limbs. In the boas and pythons, the remnants of the hind-limbs are seen externally as two spurs, one on each side of the body in front of the base of the tail. These do not serve any purpose in locomotion (See Q & A 60).

57. What major skeletal features distinguish snakes from mammals?

Unlike mammals, snakes have no sternum (or breastbone), no pectoral (or shoulder) girdle, no collar bone and no forelimbs. The majority of snakes have no pelvic girdles or hind limbs but these remain as vestiges in a few primitive species (boas, pythons). The absence of the breastbone, collarbone and shoulder girdle help in the passage of large-sized prey through the digestive tract (See Q & A 148). The absence of limbs, paradoxically, helps in the quick and smooth locomotion over different kinds of terrains, through dense vegetation etc. and through holes and tunnels and other narrow spaces.

58. Which snake has the largest number of vertebrae?

The Oenpelli python (*Morelia oenpelliensis*). Australia. This has 585 vertebrae. Generally, in snakes, the number does not exceed 400.

In contrast, the human body has a mere 26 vertebrae. Don't we have reason to rejoice, what with the high incidence of slipped discs, cervical spondylitis, lordosis, kyphosis and so on even with the such meagre vertebrae we possess?

59. Which snakes have the smallest number of vertebrae?

In snakes, the 'smallest number' of vertebrae may mean as many as about 180 as in short snakes like the blind snakes.

60. Do snakes have limbs?

No present day snake has limbs though the ancestors of the snakes are believed to have been limbed. The limblessness is an adaptation to suit their life-style. But the pythons even now have a 'spur' (longer in males) on each side of the anal scale and these are believed to be the vestiges of hind limbs. These are of no use in locomotion. During copulation, the male uses the spurs to align its cloaca with the female's and, perhaps, to stimulate the female as well.

61. What are the hypophyses?

These are the spike-like projections pointing downwards from the vertebrae in the snakes. The presence or absence of these, especially in the lumbar region of the vertebral column, is an important diagnostic aid in the classification of snakes.

The egg-eating snakes of India and Africa (See Q & A 249) are peculiar in that their hypophyses have been modified as cutting tools to slice the egg as it passes down the gullet. For this reason, their hypophyses are also known as 'gular teeth'. 'Gular' means relating to the throat. But the hapophyses are not exactly in the throat but lower down, in the gullet or oesophagus. These occur from the 17^{th} through the 38^{th} vertebrae.

The Japanese rat snake (*Elaphe climacophora*) has several anterior facing vertebral hypophyses projecting ventrally into the oesophagus. However, unlike the egg-eaters, this snake ingests the entire egg, the shell and all.

62. Are there hairy snakes?

No, there cannot be. One of the distinctive features of a snake just as of other reptiles is that it has no hair on its body. In a few rare cases, the scales, some or most, are modified to look like hairs. One good example is the African rough-scaled viper *Atheris hispida* which has long and pointed scales with tips raised. This makes the

snake look as if it is covered with hair. For this reason, it is also called the 'hairy viper'.

It is worth retelling here how the cobra was once depicted in Italy as covered with hair. *Cobra de capello* was the name given to the snake by the Portuguese and means 'snake with hood'. J.A. Da Gama in the *Journal of the Bombay Natural History Society* Vol.III Issue 3 (1888) says: "Cobra de capello had once been fabulously described and painted in Italy with more hairs on its body than a bear has. 'Capello' in the Italian language means hair and a hood as well. In giving the description of the cobra, the writer who had never seen a cobra de capello before, said that it had long, thick and grisly hair, and illustrated it so".

63. Are all snakes cylindrical in cross-section?

Mostly, yes. This helps in movement especially through narrow spaces. But there are exceptions, the reasons for which are not always clear. Many heavy-bodied snakes like the larger vipers are dorsally (top to bottom) flattened. This, perhaps, helps to get a better grip on the surface. Many arboreal or tree-living snakes such as tree-boas, (*Corallus* spp.) found in S. America and the many cat snakes (*Boiga* spp.) found in India and also sea snakes are laterally (sideways) flattened. This streamlines the body and facilities quick motion.

But, why are some like the African file snakes, the *Mehelya* spp. found in Sub-saharan Africa, the America indigo snake (*Drymarchon corais*), and the banded krait (*Bungarus fasicatus*) found in parts of India and neighbouring countries triangular in cross-section? There is no known explanation.

An even more peculiar case is that of the tentacled snake (*Erpeton tentaculum*) found in Thailand and Indochina which is almost rectangular in cross-section.

64. Which aquatic snake has twice as much blood as a land snake of the same size?

The file snake (*Acrochordus granulatus*). It is seen all along the Indian coast and estuaries in India (also in South and Southeast Africa) is not a true sea snake. The large quantity of blood and the high count of red blood cells make it possible for this aquatic snake to store up enough oxygen in the blood and thus to remain submerged for more than two hours at a time. This is as against about half-an-hour at a time in the case of true sea snakes after which they have to come to the surface to breathe (See Q & A 35)

65. How many teeth do snakes have?

The number varies; but some species have more than 200 teeth.

66. What is the significance of the reptilian jaw (including that of snakes) in evolution?

In the course of evolution, three bones that form part of the hinge of the reptilian jaw, the articular, the quadrate and the columella auris got incorporated into the middle ear of the mammals as a three-bone link, the malleus, the incus and the stapes (the hammer, the anvil and the stirrup). These small bones of the middle ear give mammals a more acute sense of hearing than other vertebrates. (See Q & A 29)

67. Why do snakes often move their throat up and down as frogs do?

Frogs do this to pump air into the lungs. Snakes do this to draw air into the mostrils to enhance their sense of smell (in addition to the use of the forked tongue – (See Q & A 32).

68. What is special about the kidneys of snakes?

The kidneys in snakes are generally elongated. They are not side by side as in other vertebrates but one below the other (i.e. length-wise).

69. Do snakes produce urine?

No, snakes do not excrete their nitrogenous waste in the form of urine. The nitrogenous waste is voided along with the rest of the excreta in the form of uric acid, a semi-solid waste material.

70. Which are the only snakes that can produce body warmth to any significant extent?

Snakes are cold-blooded creatures. (See Q & A 18). They are generally incapable of producing body heat as warm-blooded animals can. The only confirmed exceptions are the Indian python (*Python molurus molurus*) and the Burmese python (*Python molurus bivittatus*) and, that too, only when they are incubating their eggs. (See Q & A 189). The muscular contractions which produce the heat are easily visible to us. Some authors say that snakes of the *Farancia* and *Leptophis* species also incubate their eggs (See Q & A 189).

71. Are sea snakes found in the deep sea or in shallow waters?

Generally in the shallow waters. But they can dive down to a depth of 300 ft. A man, unequipped, can dive down to a depth of 500 ft. by holding his breath.

72. Can sea snakes be found other than in the sea?

Among Indian sea snakes, the yellow-lipped sea krait (*Laticauda colubrina*) has sometimes been seen in tidal rivers. The hook-nosed sea snake (*Enhydrina schistosa*) and the short sea snake (*Lapemis curtus*) occur in estuaries also. The annulated sea snake (*Hydrophis cyanocinctus*) and the Malacca sea snake (*Hydrophis caerulescens*) can be found in mangrove swamps.

Elsewhere, there are even instances of sea snakes being found in fresh water or brackish water lakes if the lakes are open to the sea at any time for varying durations. *Hydrophis samperi*, a sea snake endemic to the Philippines, is confined to a fresh water lake in Luzon near the coast. *Laticauda crockeri* is confined to a brackish water lake on Renault island in the Solomons.

A species of sea snake is found permanently residing in the fresh water Lake Taal in the Philippines even though the lake is land-locked and the sea is some 10 k.m. away. The ancestors of the snake must have entered the lake when, sometime in the distant past, it was linked to the sea and later adapted themselves to a fresh water regime when the link was cut off permanently.

73. Sea snakes are likely to swallow a lot of sea water. Does this not result in heavy concentration of salt in the blood?

Sea snakes have 'salt glands' in the mouth which absorb excess salt from the body fluids. The concentrated salt solution so formed is ejected from the mouth.

Sea snakes are not alone in this. Sea birds get rid of the excess salt through special nasal glands at the base of the bill, dribbling the saline solution. The giant petrel has a prominent 'tubenose' for this purpose. Marine iguanas, a species of large lizards, have special glands in the nasal cavity which excrete excess salt; the lizard vigorously shaking its head from time to time to help this process.

74. What is meant by the 'bends' and how do sea snakes avoid this?

When an air-breathing animal dives deep, the water pressure compresses the air in the lungs. This forces more air from the lungs to dissolve in the blood. While

this assists more of oxygen-intake into the blood, it also results in a greater nitrogen build-up in the blood since air is four-fifths nitrogen. Nitrogen in the blood has no beneficial function. The level of nitrogen accumulation may get very high, depending on the duration of submersion. When the animal surfaces and the pressure is released, the nitrogen comes out of the blood and forms bubbles in the blood stream that can cause severe distress, crippling or even death. This is called 'bends'. This can happen to human divers also when it is also called 'caisson disease'.

There are many explanations as to how sea snakes avoid this. The sea snakes may remain at the surface only long enough to take a quick breath and then submerge again before bubbles are formed in the blood. Secondly, since the blood absorbs nitrogen only from the air in the lungs and since sea snakes also breathe through the skin to some extent, the nitrogen intake into the blood may get reduced. Thirdly, some of the excess nitrogen in the blood may pass into the water through the skin by a process of osmosis.

75. Are all sea snakes helpless on land?

Most, yes. But a few e.g. the annulated sea snake (*Hydrophis cyanocinctus*) and the short sea snake (*Lapemis curtus*) can crawl slowly on land; the yellow-lipped sea krait (*Laticauda colubrina*) can crawl well on land.

76. Can land snakes swim?

Most land snakes, including tree-living and burrowing forms, can swim quite well.

77. In measuring a snake, how can one distinguish between the body and the tail?

The cloaca or the vent on the underside marks the division between the body and the tail.

78. What functions are performed by the tail in snakes?

The snake being structured economically, it has to use its body parts to maximum advantage.

In most snakes, the tail helps in locomotion whether on land or in the water. In the arboreal species, it is curled around branches to get a good grip. This facilitates both climbing and also reaching out to the prey which may be at a considerable distance or even flying. In some snakes, the tail is used for what is known as agonistic (=conflict–related) actions such as the following: In some, the tail is blunt and shaped

like the head which distracts the predator's attention from the real head (e.g. red sand boa, See Q & A 113 & 296). Some vibrate the tail rapidly as a threat display, this action being perfected in the rattlesnakes (See Q & A 115). Some raise the tail as distraction display (e.g.slender coral snake – *Calliophis melanurus*) and this is very effective when the tail is brightly coloured (See Q & A 113). Some snakes, when handled, thrash and whip the tail wildly and this may be enough to put off the intruder. Some may jab the tail into the perceived enemy (e.g. *Farancia, Typhlops.* See, however, Q & A 128). Some use the tail to lure their prey (See Q & A 158). The uropelts use the tail to plug their burrow (See Q & A 257).

79. Are there snakes that can 'drop' their tails like some lizards do to escape adversaries?

When seized by an enemy, some lizard species 'drop' the tail, the severed tail twisting and turning as if having a life of its own, leaving the predator totally confused and allowing the lizard to escape. 'Lose your tail, but save your head' seems to be the motto. This ability, known as autotomy, is found, for instance, in the all-too familiar geckos or the house lizards, the skinks and the anguids (which include the glass snakes (See Q & A 370)). A lizard that indulges in such self-mutilation may grow a new tail but it will be an apology for the original. Though a regrown tail is not a thing of beauty, it more or less performs the functions of the original. But the main drawback is that a lizard with a re-grown tail cannot repeat the trick.

Some snakes are capable of losing their tail-tips under duress but they are incapable of regrowth. (See Desmond Morris: *Animal Watching,* 1990). This has been reported in a few species belonging to the genus *Scaphiodontophis* (small snakes from Central America) and also some species of sand snakes (genus: *Psammophis*). Inida has four species of *Psammophis* but there is no report of this behaviour in the Indian species..

No Indian species of snakes is known for certain to resort to autotomy. However, Whitaker & Captain (*Snakes of India : The Field Guide,* 2004) say about the Khasi hills keelback (*Amphiesma khasiena*), a common, non-venomous snake of the Northeast: "curiously, most adults and juveniles have missing tail tips". Whether this is because of tail-dropping or for some other reason is not known.

80. What is peculiar about the tails of sea snakes?

Most sea snakes have paddle-like laterally flattened tails. This helps movement in water.

81. Is there anything peculiar about the tails of any of the sea snakes (apart from their being laterally flattened)?

Harold Heatwole and Kenneth Zimmerman found in experiments with olive sea snakes (*Aipysurus laevis*) that the tip of the tail of this snake, which frequents coral reefs, is photo–sensitive, that is, sensitive to light. See Heatwole: *Sea Snakes*, very little research has been done on this. This is a very challenging area for research since the complex structure of eyes in the animal kingdom is supposed to have had its origin in two light-sensitive spots in certain primitive organisms. In the beginning, the spots could distinguish between light and darkness only, but over millions of years, they evolved into complex structures that could distinguish movement, then form and then colour. So, why should this particular snake which has regular eyes on its head also have these light-sensitive spots on the tail? Will it evolve into a snake with both foresight and hindsight, in a manner of speaking?

82. What is the egg-tooth?

This is a hard protrubrance that the embryo in the egg grows on its jaw with which it breaks open the shell from inside before emerging. Embryos of birds also have this, on their beaks.

83. How does the heart of snakes differ from that of crocodilians and mammals?

Snakes have three-chambered hearts while mammals and crocodilians have four-chambered hearts.

84. Which snakes have the longest venom glands compared to body size?

There are 11 species of coral snakes of genus *Calliophis* distributed in India, Indo China and Southeast Asia. They are small to medium-sized snakes with very slender bodies and small heads. The venom glands are huge, extending to about one-third of the length of the body.

India has four species: slender coral snake (*Calliophis melanurus*), striped coral snake (*Callliophis nigrescens*), Beddome's coral snake (*Calliophis beddomei*) and Bibron's coral snake (*Calliphis bibroni*). Northeast India has the rare

Macelelland's coral snake but now assigned to a different genus: *Sinomicrurus macclellandi*.

Coral snakes are generally inoffensive. Effect of bite poorly known, but possibly dangerous to humans. Whitaker and Captain (*Snakes of India: The Field Guide*, 2004) say of *Calliophis melanurus*; "Bites cause swelling and itching".

85. Which venomous snake has the largest fangs?

The gaboon viper (*Bitis gabonica*) of Africa has fangs nearly 5 cm. in length. As against this, even among vipers which generally have large fangs, the Russell's viper (*Daboia russelii*), found in India and elsewhere, has a maximum fang-size of 2 cm. only. In kraits and sea snakes they are as short as 2 to 4 mm, in cobra 5 to 10 mm and in king cobra 8 to 10 mm.

86. What is the difference between the fangs of a cobra and a viper?

The fangs of the cobras, kraits, coral snakes and the sea snakes are fixed and small in size and always erect. The vipers have fangs which are anchored to a 'rotating' jaw bone. These fangs are comparatively long and, when not in use, are kept folded backward and upward against the roof of the mouth. When the viper makes a hit, the mouth opens very wide –nearly 180º -- and the fangs get erected.

87. How are the fangs of spitting cobras different from that of other cobras?

In the other cobras, the venom is ejected through a slit-like opening a little above the fang's tip. In the spitting cobras, the opening is about midway up the fang and it is smaller and more circular. The inner canal conveying the venom takes a 'L' turn near the opening. This facilitates the stream of venom being directed outward and upward as it leaves the fang orifice. The forcible ejection of venom from the fangs is further assisted by a hissing which serves to spray the venom for a distance of about 3 m.

88. What is the difference between front-fanged and rear-fanged snakes?

Most of the venomous snakes (e.g. cobras, kraits, sea snakes) have their fangs for venom delivery located in the front of the upper jaw. They have hollow, sharp-pointed, front fangs connected to venom glands which are modified salivary glands. But there are some colubrid snakes – which have their fangs located in the back of the upper jaw. These are the back-fanged or rear-fanged snakes. There is no venom gland in these snakes. However, the secretion of the Duvernoy's gland (which is also

a modified salivary gland) is delivered through the grooves on these rear fangs (not injected as in the case of the hollow front fangs). This secretion is toxic enough to paralyse the prey. But in humans it causes only mild irritation. Hence, they are called 'mildly venomous'. (Examples from India : The vine snakes (*Dryophis* spp.), the cat snakes (*Boiga* spp.), etc.)

A few of the back fanged snakes are, however, venomous: the boomslang (*Dispholidus typus*) and the twig snake (*Thelotornis capensis*), both found in Africa, the Asian tiger snake or Yamakagashi (*Rhabdophis tigrinus*) found in Japan and South-east Asia.

The injection of poison to deter / paralyse / kill prey / adversaries has a significant place in the evolution of species. It has been pointed out that injecting poison hypodermically through a sharp- pointed body part has evolved atleast ten times independently, apart from in snakes – in Jelly fishes and their relatives, spiders, scorpions, centipedes, insects, molluscs (cone shells), the shark group (stingrays), bony fish (stone fish), mammals (male platypuses) and plants (stinging nettles).

Man takes pride in his various discoveries and inventions, but it is a sobering thought that the principles underlying many of these had been developed in animal species, often in very early stages of evolution: examples are aeroplanes (birds), paddle boats (sea snakes), radar (echo-locating bats), electrolocation (the duck billed platypus), dams (the beaver), parabolic reflector (limpets), heat-sensors as location-finders (pitvipers and pythons), jet propulsion (squids), fishing line (angler fishes) and hypodermic needles (scorpions, snakes, etc.). Even the wheel, claimed as mankind's greatest invention (Mesopotamia, 4^{th} millennium B.C.) had been anticipated by the Rhizobium bacteria.

(Perhaps, what some think is mankind's second greatest invention has no parallel in the animal kingdom: sliced bread!).

89. Does the snake 'sting' with its tongue?

This is a popular misbelief because of the snake frequently sticking out its forked tongue. The tongue is flicked in this manner to smell (See Q & A 31).

90. How does a snake move forward?

The snake has numerous ribs loosely attached to the vertebrae which may be as many as 400 pairs or even more. These ribs are mobile. Muscular action enables the ribs to move forward and then the overlapping ventral shields are also carried

forward taking advantage of the irregularities of the surface, and the rougher the surface the faster the movement. The undulations of the body in a lateral manner also aid the progression. (See also Q & A 117).

91. Can snakes crawl backward?

No. Earthworms and some other legless animals can crawl backward but not snakes. However, snake entering a burrow can come out through the same burrow. This it is able to do because it can turn the front half of its body rearward.

According to some accounts, corals snakes can crawl backward. This needs confirmation.

92. Can a cobra move forward to any appreciable extent with its fore-body raised in the threat posture?

No. But a king cobra can.

A cobra raises one-fifth to one-third of its body-length in the threat posture. It may be half the body length in the case of a young one.

Incidentally, a threatening cobra never bites upward; its strike is not directed higher than the level at which the mouth is in the reared-up position.

93. Can snakes extend their body forward without support?

This is known as cantilever ability and it is most developed in arboreal species which can extend more than half their body length without any support (a common example from India and elsewhere: green vine snake – *Ahaetulla nasuta*). This ability is very necessary for the tree snakes to move from branch to branch and to catch prey which may be at a distance in the foliage or even flying. Some terrestrial snakes like the rat snake (*Ptyas mucosus*) also have this ability to a limited extent. This ability is extremely limited in aquatic species.

Special musculoskeletal features of the vertebral and associated epaxial muscles account, in part, for the superior cantilever ability of some snakes.

In a paper published in *Herpetologica* 59 (1), 2003, Yu-Chung Lin *et al.* hypothesized that the posterior part of the functional lung may contribute significantly to the cantilever ability.

94. Which snake species best illustrate the evolutionary principle of convergence?

Animals living in different parts of the world sometimes show striking similarities in appearance or in some unusual behavioural characteristics in defence,

feeding, reproduction etc. Sometimes, this may be because of shared genes from a common ancestor when it is called 'parallel evolution'. But, sometimes, vastly separated groups of species come to resemble each other in appearance, habits etc. more closely than their common ancestors. This is called 'convergent evolution' and it is occasioned by similar habitats and similar ecological requirements necessitating or facilitating similar body shapes and colours and similar abilities and similar life-styles.

Australia provides the best examples of this phenomenon. Most mammals of the world are placental – they give birth to fully developed young ones. But in North and South America, and more so, In Australia, there are marsupial mammals – they give birth to immature young which then develop to their full form in a pouch on the mother's underside, the kangaroo being the best known example. Some of these marsupial mammals have, by developing body forms similar to some placental mammals, come to successfully occupy niches similar to those filled by placental mammals elsewhere in the world. Thus, for instance, the thylacine or Tasmanian tiger (no tiger this) in Australia is very similar to the wolf elsewhere; the quoll, a spotted carnivore in Australia, is very similar to the ocelot, a spotted and striped wild cat of North and Central America; the numbat, an Australian anteater is very similar to the giant anteater elsewhere.

There are many examples of convergent evolution in snakes. But the oft-quoted example is the emerald tree boa (*Corallus continus*) of South America and the green tree python (*Chondropython viridis*) of Australia. Both are boids but are not very closely related and are placed in different sub-families. But both look alike: same size, same body shape and same green colour. The young of both have different colours from adults. Both behave in the same fashion, draping themselves over horizontal branches and hanging with their head down, waiting to ambush any prey that passes by.

Australia again: it has been observed that in several aspects of morphology, ecology and behaviour, the taipan (*Oxyuranus scutallatus*), a large, slender elapid of coastal tropical Australia, is strongly convergent with an African elapid, the black mamba (*Dendroaspis polylapis*). Yet another example, again from Australia, is the death adder (*Acanthophis* spp.) of which there are three species. Most venomous snakes of the world are either elapids (cobras, kraits, coral snakes, etc.) or viperids (rattlesnakes and other pit vipers, Russell's viper etc.), the two families sharply

differing from each other in body shape, fangs and in feeding behaviour. The elapids are generally slender with small heads and short, fixed fangs. The viperids are thick-set with thick, triangular heads and long fangs on rotatable maxilla. The elapids move about searching for their prey; the viperids are generally sit-and-wait ambushers. Australia has a very large population of elapids but no vipers. But, most interestingly, one group of elapids of the genus *Acanthophis*, with three species, i.e. the death adders, have occupied the vacant ecological niche and, in the process of their evolution, have come to remarkably resemble vipers in their morphology and feeding behaviour. Their very name 'death adder' embodies the mistaken identification because they are not adders at all, adder being another term for viper. Like vipers and unlike elapids, they have thick-set bodies, thick triangular heads, vertical pupils, partly rotatable maxilla-prefrontal complex and long fangs. Like vipers they are sit-and-wait ambushers. (See 'adder' and 'death adder' in Q & A 268).

Another example of convergence is the presence of heat-sensitive facial pits with functional similarities both in pit vipers and pythons (See Q & A 21) and also in the egg-eater snakes and *Corallus* spp.(See Q & A 22)

Yet another interesting case of convergence is the vine snakes of the genus *Ahaetulla* found in India and Sri Lanka and neighbouring countries and the parrot snakes of the genus *Leptophis* found in S. America. The *Ahaetulla* species of which six occur in India are mostly green in colour. They are long, slender-bodied, arboreal snakes. The arboreal parrot snakes of South America, long, slender-bodied and bright green in colour look very similar to the vine snakes. The resemblance is particularly striking between the green vine snake (*Ahaetulla nasuta*) and one of the species of parrot snakes (*Leptophis ahaetulla*) even to the extent of their threat display of opening their mouths wide and inflating the region of the neck. Note that the generic name of the vine snake has been conferred on the parrot snake as its specific name. 'Ahaetulla' is a word of Sri Lankan (Sinhalese) origin (See Q & A 295). In fact, the scientific nomenclature of these two groups of snakes has had a chequered history. See J.M. Savage: "Two centuries of confusion; The history of the snake name Ahaetulla" in the *Bulletin of the Chicago Academy of Sciences*, vol.9, No.11, Mar. 7, 1952.

95. Do the pheromones of snakes serve a purpose other than the usually stated ones?

Pheromones are chemicals secreted in minute quantities by certain organisms and released into the environment to act as signals to influence the behaviour of other organisms of the same species. This is extensively used by insects, particularly ants and termites, and also by many vertebrates including snakes (but, strangely, not by birds). Its function is mainly to promote aggregation as in the social insects, to act as markers for trails leading to food sources as commonly noticed in ants, as signals to warn against danger and for sexual attraction. This is generally believed to be confined to behaviour that is intra-specific (within the same species) and does not extend to behaviour that is inter-specific (between species).

Snakes are known to use pheromones secreted by their cloacal glands, particularly by females in the breeding season to attract males to track them.

Chris Mattison (*The New Encyclopedia of Snakes*, 2007) makes an interesting observation on how certain blind snakes (See Q & A 27) which feed on termites and their eggs escape being bitten by the ever-vigilant and ferocious soldier-termites in the colony. He states that it is probable that these snakes produce a pheromone similar in properties to that produced by the termites which has a pacifying effect on the soldiers. If this observation is confirmed, it will be a unique case of use of pheromones in the animal kingdom to influence inter-specific behaviour.

As Edward O. Wilson, the noted entomologist who had researched on pheromones in ants, says in a paper in *Scientific American*, 208 (5) anthologized in his *Nature Revealed*: *Selected Writings*, 2006: "It is apparent that knowledge of chemical communication is still at an early stage. Students of the subject are in the position of linguists who have learned the meaning of a few words of a nearly indecipherable language. There is almost certainly a large chemical vocabulary still to be discovered".

96. How does the breeding age of snakes differ from that of mammals and birds?

Birds and mammals begin to breed only after they have finished or almost finished growing. But snakes start breeding even from an intermediate stage. Though they continue to grow in size throughout their lives, they reach sexual maturity when they are about half their potential maximum size. This may range from less than one year to four or five years.

Males in snakes mature earlier than females, generally. In some species of snakes, males and females may mature at the same age. But no case is known in snakes of females maturing earlier than males. The reason for this may be that a larger-sized female can produce more eggs or more young.

Live-bearing species generally mature earlier than egg-laying species.

97. How can the sex of a snake be determined?

In many snakes, the sexes differ in size, and this knowledge will help. For instance, in cobras, rat snakes and kraits, the male is larger than the female; in pythons, pit vipers and striped keelback, the female is larger than the male. An experienced person can also differentiate the sexes by noting the tail base and the tail-length since the male, generally, has a thicker tail base and a longer tail (This is because the male copulatory organs or the hemipenises lie inverted inside the base of the tail) (See Q & A 180). A trained person can also sex the snake by gently inserting a lubricated probe inside the cloaca (The probe is a smooth, rounded, blunt stainless steel rod measuring about 20 cm.). In a female, the probe generally passes to a depth less than in a male.

98. Are there snakes much smaller than pythons which constrict their prey?

The sand boas, which are only about 50 – 75 cm on an average, kill their prey by constriction just like the large pythons and boas. Three species are found in India: the common sand boa (*Gongylophis conicus*), red sand boa (*Eryx johnii*) found throughout India and neighbouring countries and the Whitaker's boa (*Eryx whitakeri*) found along the Western Ghats and endemic to India.

The trinket snakes (some? all?), some of which are only 75 cm long, also kill by constriction. There are some others also.

99. Compared to birds and mammals, what is special about the rate of growth of snakes?

Birds and mammals stop growing once they reach a particular size. But snakes are believed to grow continuously, though at decreasing rates, throughout their lives.

100. Which is the longest snake reported?

A yellow anaconda (*Eunectes notaeus*) killed by Col. Percy Fawcett of the Royal Artillery in Brazil in 1907 was reported as measuring 18.9 m. This is as against

its normal length not exceeding 9 to 10 m. There have also been similar reports of very long anacondas being shot. Most of these accounts including that of Fawcett are viewed with cynicism and considered as, perhaps, on a par with anglers' tales.

101. Which is the largest snake of the world and of India?

'Largest' is often taken to mean 'longest'. But if girth or bulk is also taken into account, the largest is the green anaconda (*Eunectes murinus*) of South America. Grows to atleast 9 m. (See Q & A 268).

If length alone is considered, the reticulated python (*Python reticulatus*) tops the list. (It is also bulky but thinner than the anaconda). Maximum length 10 m. In captivity, 9 m. is not unusual. Found throughout South and Southeast Asia including India.

In length alone, the second place goes to the green anaconda (See above).

Next comes the African python (*Python sebae*). African continent. Reaches an adult length of 3 – 3.7 m. The longest reported was 8.5 m., killed in Green Hill, Cairns in 1948.

Next comes the Indian rock python (*Python molurus*). South Asia including India. Maximum length 7.6 m. Average 3 m.

India has no anaconda but has the Indian rock python (*Python molurus molurus*) and the reticulated python (*Python reticulatus*). The former is found throughout India (Myanmar has a different subspecies (*Python molurus bivittatus)*). The Indian population of *P. reticulatus* is confined to the Nicobar Islands. There are unconfirmed reports about its occurrence in Northeast India.

102. Which is the smallest snake in the world and in India?

The brahminy worm snake (*Ramphotyphlops braminus*). Average length:12.5 c.m. Maximum length : 23 c.m. Found throughout the world.

According to a report in the Aug.2008 issue of *The Monitor* (Newsletter of the Hoosier Herpetological Society), Blair Hedges, an American evolutionary biologist, has described a still smaller related species from Barbados in the Caribbean, measuring only 10 c.m. He has named it *Leptotyphlops carlae* after his wife Carla.

103. Are there flying snakes?

Yes. There are five species of flying snakes found from western India to the Indonesian archipelago. Of these, two occur in India: the ornate flying snake

(*Chrysopelea ornata*) found in the forested hills of southwest India and the forests of northeast India and the paradise flying snake (*Chrysopelea paradisi*) found in the Narcondam island of the Andaman group of islands.

Flight in animals is of two kinds: powered or flapping flight and gliding flight. In powered or flapping flight, the animal can not only propel forward in the air but also lift the body from a lower to a higher altitude. Examples are bats (the only mammal that can do so), birds and insects. In gliding flight, the animal glides or 'parachutes' from a higher to a lower altitude by spreading out the membranes stretched between their skeletal parts. Examples are flying fishes, flying frogs, flying lizards, flying squirrels, flying lemurs etc.

Flying snakes also belong to the latter category but there is a significant difference. They have no membranes extending from their body as in the other cases. These arboreal or tree-living snakes climb to a high branch and then leap from there in the desired direction. While doing so, they extend their ribs (like a cobra does with ribs in the region of its neck when it 'hoods'), thus flattening their body and pull in the underside to make the underside concave. This enables them to glide through the air in a forward direction. While gliding thus, they undulate the body making lateral slithering movements and, by this, they can turn in the air in different directions and turn even 90˚, that is, in a right angle. They can cover more than 100 m. in the air at one go.

The flying snakes are uncommon or rare. They are mildly venomous.

104. How can snake species be identified?

Most laymen make the mistake of trying to identify a snake entirely by colour or patterns on the body. No doubt, these often give a general idea of the snake. But, it is necessary to remember that colour in many species of snakes is variable even though some of the colour forms may be predominant. The patterns on the head or the body can also be variable. Added to these is the problem that, in some species, the young are different in colour and markings from the adults. The general body conformation and the head-shape are important diagnostic features. In any particular species of snakes, the number, shape, size, disposition and nature of the scales on the head and the body (both upper and undersides) are fairly constant. In closely related species, when differences in scalation may not be marked, dentitional characters (i.e. the arrangement of the teeth) are important. The number and arrangement of scales in

a particular snake are the same throughout its life. Full data on the scalation and dentition of different species of Indian snakes can be found in standard texts on snakes such as by Malcolm Smith (*The Fauna of British India – Serpentes*, 1943), Mahendra (*Handbook of the Snakes of India, Ceylon, etc.*, 1984), Whitaker & Captain (*Snakes of India—The Field Guide*, 2004) and R.C. Sharma (*Handbook – Indian Snakes*, 2003). The serious student will do well to study these.

But identification of a snake, particularly a live one and, even more so, when it is a venomous snake, by a study of the scalation and dentition is certainly not easy for the layman except in very prominent cases of scale arrangements and shape of scales. Therefore, some idea of the general colour forms and the predominant patterns on the skin may be a rough and ready guide for laymen to avoid gross errors. Apart from the appearance, the behaviour of the snake, particularly its threat display, the place where it is seen *etc*. are also helpful in recognizing the snake. For more on these aspects, see texts like the ones mentioned above.

105. How long do snakes live?

In the very nature of things, information on this in respect of free-living (wild) snakes is scanty or nil. Unless snakes are marked at birth itself and their life-history in the wild closely monitored, a not-easy proposition, and a significantly large population covered under this process, no reliable data can be collected. Even so, Carl Earnest and George Zug, (*Snakes in Question*, 1996) in a summary of the existing data, give the following figures:

Timber rattlesnake (*Crotalus horridus*)	: about 25 years
European asp (*Vipera aspis*)	: about 18 ”
Ringneck snake (*Diadophis punctatus*)	: about 17 ”
American racer (*Coluber constrictor*)	: about 9 ”
Common garter snake (*Thamnophis sirtalis*)	: about 9 ”
Rough green snake (*Ophiodrys aestvus*)	: about 8 ”
Japanese four-lined ratsnake (*Elaphe quadrivirgata*)	: about 8 ”
Oriental tiger snake (*Rhabdophis tigrina*)	: about 6 ”
Hook-nosed sea snake (*Enhydrina schistosa*)	: about 4 ”

More of data is available in respect of captive individuals. But, the longevity of a captive individual is not a reliable index of longevity in the wild. With proper

feeding and veterinary care, absence of natural enemies and freedom from stress, animals in captivity live longer than in the wild. *Per contra*, captive-bred individuals are likely to live for a shorter period if there is in-breeding depression and consequent genetic deterioration. These aspects apart, it is impossible to determine the average longevity of a species as such from captive records. At best, the age of the longest lived individuals can be ascertained and, that too, provided they were born in captivity.

Clifford H. Pope (*The Reptile World*, 1964) quotes from Major Stanley S. Flower who made an investigation from Zoo records in 1937 and found that 10 kinds of snakes had survived twenty years or more in zoos. Flowers gave the following figures (no information on whether captive-born):

Anaconda (*Eunectes murinus*)	: 28 years
Boa constrictor (*Constrictor constrictor*)	: 22 - 23 ”
Reticulated python (*Python reticulatus*)	: 22 - 23 ”
European leopard snake (*Elaphe situla*)	: 22 - 23 ”
Long-nosed viper (*Vipera ammodytes*)	: 22 - 23 ”
John’s sand boa (*Eryx johnii*)	: 20 - 21 ”
Madagascar tree-boa (*Sanzinia madagascariensis*)	: 20 - 21 ”
Madagascar boa (*Acrantophis madagascariensis*)	: 20 - 21 ”
Indian python (*Python molurus*)	: 20 - 21 ”
Water moccasin (*Agkistrodon piscivorous*)	: 20 - 21 ”

C.B. Perkins of the Zoological Society of San Diego, California, gives the following figures in 1951 as a result of his scrutiny of U.S. zoo records (*Vide* Pope, C.H. *Snakes Alive and How They Live,* 1949).

Anaconda (*Eunectes murinus*)	: 28 years
Rainbow boa (*Epicrates cencbris*)	: 27 ”
Black-lipped cobra (*Naja melanoleuca*)	: 23 ”
Corn snake (*Elaphe guttata*)	: 21 ”
Reticulated python (*Python reticulatus*)	: 20 ”

Douglas R. Mader, in his book, *Reptile Medicine and Surgery*, (1996 / 2006) gives the following figures of longevity of some selected snakes in captivity:

Asian sunbeam snake, *Xenopeltis unicolor*	12 years
Neotropical sunbeam snake, *Loxocemus bicolor*	32 ”
Dumeril’s ground boa, *Acrantophis dumerili*	26 ”

Children's python, *Antaresia childreni*	24 ”
Woma, *Asidites ramsayi*	16 ”
Black-headed python, *Aspidites melanocephalus*	22 ”
Boa constrictor, *Boa c. constrictor*	40 ”
Solomon island ground boa, *Candoia carinata*	16 ”
Rubber boa, *Charina bottae*	26 ”
Coastal rosy boa, *Charina trivirgata*	31 ”
Emerald tree boa, *Corallus caninus*	19 ”
Columbian rainbow boa, *Epicrates cenchria maurus*	31 ”
Smooth sand boa, *Eryx johni*	31 ”
Anaconda, *Eunectes murinus*	31 ”
Brown water python, *Liasis mackloti fuscus*	26 ”
Carpet python, *Morelia spilota variegata*	19 ”
Green tree python, *Morelia viridis*	20 ”
Short-tailed python, *Python curtus*	27 ”
Burmese python, *Python molurus bivittatus*	28 ”
Indian python, *Python m. molurus*	34 ”
Ball python, *Python regius*	47 ”
Reticulated python, *Python reticulatus*	29 ”
African rock python, *Python sebae*	27 ”
Northern copperhead, *Agkistrodon contortrix mokeson*	29 ”
Western cottonmouth, *Agkistrodon piscivorus leucostoma*	26 ”
Jumping pit viper, *Atropides nummifer*	19 ”
Eyelash palm pit viper, *Bothriechis schlegeli*	19 ”
Terciopelo, *Bothrops asper*	20 ”
Eastern Diamondback rattle snake, *Crotalus adamanteus*	22 ”
Western diamondback rattlesnake, *Crotalus atrox*	27 ”
South American rattle snake, *Crotalus durissus terrificus*	17 ”
Timber rattlesnake, *Crotalus h. horridus*	30 ”
Banded rock rattlesnake, *Crotalus lepidus klauberi*	33 ”
Southern Pacific rattle snake, *Cortalus viridis herlleri*	24 ”
Central American Bushmaster, *Lachesis stenophrys*	24 ”
Western Massasauga, *Sistrrurus catenatus tergeminus*	20 ”
Pope's pit viper, *trimeresurus popeorum*	13 ”

Puff adder, *Bitis arietans*	15 ”
Gaboon viper, *Bitis gabonica*	18 ”
Russell’s viper, *Daboia russelii*	15 ”
Horned sand viper, *Cerastes cerastes*	18 ”
Carpet viper, *Echis coloratus*	28 ”
Common adder, *Vipera berus spp.*	19 ”
Trans-pecos ratsnake, *Bogertophis subocularis*	23 ”
Eastern Indigo snake, *Drymarchon corais couperi*	25 ”
Cornsnake, *Elaphe g. guttata*	32 ”
Black ratsnake, *Elaphe o. obsoleta*	22 ”
Western mud snake, *Farancia abacura reinwardti*	18 ”
Plains hog-nosed snake, *Heterodon n. nasicus*	19 ”
False water cobra, *Hydrodynastes gigas*	16 ”
Grey-banded kingsnake, *Lampropeltis alterna*	19 ”
Prairie kingsnake, *Lampropeltis c. calligaster*	23 ”
California kingsnake, *Lampropeltis getula californiae*	44 ”
Arizona mountain kingsnake, *Lampropeltis p. pyromelana*	22 ”
Scarlet kingsnake, *Lampropeltis triangulum elapsoides*	23 ”
Coastal mountain kingsnake, *Lampropeltis zonata multicincta*	28 ”
Grass snake, *Natrix natrix*	20 ”
Blotched watersnake, *Nerodia erythrogaster transversa*	14 ”
Great basin gophersnake, *Pituophis catenifer deserticola*	33 ”
Northern pinesnake, *Pituophis m. melanoleucus*	20 ”
Queen snake, *Regina septemvittata*	10 ”
Northwestern gartersnake, *Thamnophis ordinoides*	15 ”
Black mamba, *Dendroaspis polylepis*	21 ”
Texas coralsnake, *Micrurus fulvius tenere*	19 ”
Monocled cobra, *Naja kaouthia*	32 ”
Black forest cobra, *Naja melanoleuca*	29 ”
Cape cobra, *Naja nivea*	26 ”
King cobra, *Ophiophagus Hannah*	22 ”
Taipan, *Oxyuranus scutellatus*	15 ”

106. How are venomous snakes distinguished from non-venomous snakes?

A frequently asked question for which a non-expert will not find an immediate answer. The only fool-proof distinguishing feature is the presence or absence of fangs in the mouth (See Q & A 88). Otherwise, the only satisfactory approach is to become acquainted with the snakes, particularly venomous snakes which are only a few, that are likely to be found in the area concerned. General appearance, colour and markings (both of which are, however, sometimes variable) disposition and threat display can be studied from books on Indian snakes of which fortunately there is no dearth now unlike in earlier times (See Q & A 104). *The Book of Indian Reptiles and Amphibians,* 2002 by J.C. Daniel and *Snakes of India* by Romulus Whitaker are recommended for beginners, *Snakes of India – The Field Guide*, 2004, by Romulus Whitaker and Ashok Captain for the more serious students. Equally importantly, one should observe live specimens in the zoos. For those in or nearabout Chennai, the best option is a visit to the Chennai Snake Park. For information on other similar zoos in India see Q & A 282.

107. How does a cobra spread its hood?

The cobra, like other snakes, has numerous vertebrae. Unlike in most other species, the slender, long ribs on the sides of the vertebrae of its neck are erectile. When the snake wants to spread its hood, these ribs in the region of the neck are drawn forward by muscular action. The skin gets stretched and the hood is formed. When the skin gets stretched, the scales are drawn widely apart and this conspicuously brings out the patterns which are otherwise tucked among the scales and not easily noticed.

108. Are there Indian cobras without any marks on the hood?

There are four species of cobras in India, commonly called Indian cobras: spectacled cobra (*Naja naja*), found throughout mainland India except the Northeast, monocled cobra (*Naja kaouthia*), found only in North and Eastern India, central Asian cobra (*Naja oxiana*), found in a very limited range in Jammu & Kashmir, Himachal Pradesh, and, probably, in the Punjab and Andaman cobra (*Naja sagittifera*), found only in the Andaman Islands.

Generally, the spectacled cobra has a double eye-shaped mark and the monocled cobra and the Andaman cobra have a single eye-shaped mark on their hoods. Sometimes, the marks may be in different shapes or may even be absent. The

absence of the hood mark occurs more frequently in the Andaman cobra. The Central Asian cobra does not have any eye-shaped mark on its hood.

109. What is the difference between the boa species in India and in countries like the Americas?

The family Boidae is divided into two sub-families: Boinae or the 'true boas' which are large and arboreal (=tree-living) and Erycinae, the dwarf boas, which are small and are fossorial (=burrowing) or semi-fossorial. Like most pythons (family: pythonidae) (See Q & A 23), some members of the sub-family. Boinae have heat-sensitive pits (See Q & A 21) between the labial scales i.e. on the upper lip, to be precise, (not within the labial scales as in pythons).

The dwarf boas have no heat –sensitive pits.

While some of the boa species in countries like South America, North America, Canada and Madagascar are huge measuring upto 11 m, India has only the small-sized sand boas (three species) which measure not more than about 1 m.

CHAPTER-III

BEHAVIOUR

110. Do snakes dream?

Behavioural scientists say that dreaming sleep is found only in the birds and mammals. Snakes see no dreams.

111. Are snakes intelligent?

The brain in snakes, as in other reptiles, is small. Snakes and other reptiles are mainly ruled by instinct. But, even in instinct, snakes are inferior to birds.

Having said that, one must hasten to add that the subject is far too complex to be disposed of in three short sentences.

Literature on the subject is scanty, not comprehensive, not clear. Experiments have been conducted, but the methodologies followed are controversial and the experiments rarely replicable (which is a crucial test for scientific evidence), the results unconvincing.

Anecdotal accounts are there to point to the learning ability of snakes. It has been noticed by some snake keepers that some species of snakes recognized their cages or hiding places even when these are taken to new surroundings. Grace Olive Wiley, the famous "snake woman" and the owner of the Long Beach serpentarium in California, found that some of her rattle snakes behaved as though they recognized her. According to Clifford H. Pope (*Snakes Alive and How They Live,* 1949) one of Wiley's rattlers, Huckleberry Finn, arched its back only while being stroked by her and it often crawled up to coil by her chair when it was led into the lawn. She had won its confidence by consistently gentle treatment. This venomous snake was so tame that it would lie coiled in her lap "like a contented old cat" while she sewed in the evening.

Dr. Raymond Ditmars, the famed herpetologist, found from experience with cobras how quickly they learnt things – one individual learned to turn away from its keeper when he used to approach it for its daily treatment (*Ibid.*).

Experiments by W.N. Kellogg and W.B. Pomeroy of the University of Indiana with water snakes kept in a water-maze showed the extent to which the snakes could negotiate the maze by their learning skills.

While accounts by known herpetologists like these could be accepted at their face value, the credibility and acceptability of similar anecdotal accounts by most others have to be questioned ruthlessly.

There are also problems in distinguishing between learning ability and intelligence or reasoning power. Many animals learn to do things by a process of trial and error but this does not prove intelligence or reasoning power. Snakes cannot be an exception to this. But, even here, accounts pointing to the contrary are not lacking.

In *The Herpetological Bulletin* 2003 – No.86, Robert Bustard writes of five adult Arizona mountain kingsnakes kept in a glass tank covered by a sliding glass panel. It was observed that, on four successive nights, all the snakes escaped and on each occasion had to be rounded up and put back into the vivarium. A close watch showed the strategy adopted. "The large male emerged from cover as dusk fell, climbed up into the glass ledge near the top of the tank immediately below the vivarium lid, and by a combination of pressing its body against the glass and making sideways movements of its body all in one direction, slid the glass lid back. It then moved out of the vivarium followed shortly thereafter by the other four snakes". The author adds: "The fact that one of them … managed to escape by sliding the glass of the vivarium lid is unremarkable. What is noteworthy is that having once managed to slide the lid back and escape it was able to repeat the performance at will… It was obvious from watching it that the snake was carrying out a precise set of movements which resulted in a rapid escape, not effecting escape by trial and error as must have happened on the night of the first escape. Hence the components of what began as a trial and error escape routine were learned as a result of the single 'trial' on the first escape night, and used successfully to effect escape on each of the three following nights". But such odd observations do not help us to frame a consistent and credible hypothesis.

No conclusions about snakes applicable across the spectrum can be drawn from the stray observations in captivity or in the wild in regard to particular individuals or particular species.

Gordon M. Burghardt, Dept. of Psychology, University of Tennessee (see paper in *Biology of the Reptilia*, 1977 ed. Carl Gans vol.7) rues that even among the severely limited behavioural studies on reptiles in general, snakes have been almost completely neglected. "As there are almost as many snakes as lizards and many more species than either turtles or crocodilians, our ignorance of this major and highly successful group of animals is most unfortunate".

112. What is meant by 'death-feigning'?

Some animal species, when confronted by a predator or enemy and are unable to hide or to escape, may pretend to be dead to fool the adversary. This behaviour has been noticed in the opossum (hence the English saying, 'play the possum'), foxes, hedgehogs and in certain species of snakes among various animals.

No Indian snake is known for sure to indulge in this behaviour. But, Whitaker and Captain (*Snakes of India : The Field Guide, 2004*) give one instance of this in a striped keel back (*Amphiesma stolatum*). Perhaps, sometimes, the Indian cobra (*Naja* spp.) may also show this behaviour. It has been noticed in the Egyptian cobra (*Naja haje*) and the African spitting cobra, rinkhals (*Hemachatus haemachatus*).

'Thanatosis' from the Greek word for death (Thanatos) is the technical term for death feigning. Also known as letisimulation.

For more on this, see Q & A 119.

113. What is auto-mimicry in snakes?

Automimicry or mimetic behaviour can take various forms including the same individual trying to make one part of its body resemble another.

In some snakes, for example, the shape of the tail and the way it is moved may imitate the head. The red sand boa (*Eryx johnii*), found throughout India, has a blunt tail with a rounded tip which deceptively resembles its head (See Q & A 296). The white-barred kukri snake (*Oligodon albocinctus*), found in West Bengal and Northeast India, curls up the end of its tail. The rubber boas and calabar burrowing boas try to deflect an attack on the head by hiding the head in the coils and holding up the tail which the adversary may mistake for the head. The Sri Lankan pipe snake (*Cylindrophis maculatus*) flattens its tail, elevates it and slowly moves it from side to side.

The slender coral snake (*Calliophis melanurus*), a rare snake found in peninsular India and in West Bengal, Bangladesh and Sri Lanka, is light brown above and coral red below. But it has a tail which is brown above and bluish-grey underside with two black rings. The snake found amidst leaf-litter will, if disturbed, raise its tail, to divert attention from its head.

114. Do non-venomous snakes mimic the appearance or behaviour of venomous snakes to escape predation?

Yes. This is known as Batesian mimicry. See Q & A 336. The typical example is that of many non-venomous snakes like the king snake or milk snake (*Lampropeltis triangulum*) of the Americas mimicking the appearance of the venomous coral snakes of which there are more than 50 species in the Americas. The similar conspicuous colouration is so effective as to fool some snake-eating birds which carefully avoid the non-venomous snakes mistaking them for coral snakes.

Some of the non-venomous egg-eating snakes of Africa (*Dasypeltis* spp.) mimic the saw-scaled viper (*Echis carinatus*) in markings, in the coiled-up defence posture and in producing the rasping sound by rubbing the scales together.

Among Indian snakes, good examples are the non-venomous wolf snakes (*Lycodon* spp.) and the bridal snake (*Dryocalamus nympha*) which are dark-coloured with white bands, thus bearing a close resemblance to the venomous common krait (*Bungarus caeruleus*) (See Q & A 261). The Indian egg-eater (*Elachistodon westermanni*), just as in the case of its African counterpart, and the common cat snake (*Boiga trigonata*) appear to be Batesian mimics of the saw-scaled viper. But, unlike in the case of the American and African snakes mentioned above, no one seems to have studied this phenomenon among Indian snakes to confirm the extent to which these are actually cases of mimicry.

Cases of non-venomous snakes 'hooding' in a sort of imitation of the cobra could be behavioural mimicry (See Q & A 317).

115. Why does a rattler rattle?

This is a warning display. When the rattle snake vibrates its tail rapidly the loose-fitting rings of keratinised skin rasp against each other and produce the buzzing sound or rattle. The rattlesnake is a sit-and-wait ambusher. While thus watching out for its prey of small animals, there is every likelihood of it being trodden upon accidentally by the grazing animals and others. Here, the warning display comes useful.

116. What is the sound made by a rattle snake's rattle?

The sound, in fact, does not sound like a rattle. The word 'rattle' implies discontinuous or discrete sounds as made by a baby's toy rattle. But the sound made by the vibrating tail of the snake is a continuous toneless buzz as the buzz made by a

large bee or a strident hiss-like sound. It is also not possible for us to produce the sound by our physically shaking the rattle since the speed required to imitate the sound is far beyond our capacity.

117. What are the different types of movement of different kinds of snakes?

Different kinds of snakes have typical styles of movement. These can take many forms. In the main, these are as follows:

i) The undulating or wavelike motion. The commonest mode in slender snakes. Every part of its body follows the same path made by the front part of the neck. Successive loops of the body push against small irregularities or larger objects on the ground. In arboreal snakes, the body pushes against the branches and the foliage.

ii) Side-winding, used by a few snakes especially in desert areas and, particularly, vipers. Example from India: the saw-scaled viper (*Echis carinatus*). The parts of the body behind the head and in front of the tail are used alternately and lifted and lowered to support the body and the movement is sideward and not in a straight line. The snake moves at about 45º to the intended direction. This leaves a discontinuous twin set of tracks on the ground which is very distinctive. (Since this kind of movement is generally found in desert-dwelling species, it is likely that it also serves the purpose of minimizing contact with the hot sands).

iii) Rectilinear crawling. Mostly used by thick-bodied snakes like pythons. No undulation. Vertebral column stays straight. The ribs, muscles and the skin with its scutes together propel the snake forward.

iv) Earth-worm like movement. The front portion of the body is anchored to the substrate and the hind-end comes forward. Then the hind-end is anchored and the front is shoved forward. Unlike in the caterpillar motion, the vertebral column is not kept straight but forms a wave as the body is pulled forward.

v) 'Hitch and hike locomotion'. Some arboreal snakes (e.g. pit vipers) climb the branches by anchoring themselves grasping a branch in their coils (particularly tails) and then reaching out to a higher branch, repeating the process.

vi) 'Flying'. Restricted to five arboreal species found in South and South East Asia. This is not really 'flying' but gliding. (See Q & A 103 for details).

118. What is 'half-hiding'?

This is a technique adopted by many desert–dwelling, sit-and-wait species such as vipers which ambush their prey. The snake wriggles its body in the sand beneath the surface until only the top of the head is exposed. In this position, it keeps a close look-out for potential prey without revealing its presence. When the prey unwittingly approaches the half-hidden snake, the snake strikes.

119. Which snakes are the most remarkable bluffers?

Some snakes, when cornered by a predator or enemy, may stage various displays to scare them away or put them off. Some may inflate their body to make themselves appear larger than they are. Some may raise their forebody, flatten their neck or head in an initiation of the cobra. Some may open their mouth wide to appear grotesque. Some may hiss. But the star performing artistes are the woodsnakes of the West Indies, the grass snake (*Natrix natrix*) of Europe, parts of N.Africa and Asia and the hog-nosed snakes (*Hetrodon* spp.) found in nearly all of N.America and parts of Canada and Mexico. While the other bluffers are mostly 'one-trick ponies', these snakes have a whole repertoire 'up their sleeves'.

The West Indian woodsnakes like the Cuban boa (*Tropidophis melanurus*) and the Haitian woodsnake (*Tropidophis haetianus*) are small boas which, in order to escape unwanted attention, will roll themselves up tightly. They will then release a foul-smelling fluid from their cloacal glands to make it seem that they are long dead and are fast putrefying. If even this does not put off the visitor, they will voluntarily rupture the capillaries in their head and make blood ooze into their eyes and out of their mouth, thus accentuating the cadaver effect (or so they believe). (This rare faculty is known as autohaemorrhagy.)

The hognosed snakes (*Heterodon* spp.) of N.America and Mexico and the European grass snake (*Natrix natrix*) do even better. When cornered, the snake will first flatten itself displaying a range of hitherto unsuspected colours. Then it will hiss and strike in an intimidating (but perfectly harmless) manner. If these do not put off the adversary, the snake will pretend to die slowly, writhing its body in apparently painful spasms, holding its mouth wide open and lolling its tongue. Then, as the writhing ceases, the snake will roll on its back as if truly and properly dead. Blood will trickle out of its mouth from the self-inflicted rupture of its capillaries. Alas! At this final stage, it may, perhaps, spoil the show. If the adversary, not impressed by all

this performance, proceeds to turn the snake on its belly, i.e. restoring it to its normal posture, the snake, forgetting that it is 'dead', will roll over and assume the belly-up posture once again. This it will repeat everytime it is turned belly-down.

The African spitting cobra, rinkhals (*Hemachatus haemachatus*), while feigning death, will not forget to keep its eyes directed towards the enemy which too is a giveaway.

See also 'death-feigning' : Q & A. 112.

120. Is there a snake that shakes its head back and forth horizontally as if saying 'no!'?

Ludwig Trutnau (*Venomous Snakes*, 2004) says that Jameson's mamba (*Dendroaspis jamesoni*) and the related *Dendroaspis viridis*, both of Africa, have a habit, if slightly disturbed, of shaking their heads back and forth horizontally as if saying 'no!'.

A somewhat similar habit has sometimes been noticed in the common vine snake (*Ahaetulla nasuta*) seen in India and neighbouring countries. Malcolm Smith (*Fauna of British India: Serpentes*, 1943) says of its habit, when caught and placed in front, of turning its head from side to side while watching its captor.

Ahaetulla nasuta is one of the very few snakes known to have the 'spot' or depression in the middle of its retina known as fovea centralis which gives the greatest acuity of vision (See Q & A 26). Is it possible that the reported behaviour of this snake is for the purpose of bringing the object viewed in line with its fovea for better vision? Do *Dendroaspis jamesoni* and *D. viridis* also have foveas which may explain their similar behaviour?

121. What is meant by 'negative behaviour' in snakes?

Some snakes, when facing harassment or in fear of predation, assume a posture that conceals the head. Or they may coil into a tight lump or ball to protect the head and other vital areas. This is known as 'negative behaviour'. E.g. The common sand boa (*Gongylophis conicus*) may hide its head when harassed. The ball python (*Python regius*), Cuban boa (*Tropidophis melanurus*) and the Haitian wood snake (*Tropidophis haetinus*) coil up into a tight ball. (See Q & A 119). The common krait, when harassed, during the day, may hide its head under its coils. (See Q & A 122).

While warding off predator – attack, uropelts always hide the head and display the tail. The head that is hidden under the coil will also be engaged in digging into the soil or sliding into an existing tunnel (See Q & A 257).

122. What is peculiar about the common krait's behaviour during day-time?

The common krait (*Bungarus caeruleus*) is nocturnal. But, nocturnal snakes if disturbed or provoked during day-time will also react even to the extent of biting the intruder. But the common krait, during day-time, is extremely shy and timid and will rarely bite even if provoked. It will choose to ignore any such disturbance and lie coiled up, sometimes hiding its head under the coils, (See Q & A 121). At night, on the other hand, it is very vicious and is very quick to react, inflicting fatal bites. Mark O' Shea, the well-known herpetologist, appropriately calls it the "Dr. Jekyll and Mr. Hyde of the snake world".

The Strange Case of Dr. Jekyll and Mr. Hyde is a novel by R.L. Stevenson, published in 1886. In this, Dr. Jekyll, a good-natured physician, discovers a magic drug which he consumes at night to become a repulsive and horrid personality whom the author calls Mr. Hyde.

123. What is the maximum speed of a snake on land?

Contrary to popular belief, the snake's speed on land is not very considerable. The maximum speed is attributed to the green mamba (*Dendroaspis viridis*) of Africa which is about 11 k.m. per hour, the rest of the snakes coming to less than half of this. The adult human can run much faster. Stories of the green mamba out-running a man on foot or even on horse-back are all fiction.

A king cobra can, in one leap forward, cover 3 m. or more. One has, therefore, to be very careful in approaching a king cobra.

124. Do snakes jump upwards?

Mostly, no. But some snakes do, while in a threatening mode. The rhombic night adder (*Causus rhombeatus*), found throughout sub-Saharan Africa, is reported to be one of the best 'jumping' snakes. Forceful inflation and deflation of the anterior one-third to one-half of the body, while striking, frequently lifts its entire length of some 60 cm. off the ground.

Some species of puff adders found in Africa do so. E.g. horned puff adder (*Bitis caudalis*).

The same habit is found in the jumping viper (*Bothrops nummifer*) that occurs in Southern Mexico and Central America.

Among Indian snakes, this has been noticed in the Russell's viper. Wall says (*Snakes of Ceylon,* 1921): "I have known one spring with such a powerful muscular effort, that I believe it actually left the ground in its endeavour to strike me". Daniel says (*The Book of Indian Reptiles and Amphibians,* 2002) : "When striking, it hurtles itself forward and may even leave the ground".

125. Do snakes preen themselves?

It may come as a surprise, but some species of snakes preen themselves though not as elaborately as birds do. Birds use their bills to re-arrange ruffled feathers, remove dirt and ecto-parasites from the feathers and dress the plumage with 'preen oil' that it secretes on its body. Preening in snakes, wherever it occurs, does not extend to this whole range. But they rub a secretion from their nostrils with their face on their body. The up-and-down movements to rub it on may even be a hundred times. Only a few species are known to do so e.g. the Montpellier snake (*Malpolon monspessulanus*) from Southern Europe, *Malpolon moilensis* from North Africa and four species of sand snakes *Psammophis* from Africa and the Middle East.

Four species of sand snakes – uncommon or rare – are found in India: Afro Asian sand snake (*Psammohpis schokari*), Condamarus sand snake (*P.condanarus*), stout sand snake (*P. longifrans*) and Leith's sand snake (*P. leithi*). No studies are available on whether this behaviour is shown by the Indian species.

126. Why are snakes found to bask in the sun?

Snakes being cold-blooded creatures (See Q & A 18) have to absorb the warmth from the surroundings. Basking in the sun whenever possible is tempting for many snakes. There are some species which regularly do so. (e.g.the saw-scaled viper). On roads less-frequented by humans, this is a usual reason for road-kills by vehicles.

127. Do snakes resort to thermoregulation by keeping their mouths open?

No, unlike some other reptiles. Crocodiles can often be seen lying with their mouths open. This is for the purpose of thermoregulation i.e. to reduce the body temperature by promoting evaporative cooling through exposed oral mucosa. (There can, however, be other reasons also such as in a social context or as threat behaviour. (See Loveridge J.P. (1984) in *Symp. Zoo. Soc. London* 52: 443-467.). Lizards and

turtles and tortoises may also sometimes resort to this practice for thermo-regulation—but not snakes. If a snake is seen with its mouth open for a long time, it is breathing through its mouth and it is generally a sign of respiratory disorder and pneumonia.

128. Why do some worm snakes have a spine at the tip of the tail?

The worm snakes (See Q & A 268) bury into the ground and live underground (sometimes in decaying wood or vegetation). Some of them like the brahminy worm snake (*Ramphotyphlops braminus*), Diard's worm snake (*Typhlops diardii*) and the beaked worm snake (*Grypotyphlops acutus*), all found in India as elsewhere, have a spine at the tip of the tail. They make use of it to get a firm hold on the ground, thus enabling the body to move backwards and forwards and thus do the digging operation. The spine by itself may be of little help in digging.

The spine may also be used against an adversary to simulate a bite. The American mud and rainbow snakes (*Farancia abacura* and *F. crytrogramma*) do so and, for this reason, they are known as 'stinging snakes'.

129. Do some snakes writhe and twist as a defense tactic?

Clifford H. Pope (*Snakes Alive and How they live,* 1949) writes of some snakes writhing and twisting about "like a contortionist gone mad" to bewilder an enemy. He quotes Edward H. Taylor on such a performance by the little hook-nosed snake found from Western Texas to Arizona: "Immediately on being touched, it began to writhe and to throw its body in strange contortions as if in agony, sometimes throwing itself off the ground. It would continue these actions for several seconds and, at the same time, it would extrude and retract the cloaca rather rapidly for a distance of half an inch or more which resulted in a popping sound".

130. Why do two snakes of the same species sometimes twine together?

Two snakes entwined together can, sometimes, be seen. This is not mating as is commonly supposed. It is a 'combat dance' or a ritual fight between two males contesting for the favours of a female that may be nearby but rarely noticed by us. But, the female need not always be present. This is nothing more than a wrestling match and, generally, they do not bite or injure each other. The objective is merely to establish supremacy. It is surmised that atleast on occasions the combat may be over

territory. (Partial body entwining, particularly the tails, may, however, feature sometimes in mating).

The graphic description of the wrestling match of the Australian black snake (*Pseudechis porphyriacus*) given by David Fleay, as paraphrased by Chifford Pope in *The Reptile World*, 1964, fits most cases: "With arched necks and raised heads, the contestants spar for advantage, each trying to get its head above that of the other. When this is accomplished by one, it violently entwines its body about the adversary until the two look like strands of a rope. Furiously writhing and hissing, the two snakes constrict each other as they roll over and over. As if by signal, the round ends suddenly and preparation for the next begins with the same sparring. This contest continues until complete exhaustion ends it. Battling pairs may even be picked up without separating, so engrossed do they become".

Carl Sagan and Ann Druyan (*Shadows of Forgotten Ancestors*, 1992), in a poetic mix of fancy and science, say of this: "Like some macroscopic echo of their underlying microscopic reality, they form a double helix".

The contest may last an hour or more until one admits defeat. The adversary, defeated in this serpentine version of arm-wrestling, crawls away to safety. The snakes rarely harm each other when the contest takes place in the wild. But, in captivity, when the defeated snake is unable to leave the scene, the victor may inflict savage bites on it.

The male-and-male combat may have an evolutionary significance since a dominant male will ensure a healthier progeny. It has also been observed that in snake species that engage in such combats the males tend to be relatively larger than in the species where no such combats are seen.

Sometimes, the wrestling may be between a male and a female – but this is very rare. Contests in which more than two males participate together have also been noticed on rare occasions.

Among Indian snakes, the 'combat dance' is most often noticed in the rat snake but has also been seen in king cobra, saw-scaled viper, dog-faced water snake and common krait.

Apart from snakes, ritualized combats, with little or no mutual damage, are seen in animal species like antelopes, geese, grebes etc. The celebrated ethologist Konrad Lorenz calls this 'tournaments'.

131. Do different species of snakes fight with each other?

Not as far as is known. No doubt there are some species of snakes that feed on other species of snakes (and also on the same species) (See Q & A 147), but, this apart, there are no combats between different species. They believe in peaceful coexistence. (There can, of course, be fights between individuals of the same species – the combat dance, but, even they do not generally harm each other. See Q & A 130).

132. How does a snake extend its tongue with its mouth closed?

This it does through a notch in the upper jaw known as the lingual fossa. The tongue so extended collects scent particles from the air (See Q & A 31).

133. Why and how do snakes hibernate?

Hibernation or winter sleep is resorted to by many animals including mammals, birds and snakes in the cold countries to pass a severe winter. During this period, they do not feed, no food often being available in any case in the snow-covered terrain, and they conserve their energy by stopping all movements, and by slowing down their breathing and heart-beats. An ambient temperature of less than 2° C can be fatal to snakes. Therefore, hibernation is a common phenomenon in the colder climes. In the tropics like India, it is rarely seen, though there are exceptions. In India, pythons are known to hibernate in parts of their range in very cold climates.

The saw-scaled viper (*Echis carinatus*), which is at home in the arid tracts is likely to hibernate in the cold season. Whitaker and Captain have recorded that when in the Ratnagiri district of Maharashtra, over 2000 saw-scaled vipers could be seen in one week in July, not a single one could be found in the same area in December, which is the cold season.

The hibernation may be only for a few weeks or as long as nine months depending on the climate.

Snakes hibernate in burrows made by animals, cavities beneath boulders, in old stone walls, deep holes in river banks etc.

134. What is a hibernaculum?

The word literally means ‘tent for winter quarters’.

During a severe winter in cold countries, snakes hibernate (See Q & A 133) in large numbers, huddling together, in caves, crevices and holes. These spaces are

known as hibernacula (singular: hibernaculum). The huddling together minimises loss of moisture and also increases the body warmth. (Some herpetologists do not agree that this helps the snakes to warm up). Aggregations also help to bring females and males of some species together for mating, either before hibernation or, more so, upon emerging. Strangely enough, different species of snakes often sleep together. Even predator-snakes and their prey species may find their mutual company comforting on these occasions. Some of these aggregations are massive. Ernest & Zug, (*Snakes in Question*, 1996) report that as many as 10,000 garter snakes (*Thammophis serialis)* have been found in one aggregation, apparently because of absence of other suitable sites nearby to avoid sub-freezing temperature. As many as 150 prairie rattlesnakes are known in one case. Adult snakes may return to the same site year after year to winter, sometimes traveling 10 to 20 miles.

135. What is aestivation? Which Indian snakes aestivate?

Animals in tropical climates spend extreme summers in a dormant state. This is known as aestivation as opposed to hibernation (See Q & A 133). Among Indian snakes, this behaviour has been noticed in the dry parts of their range in the striped keelback (*Amphiesma stolatum*) and the checkered keelback (*Xenochrophis piscator*).

136. What is brumation?

Winter dormancy in snakes (and other reptiles) as distinct from true hibernation.

137. Why should a person who has recently handled snake-food, wash his hands thoroughly before approaching a snake?

The sense of smell plays a predominant role in the snake's ability to locate its prey. This, particularly coupled with the poor vision in many snakes, means that, if a person with the smell of snake food on his hands approaches a snake, it may well mistake the hand for a prey-item and attack.

138. Are there snakes which almost never bite when handled?

Even a generally well-behaved snake may sometimes bite if roughly handled. But some are quite docile. Among Indian snakes, the buff-striped keelback (*Amphiesma stolata*) rarely bites. The barred wolf snake (*Lycodon striatus*) and the yellow-spotted wolf snake (*Lycodon flavomaculatus*), both found in India, almost never bite when handled or even under provocation. But the closely related common

wolf snake (*Lycodon aulicus*), also found in India, is almost sure to bite unless handled with care. The shieldtails (See Q & A 257) also do not bite when handled.

139. Is it always safe to lift a snake by its tail?

Often yes; but not always. In the *Bible* (in Exodus 4), when Moses, upon God's instructions, cast a rod on the ground and it became a serpent, and Moses terrified of it fled, God asked him to put forth his hand "and take it by the tail". But it is not always safe to do so. Some snakes, particularly arboreal species like the common vine snake (*Ahaetulla nasuta*), can curl upward and bite the hand. The rhinoceros viper (*Bitis nascicornis*) found in Africa, if held by the tail, is known to throw itself upward and strike.

140. Do snakes chase people?

On seeing a snake, many fear that it may chase them. The fear is mostly unfounded. Carl Ernest and George Zug (*Snakes in Question*, 1996) say that there are no authenticated accounts of snakes chasing people that were not attempts at defence or escape. A snake may be provoked to advance on an adversary as a defensive measure or when its escape route (say, into its burrow) is knowingly or unknowingly intercepted by someone.

David Mallow *et al.* in *True Vipers,* 2003, quote Mendelssohn, 1963, to the effect that there are occasional reports of aggressive individuals of the Palestine viper (*Daboia palaestinae*) pursuing people, but this is when disturbed during the mating season.

The black mamba of Africa (*Dendroaspis polylepis*) alone has a pronounced reputation of attacking unprovoked. But, even here, there is a possibility that the victim had unintentionally approached the camouflaged snake too near for its comfort.

141. Are there Indian snakes found to live in aggregations?

The worm snakes (See Q & A 268) have sometimes been found to live gregariously under the earth or in decaying wood.

142. Do snakes reside for long periods in the same locality?

Yes, if they are not harmed or frequently disturbed and if they can easily access prey. This explains the assured presence of snakes in many 'sacred groves' (See Q & A 377) and temples in wild areas which do not have too many visitors and

even in or near a few houses in places like Kerala and Bengal where they are worshipped for generations.

In olden times, in Kerala, some of the households had their resident cobras which were greatly revered. The belief was that the prosperity of the family for generations depended on the goodwill of the serpent. In *Nāyars of Malabār,* 1901, F. Fawcett quotes from *Malabar and its Folk* by T.K. Gopala Pannikar: "The serpent also plays a conspicuous part in contracts between citizens. The family serpent is in old deeds the subject matter of sale. The sale of a house compound extends also to the family serpent".

A similar belief prevails in other regions as well. J.P.H. Vogel (*Indian Serpent Lore*, 1926) quotes a Bengali author writing in the *Journal of the Asiatic Society of Bengal*, 1870: "Each vāstu or domicile [in Bengal] is believed to have a representative snake, called the *vāstu sarpa* which is regarded with great awe".

Abbé Dubois in *Hindu Manners, Customs and Ceremonies*, 1829, refers to the practice of having serpents as guardians of the family as prevalent in South India. The benevolent household snake was believed to be the incarnation of some deceased caring ancestor come to safeguard the fortunes and welfare of successive generations of the family.

There are two namboothiri *illams* (households) in Kerala which are famous for the peaceful co-existence of humans and snakes: the *pāmbumekkattu mana* in Trichur district and the *mannārsāla* in Alappuzha district. Snakes are held in great respect here from time immemorial and devotees from far and near flock to these houses on auspicious days when special worships are conducted.

143. What is the speed at which a snake strikes?

Many snakes like the cobras and the vipers can strike at tremendous speed. In some cases, it can be as much as 24 metres per second. The actual distance covered by the snake may be only less than a metre. This means that someone within the striking range does not have more than a split second to move away and avoid the strike.

144. What is the preferred temperature range for snakes?

21º C to 34º C.

145. Which animal produces a specific alarm call for snakes?

It is well-known that many birds and other animals produce alarm calls on sighting a predator, the purpose being to alert the others nearby to the danger, apart from scaring away the predator. These calls, though distinctive, are not generally different for different predators, but there are exceptions. Tree-living sifakas and other primates of Madagascar, squirrel monkeys and ground squirrels of N. America and birds like the robin have different alarm calls for threats from the air and from the ground. But the vervet monkey found on the southern and east Africa is exceptional in that, apart from these two types of alarm calls, it has a specific alarm call for snakes.

Though primarily a tree-living species, the vervets which move about in troops of 20 or more, often forage on the ground where they are vulnerable to attack from the sky from a martial eagle or a crowned hawk eagle, or from the ground from a leopard or from a constrictor snake or a venomous snake nearby. They have to be alert against all of them all the time. When the vervets are feeding on the ground, one or two of the members of the troop act as sentinels, often standing up on their hind legs, looking around and above for signs of danger and emitting alarm calls to warn their comrades of any threat. The response of the troop has to be different for different predators. If it is a leopard, they have to flee to the tree tops beyond the reach of the leopard which too can climb trees but cannot get a firm foot-hold on the slender branches at the top. If it is a soaring bird of prey, the vervets have to disappear into the bushes. Therefore, the sentinel vervets produce different calls which the others in the group recognize and respond appropriately. Snakes will require a still different response and, therefore, evoke from the sentinels a particular alarm call. This is a high-pitched chattering, onomatopoeically called ‘chutter’. On hearing this, the others do not instantaneously flee to the tree tops or hide in the bushes as they do in the case of a signal call for leopards or birds of prey, as the case may be. The warning call for snakes prompts the vervets to rear up on their hind legs and look around carefully. Sometimes, they choose to mob the snake and drive it away. At other times, they find it enough to just stay clear. As long as they can see the snake, they are safe and don’t have to instantly flee or hide. The snake alarm is given mostly for pythons but also for cobras, mambas and puff adders but even this specific alarm may not be uniform. This sounds to human ears as high-pitched ‘chutters’, but it seems likely that the vervets themselves may be able to distinguish subtle variations to

indicate whether the danger is from a constricting snake or from a venomous snake and respond appropriately.

The different-sounding alarm calls of vervets were first studied in 1967 by Tom Struhsaker in Amboseli in Africa.

CHAPTER - IV

FEEDING

146. Are all snakes carnivorous?

Yes. This is so with most reptiles. (But a few reptiles such as the land turtles or tortoises, the marine green turtle and the green iguana are herbivorous).

Most snakes are 'generalists' even in their carnivorous diet, feeding on a vide variety of creatures: small or large mammals, birds, lizards, frogs, snakes, insects and eggs of birds and lizards and so on. Some are 'specialists' feeding mainly or exclusively on particular kinds of prey e.g. the king cobra which feeds mainly on snakes, the egg eaters, the snail-eating species, a few sea snakes which feed exclusively on fish eggs, the semi-aquatic colubrids of the genus *Regina* which feed almost exclusively on cray fish and other aquatic invertebrates.

147. What is 'ophiophagy'?

'Ophiophagy' means 'eating snakes'. Among Indian snakes, the best and the most famous example is the king cobra (whose generic name itself is O*phiophagus*) which regularly feeds on other snakes including its own species. The banded krait (*Bungarus fasciatus*) eats mainly snakes. The common krait (*Bungarus caeruleus*) is also a frequent snake-feeder. The striped coral snake (*Calliophis nigrescens*) feeds on snakes. Some other snakes are known to feed on snakes opportunistically. Examples from India: the Indian rat snake (*Ptyas mucosa*), painted bronzeback treesnake (*Dendrelaphis pictus*), large-eyed bronzeback tree-snake (*Dendrelaphis grandoculis*), Dumeril's black-headed snake (*Sibynophis subpunctatus*), Forsten's cat snake (*Boiga forsteni*), mock viper (*Psammodynastes pulverulentus*).

To be a true cannibal, a snake has to eat its own species like, for example, the king cobra.

But even a compulsive snake-eater is not exclusively so. For instance, for the king cobra, the monitor lizard is also a favourite prey item.

148. How are snakes able to eat large-sized prey?

Snakes eat their prey whole since they do not have limbs or beaks to tear the prey apart. (See, however, Q & A 164). But, sometimes, the prey is much larger than what can be held in their mouth e.g. a small water snake swallowing a large frog or, to give an extreme example, a python swallowing an adult deer or a pig weighing some

30 kg. This faculty is known as macrophagy. Snakes are able to do this because of the following:

The upper and lower jaws each consist of different units and are not fused wholes as in mammals. Each unit can move independently sideways and this gives the mouth great flexibility. Particularly, the two sides or two halves of the lower jaw can be separately stretched sideways greatly increasing the capacity of the mouth to hold a large prey. Since each half of each jaw is an independent unit, the snake can work them on the prey in turn pushing the prey deeper into its mouth and gullet. In other words, the snake 'walks' its jaws over the prey, one jawbone at a time until it is completely engulfed. A copious coating of saliva lubricates the prey and facilitates the process. Since the snake has no breast bone or collar bones, the body cavity expands to a significant extent to accommodate the large prey. The skin being elastic is capable of expansion to a great degree and this too helps. The large prey in the mouth does not also hinder respiration, because, unlike in other animals, the glottis (the opening of the trachea, the air pathway) in the snake is protrusible and the snake can extend it outward to the edge of the mouth.

However, it is unlikely that even a python will try to swallow a stag with large branched antlers.

149. How do snakes drink water?

They immerse their mouth in the water and, by pumping with their throats, draw water into the gullet. They do not lap water using the tongue.

The method is distinct from that of mammals and birds. Mammals lap water using the tongue to scoop it up. Birds adopt different methods. Passerines like crows, sparrows etc. fill the bills or mouth with water and, each time, raise the head to let the water down the throat (dip and lift method). Sandgrouse, button quails etc. imbibe continuously without raising the head, aided by a pumping action in which water is sucked into the throat by a peristaltic movement of the oesophagus. Some birds like pigeons employ both the dip and lift technique and the pumping technique depending on the depth of the water. Swifts, swallows etc. drink even as they fly by skimming the surface of the water.

150. Do snakes drink milk?

In the wild, there is, of course, no possibility of snakes securing milk (See also Q & A 354). In captivity also, they are not known to drink milk. Milk is not their natural food. But a very thirsty snake is not unlikely to drink milk, if made available, and if it has no access to water.

Strangely, offerings of milk play a prominent part in snake worship though even here there seems to be no reliable account of their actually drinking the milk. In snake worship in Kerala this practice is improved upon and the offerings are called '*noorum pālum*'. *Pāl* is milk. But the '*nooru*' is something more substantial. It is a sort of dough made of rice-flour, turmeric powder, cow's milk, water of tender coconut, *kadali* (a variety of plantain) and ghee. I have seen no reliable account of a snake partaking of this and it is almost certain it never would.

151. Will a snake attempt to eat itself?

Fanciful and absurd, isn't it? But, here's what Chris Mattison (*The New Encyclopedia of Snakes,* 2007) writes: "Just about the most bizarre accounts of snake feeding behaviour must be those of ratsnakes, *Elaphe obsoleta*, [attempting to eat] themselves! One individual, a captive, did this on two occasions and died at the second attempt. The other individual was wild and was found in a tight circle and had consumed about two-thirds of its body when it was discovered". For the myth of ouroboros, see Q & A 367.

152. Can new-born snakes hunt prey?

Yes, quite in the manner of an adult, whether it is a venomous snake or a constrictor like a python.

153. Why do snakes eat sparingly?

Snakes do not eat often. Once they have had a good meal, they can go without food for long intervals, in some cases lasting even for months together. This is so because snakes expend very little energy. They have a low rate of metabolism. They restrict their movements to the minimum and thus save energy and, consequently, they need consume food only after long intervals.

154. With what senses do snakes hunt prey?

Mostly by sight. Some with the help of heat-sensitive membranes on their faces (See Q & A 21). Many by smell. Sea snakes, sometimes, by sensing the vibrations in water.

155. What are the different methods by which a snake captures its prey?

Mainly, two: By stalking (e.g. cobras, kraits, rat snakes) and by ambush or wait-and-watch. (e.g. many vipers).

156. Can a snake swallow a snake that is longer than itself?

This is not an impossibility. In Ditmars's *Snakes of the World*, 1931, there is an X-ray picture of just such a case. The prey is seen to have been accommodated within the predator by many bends and loops.

157. Does any snake lure its prey by using its tongue?

The bird snakes or twig snakes (*Thelotormis* spp.), rear-fanged, venomous, colubrid snakes of East and South Africa, use their tongues to attract their prey which consists of small birds, frogs and lizards. The bright orange, black-tipped tongue is thrust out and this is mistaken by the prey for an insect, making the job of the snake easy.

Incidentally, the tongue colouration of two closely-related bronzeback tree snakes found in India, as elsewhere, is interesting and is a rough and ready diagnostic feature to tell the two apart. The common bronzeback tree snake (*Dendrelaphis tristis*) has a dark blue tongue. The painted bronzeback tree snake (*Dendrelaphis pictus*), a less common species with limited distribution (West Bengal to Arunachal Pradesh and parts of Southern India), has a bright red tongue. Whether they use their tongues to lure prey is not known.

158. Does any snake lure its prey by using its tail?

This is known as 'caudal luring'. Some snakes that camouflage well, preventing their prey-species from seeing them easily have brightly coloured tail-tips that they wave to attract their prey. A hungry lizard or frog or bird mistakes this for some tasty morsel and when it comes within striking distance, the snake strikes. See, for instance, the death adder Q & A 268.

159. Why does a snake often twitch its tail while stalking its prey?

This may distract the prey or attract its curiosity making it easier for the snake to attack it. This kind of behaviour can also be observed in a cat or other felines while stalking their prey.

160. Do snakes chew their food?

No. The teeth in snakes which are small and backward-curving are for preventing the prey caught in the mouth from escaping. The teeth are not fit for chewing. But they serve a purpose in puncturing the prey, allowing the enzyme in the saliva or venom to digest the prey better.

161. Can snakes digest the bony parts of their prey?

Yes. The powerful gastric juices can digest bones, teeth, hair, spines and egg shells wholly or partly.

162. Do snakes regurgitate the undigested bony parts of their prey like some birds (e.g. owls) do?

No. They are excreted along with other waste products from the stomach and the kidneys. However, the egg-eating snakes found in India and Africa, after slitting open the shell in its gullet and swallowing the contents, spit out the shell fragments (See Q & A 249). No other snake seems to do so.

163. How long does a snake take to digest its food?

Generally about 10 days, depending on the size of the prey, the snake's metabolism and the body temperature.

164. Are there snakes which dismember their prey before swallowing them?

Since they do not have limbs to hold the prey down or beaks or large teeth to tear the prey apart, snakes generally swallow their prey whole. But there are some interesting observations to the contrary. Whitaker and Captain (*Snakes of India, The Field Guide,* 2004) report that the glassy marsh snake (*Gerarda prevostiana*), an uncommon snake of the Indian coast and tidal rivers, if it catches a crab too large to be swallowed whole, "pulls the crab through a body coil to tear it into smaller pieces". The crab-eating water snake (*Fordonia leucobalia*), a rare snake of the Sundarbans and Nicobar Islands and Southeast Asia, which feeds on small crabs,

"strikes with closed mouth and pins crabs using chin and underside before biting them" and "also tears legs off larger crabs before swallowing them"(*Ibid.*).

165. Why is a python having swallowed a large animal often found to lie in a torpor?

It is usually believed that such a python is fully satiated and is resting till digestion has advanced (like we humans are wont to do) or is feeling too heavy to move about. It is equally probable that the python does so to avoid any internal injury from the large mass inside, particularly if the prey had on its body sharp protrubrances. This happens in other species of snakes also for the same reasons. In any case, a fully satiated snake has little reason to move about unless it is in search of a safe place to hide or is in search of a mate.

166. Do the constrictor snakes like pythons and boas kill their prey by crushing their body?

No; this is a common misbelief. They kill their prey by asphyxiation. Every time the prey breathes out, the snake tightens its coils a little more and this process is continued till the prey dies of asphyxiation.

167. Pythons and boas are well-known for killing prey by constriction. Name some of the small snakes which do so.

Apart from sand boas (See Q & A 98), some of the other small (compared to pythons or boas) snakes which kill their prey by constriction are, among Indian snakes, some species of trinket snakes e.g. green trinket snake (*Elaphe prasina*), Khasi Hills trinket snake (*Elaphe frenata*), mandarin trinket snake (*Euprepiophis mandarinus*) and the banded racer (*Argyrogena fasciolata*).

168. Are there snakes which kill their prey by applying body pressure without constriction as pythons and boas do?

The Indian rat snake (*Ptyas mucosa*) does not kill its prey by constriction, but adopts a slightly different technique. While small-sized prey are swallowed without further ado, a larger prey is immobilized by pressing it down. The banded racer (*Argyrogena fasciolata*), found over most of India, may kill its prey either by constriction or by pressing it down with its body.

169. Is it true that the digestive process of a snake commences even before the prey is grabbed in the mouth?

Yes, in the case of venomous and mildly venomous species. The venom is not only intended to kill or incapacitate the prey but it is also an enzyme to aid digestion. When a venomous or mildly venomous snake bites its prey, it usually does not inject enough venom or secretion from the Duvernoy's gland (in the case of a mildly venomous snake) to kill it outright but only enough to paralyse it and slow down its movements. The snake will then leisurely follow the prey, tracking it by means of its scent trail. In the meantime, the powerful enzymes in the venom or secretion from the Duvernoy's gland (in the case of a mildly venomous snake) would have started working on the tissues of the prey breaking them down. By the time the snake finally seizes its prey, the 'digestion' of the prey would already have been in progress.

170. Which snake uses both muscular strength and venom to overpower its prey?

Some species of snakes use muscular strength to overcome their prey e.g. pythons and other constrictors; some use venom. Only one species resorts to both together. This is the mussurana (*Clelia clelia*), an over 2 m. long venomous colubrid snake of S. America that kills and eats even large vipers. It wraps its entire body about its victim and simultaneously bites and injects the venom into the prey. Its mode of attack has given it the name 'pseudoboa' or false boa.

171. Do snakes eat carrion?

In the natural state, snakes rarely eat carrion; they look for live food.

But, one cannot be categorical about this. On the few occasions when a snake ingesting a prey is come across in the wild and the prey is already dead, it is not possible to determine when the death had taken place. Carrion-feeding is more likely in the case of venomous snakes. A venomous or mildly venomous snake bites its prey and releases it and then follows it by means of the scent trail (See Q & A 169). The prey is likely to have been dead, may be sometimes for long hours, by the time the snake grabs it. These snakes may thus get habituated in the wild to eat carrion even if the animal had not been killed by them.

In captivity, snakes can be conditioned to eat dead animals, even items frozen and then thawed.

172. What do sea snakes eat?

Mostly fish. However, both species of the genus *Emydocephalus* and one species of *Aipysurus* (*A. eydouxii*) apparently feed entirely on fish eggs. Their venom is weak and there is a possibility that, in the course of further evolution, they may become non-venomous.

173. What is the fasting record of a snake?

Full data from zoos is not ready at hand. Frank Wall (*Snakes of Ceylon*, 1921) quotes Ferguson that in the Trivandrum Gardens (present Tiruvananthapuram zoo), a python fasted for over a year. Bernhard Grzimek (*Animal Encyclopedia* Vol.6, 1971) records that a reticulated python (P*ython reticulatus*) with the Frankfurt zoo ate nothing for 570 days and, then, after eating for a while, fasted another 415 days.

Kenneth R. Porter in *Herpetology*, 1972, quotes Romer, 1959, to the effect that a captive python (species not mentioned) is reported to have lived for three years without food.

174. What happens if two snakes attempt to eat the same prey?

This has happened on rare occasions in captivity. If two pythons begin to swallow the same prey from opposite ends till their noses meet and if one does not let go, the other may proceed to swallow the prey together with the other snake. Wall says (*Snakes of Ceylon*, 1921): "This happened once in Regent's Park and once in the Bombay Natural History Society's rooms where both snakes struck at the same partridge and similar occurrences have been reported in other institutions where snakes are kept".

In the *Journal of the Bombay Natural History Society*, Vol.XIV, (1910), W.S. Millard, Hon. Secretary of Bombay Natural History Society reports incidents of two Russell's vipers in the Society's museum biting the same rat. "…[W]hen their heads approach each other in trying to swallow the rat, one of them always manages to let go – and the viper who has secured the head of the rat first, is almost always the winner". He adds: "In the case of cobras, however, they are more tenacious of their hold and their fangs being fixed, slanting backwards, it is probably more difficult for them to detach themselves from their prey, and the victim only finds out his mistake when it is too late to extract himself from the other cobra's throat".

Such behaviour has been reported in sea snakes also. (See *The Fascinating Secrets of Oceans and Islands* by Wm. J. Cromie *et al*. 1972).

175. What is the feeding mechanism of snail-eating snakes?

There are a few species of snakes which have a specialized diet of snails and their feeding habits are accordingly specialized. The North American brown snake (*Storeria dekayi*), the snakes of the sub family Dispsadinae found in both the Old and the New World, the 'slug snakes' (*Pareas* sp.) found in South and Southeast Asia, all belong to this category. The Indian representatives are the Darjeeling snail-eater (*Pareas macularius*) found in the North East, Sikkim and part of West Bengal and the Assam snail-eater (*Pareas monticola*). Their lower jaws are adapted for removing the soft part of the snails from the shells. The lower jaw is capable of being extended or retracted independent of the upper jaw and it has long curved teeth. The snake inserts its lower jaw into the snail's shell so that the curved teeth at the tip of the jaw sink into the snail's body and then the snake retracts the jaw thus pulling out the soft parts from inside the shell.

176. Which group of snakes regularly feed on earth-worms?

The shieldtails (See Q & A 257).

CHAPTER - V

REPRODUCTION

177. In snakes, how do the sexes meet for reproduction?

In temperate and sub-polar regions, during winter, snakes hibernate in large numbers in communal dens (See Q & A 133 & 134). They breed as they emerge and have little difficulty in finding mates because of the numbers. But, other snakes are mostly solitary and, during the breeding season, the male has to seek out the female. This it does by following the scent trail left by the female which exudes pheromones from its cloacal glands. Though there is no categorical evidence that it is always the male that tracks the female, this is the general observation.

178. Are there snakes where the female can reproduce without the male?

Yes. This is a phenomenon known as 'parthenogenesis' or virgin birth which means biological reproduction that involves the development of a female sex cell without fertilization by a male sex cell. It is more commonly seen among invertebrates, and is extremely rare among vertebrates. Among vertebrates, it is known to occur in certain species of fishes and lizards. One species of snake, the brahminy worm snake (*Ramphotyphlops braminus*), found in India and worldwide, demonstrates this phenomenon (See Q & A 268). No male of this species has so far been discovered.

It has long been believed that the brahminy worm snake is the only snake that is capable of parthenogenesis. But, Douglas R. Mader says in *Reptile Medicine and Surgery* 1996/2006: "Parthenogenesis has also recently been reported in one file snake (*Acrochordus arafurae*) and a couple of North American snakes". Details are not known. Such instances will however, need careful scrutiny before being accepted as genuine cases of parthenogenesis. See Q & A 182.

Parthenogenesis is, perhaps, not such a bright idea after all. It, no doubt, helps in the worldwide extension of range and proliferation since a single individual transported elsewhere by chance or human intervention can found a whole population. At the same time, generations of inbreeding may result in inbreeding depression and genetic degradation. That is, at least, the received wisdom. But, most curiously, the brahminy worm snake like other typhlops, has been around for 50 million years, give or take a few millions, being a member of one of the oldest families, and, when the last reports came in, was still going strong.

179. Are snakes monogamous, polygamous or polyandrous?

All three, depending on the species. In monogamy, the male and the female stay together either for life or during the breeding season. In polygamy, the male mates with several females. In polyandry, the female mates with several males. Life-long monogamy has not been proved in snakes since it is not possible to get convincing evidence from the wild. But instances are known in snakes of monogamy during a particular breeding season and also polygamy and polyandry depending on the species.

180. What are the hemipenises in snakes?

The male snake possesses two penises called hemi-penises (or hemi-penes). These are normally carried inside the body and are extruded from the cloaca just before one of them is pressed into the female cloaca. Only one of them is inserted at a time and each is a complete penis (hemi-or half-penis is, therefore, a misnomer). Instead of being erected like a mammalian penis, the hemi-penis, once it gets engorged with blood, gets everted or turned inside out. The everted surface is brightly coloured and with many spines, ridges, spurs, convolutions, etc. and these fit into receptors in the female's cloaca. There is a groove down which the sperm passes. Once the hemi-penis is inserted, the female cannot free herself until the sperm delivery is completed which may take many hours.

181. Do male pythons and boas use the 'spurs' during courtship?

Yes. The 'spurs' of the boas and pythons are the vestigial hind legs(See Q&A 60). These are larger in the males than in the females. The male uses them to stimulate the female during courtship.

182. Can a female snake store or retain the sperm received during copulation?

Yes. A female snake can store or retain within its body, the sperm received during a single copulation and use it to fertilise the eggs at staggered intervals over a long period of time. The sperm may remain viable even for many years, probably drawing nutrients from the glandular sac walls. An American cat-eyed snake is reported to have produced a fertile clutch of eggs six years after copulation.

By storing the sperms and by separating fertilization from mating, the female is able to determine the best time of the year and the best environment for laying eggs or giving birth to the young, as the case may be.

This makes it necessary to scrutinise with care reported cases of 'captive breeding' of snakes in zoos. Even if a female caught from the wild is not gravid at the time of capture (most captive births are because the snake was gravid when captured), it is capable of fertilising its eggs long after it was brought into captivity, utilising the retained sperm.

For the same reason, suspected cases of parthenogenesis (See Q & A 178) in zoos need careful scrutiny. Just because the female had shown no signs of being gravid at the time of capture and had been in the zoo for months without the company of a male, it does not automatically mean that the fertile egg produced or the young born is a case of parthenogenesis since the sperm received from a male from a copulation that had taken place many months or years previously either in the wild or while within the zoo before it was segregated might have been stored inside by the female.

183. Do all snakes lay eggs?

No. Some, known as 'oviparous', lay eggs e.g. the cobras, the pythons, the keelbacks. Some, known as 'viviparous', bring out live young e.g. most vipers, vine-snakes, estuarine snakes, most sea snakes. In some known as 'ovoviviparous', e.g. boa constrictors, anacondas, sand boas, the female retains the eggs inside her oviduct where they hatch and the babies come out fully formed.

Most pit vipers bear live young. One of the few exceptions is the mountain pit viper (*Ovophis monticola*) found in West Bengal and the North East which lays eggs.

Some herpetologists do not make the distinction between viviparous and ovoviviparous and call all such snakes as ovoviviparous since there is no placental attachment as in mammals.

Three-fourths of the snake species are oviparous.

Viviparity is more common in colder climates.

184. Do snakes build nests to lay eggs?

No, with one exception, the king cobra.

The king cobra builds a nest on the ground by scraping together leaf litter from the forest floor with its body and lays its eggs in this.

The few observations regarding nest-building by the king cobra show that the female does it all by itself and the male is not even allowed to approach the construction site and the female will drive it away if the male approaches the site (See Kenneth Porter, *Herpetology*, 1972)

Snakes lay their eggs in burrows, mostly in earth or sometimes in tree holes or sometimes in rotting vegetation, and in ant and termite nests (See Q & A 188).

185. Are there snakes which congregate in the same spot for egg-laying?

This behaviour is known in some snakes. This happens when sites suitable for egg-laying are hard to find. This has been reported in sea-kraits (*Laticauda* spp.), European grass snake (*Natrix natrix*), American green snakes (*Ophiodryas* spp.) Australian whip snake (*Demansia psammophis*), etc.

As far as Indian snakes are concerned, Firoz Ahmed and Abhijit Das (*Hamadryad* 30, 1 & 2 (2006), while recording, for the first time, the occurrence of the groove-necked keel back (*Rhabdophis nuchalis*) in India (from Nagaland in Apr.2004) state that they found one habitat with "several hundreds of snake egg-shells between one or two years old… We are convinced that only a common species like this could … lay eggs in such huge numbers, suggesting a communal breeding behaviour. The local villagers, who have a remarkable natural history knowledge on this snake also suggested this behaviour".

186. What is the gestation period in egg-laying snakes?

In general, about 40 to 50 days. Pythons take longer, sometimes upto 100 days.

187. What is the gestation period in live-bearing snakes like vipers and boas?

Three to six months.

188. Do snakes dig their own burrows to lay eggs?

Snakes are not known to make their own burrows for laying eggs. They commandeer burrows made by other animals like rats and porcupines or tunnels in anthills made by termites.

But, one exception has been recorded. Burger and Zappalorti (1911) found that in the northern pine snake, *Pituophis melanoleucus melanoleucus,* the female digs burrows in sandy soil and excavates tunnels measuring about 1.5 m in length and leading to a nest chamber, accomplishing the task in two to three days (Quoted by Chris Mattison): (*The New Encyclopedia of Snakes,* 2007)

One curious incident has been reported in respect of the Indian cobra which lays its eggs in existing burrows, holes etc. Kenneth R. Porter in *Herpetology*, 1972 quotes from Malcolm Smith's paper titled "Breeding habits of the Indian Cobra" in *J. Siam Soc. Nat. Hist.* supplement 11:62-63, on how a pair of Indian cobras in a zoo were seen to construct together a tunnel in a pile of dirt by burrowing into it from both ends until their noses met and how they then formed a cavity in this tunnel in which the female laid eggs and both of them, by turns, guarded the eggs throughout most of the incubation period.

189. Do snakes incubate or hatch the eggs like most birds do?

Most snakes do not. Generally, snakes abandon their eggs and leave it to nature to supply the warmth to incubate or hatch the eggs. The only birds which do not incubate their eggs or, like most birds of the cuckoo family, 'outsource' incubation of their eggs to other birds and depend on the warmth provided by the sun or generated by decomposition of vegetable matter to incubate the eggs are the ground-nesting megapodes represented in India by the Nicobar megapodes (*Megapodius freycinat*).

Some snakes like cobras, the king cobra, kraits and the checkered keelback guard the eggs and will be found in the vicinity. The striped keelback may also do so. But they too do not incubate the eggs.

The pythons (not all species) incubate the eggs by coiling round them. The female Indian rock python (*Python molurus molurus*) and the female Burmese python (*Python molurus bivittatus*), while in this position, also try to raise the temperature by muscular contractions or 'shivering'.

Female Indian pythons maintain a temperature of 32-33º C within the egg mass which may be as much as 7 º C more than the ambient temperature.

This 'shivering' behaviour is not seen in the reticulated python (*Python reticulatus*) while it incubates its eggs.

It has been said of *Farancia*, two species of aquatic snakes found in the southeastern corner of N. America, that there is some evidence that the females coil around the eggs until they hatch.

Kenneth Porter (*Herpetology*, 1972) quotes Bellairs, 1970 to the effect that some worm snakes (*Leptophis* spp.) brood their eggs.

190. Do snakes lay eggs round the year?

Most snakes have only one reproductive season in the year. In some, perhaps, two. The mating season in the same species may differ from region to region depending on climatic conditions.

There are, however, a few species known to reproduce throughout the year e.g. among Indian snakes, the red-tailed trinket snake (*Gonyosoma oxycephalum*), copper-headed trinket snake (*Coelognathus radiatus*), painted bronzeback tree snake (*Dendrelaphis pictus)* in some parts of its range.

191. How many eggs do snakes lay in a clutch?

This may vary widely --- from 2 to 7 in the brahminy worm snake (*Ramphotyphlops braminus*) to 50 to 124 in the reticulated python (*Python reticulatus*), both found in India. The average for all Indian species together may be taken roughly as 6.

Speaking about snakes worldwide, among the few species with clutches of more than 100 eggs are the Indian rock python (*Python molurus*), the reticulated python (*Python reticulatus*) and the African python (*Python sebae*).

192. Which sea snakes lay eggs?

The sea kraits, which belong to the genus *Laticauda.* While all other sea snakes bring forth live young in the sea, the sea kraits lay eggs and on land. They are distributed from the sea off eastern India to western Pacific Ocean. India has two species: the common sea krait (*Laticauda laticaudata*) and the yellow-lipped sea krait (*Laticauda colubrina*).

193. Can twin snakes come out of one egg?

Such 'twinning' has been found to occur occasionally in pythons. This is caused by two embryos being accidentally shelled together during passage through the oviduct and is not the result of a fertilised egg dividing into two, as may happen in other animals including humans, and developing as individual embryos.

There seem to be no reported cases of more than two snakes from one egg.

194. Why do the eggs of some snakes like pythons stick together?

This reduces their total exposed surface and helps to prevent them from drying out. In snake eggs in general, if the substrate is too dry, moisture will escape from inside and the embryo may get dehydrated.

195. Does a snake produce more than one clutch in a year?

Little is known about this from the wild. But, in captivity, snakes have sometimes produced two or even three clutches in a year. Sometimes, this may happen from stored sperm (See Q & A 182).

196. Are there snakes which reproduce once in two years?

It has been reported that three species of *Hoplocephalus* found in eastern Australia produce litters of 2 to 12 young every other year.

The rubber boa (*Charina bottae*) of western North America has been reported to reproduce only once in two or three years.

197. How long does it take for snake eggs to incubate?

30 to 50 days. The duration depends on the species and the temperature of the environment (In birds it varies from about 10 to 80 days).

198. Are snakes known to coil round the eggs for guarding them even without any attempt at incubation?

This type of behaviour is known in some species like cobras and the king cobra either throughout or part of the time till the eggs hatch. Other examples are the spotted skaapsteker (*Psammophis rhombeatus*) from Southern Africa, *Psammophis variabilis* in areas where it is oviparous (in certain areas, this snake is viviparous) *Snonatrix percarinata* found in China and the Malaysian pit viper *Calleselasma rhodostoma* (an oviparous species unlike most vipers), the aquatic snakes *Farancia abacura* and *F.erytrogramma* found in the southeastern corner of N. America.

199. What is the ideal temperature for incubation of snake eggs?

About 28ºC for temperate species. A few degrees higher for tropical species. Tropical snakes have less tolerance for variations from the ideal temperature than temperate species.

It has been noticed that the incubating temperature is much more critical for eggs of pythons than for that of other snakes. Relatively slight drops in temperature can result in poorly developed, abnormally pigmented or deformed young. At very low temperatures, they may fail to develop altogether.

200. Are there snakes where the young stay with the mother snake for some time?

Snakes are not known for parental care unlike mammals and birds. Most egg-bearing snakes, once the eggs are laid, take no further interest in them. This is so even with those which guard the eggs or incubate the eggs, once the young emerge (See Q & A 189 & 198). The live-bearing snakes also take no interest in the young born. However, in the dog-faced water snake (*Cerberus rynchops*), the young often stay with the mother for a week or more. This has also been reported in atleast one rattlesnake species. But it is not certain whether these are instances of parental care or because of the suitability of the environment.

201. How do the boas and the pythons differ in their reproductive behaviour?

Members of the family Boidae and the family Pythonidae are similar in many respects. One main difference between the two families is that the pythons lay eggs while the boas bear live young. This is true also of the sand boas found in India.

202. Do snake eggs grow in size after they are laid?

Yes. They may increase in size by about one-third and, by the time they hatch, their weight may have increased by about one-half. This is largely due to the influx of water through the semi-permeable egg shell and is used by the developing embryo.

203. Does the shape of eggs vary with the shape of the snake?

Generally, long, slender snakes lay elongated eggs, thick-bodied snakes lay round eggs.

204. Which are the most prolific egg-layers among Indian snakes?

- Reticulated python (*Python reticulatus*) : Upto 124 eggs have been seen in one clutch
- Indian rock python (*Python molurus molurus*) and Burmese python (*Python molurus bivittatus*): Upto 107 eggs have been seen in one clutch.
- Checkered keelback (*Xenochrophis piscator*): Upto 90 eggs have been seen in one clutch.

The average clutch size for snakes in general may be taken as about seven, and, in the vast majority of clutches, the number of eggs ranging from 3 to 16.

205. Which are the most prolific live-bearing Indian snakes?

The Russell's viper (*Daboia russelli*) is known to bear more than 60 young ones at a time. The plumbeous smooth-scaled water snake (*Enhydris plumbea*), a recent find for India, from the Great Nicobar Islands, (found also in most of southeastern Asia), gives birth to 6 – 30 young. All other live-bearing Indian snakes (the sand boas, mock viper, the vine snakes, etc.) bear less than 10 – 11 young at a time. However, in the common vine snake (*Ahaetulla nasuta*), it has gone up to 23.

206. Are egg shells of snakes hard as in birds?

No. They are leathery and soft to the touch.

207. Are viviparous snakes also known to lay eggs?

This has been noticed in captivity on rare occasions. e.g. In Russell's viper. In viviparous snakes, since there is no placental attachment, the embryo first develops inside the eggs while inside the body of the mother snake and then the fully formed young ones are born. But, sometimes, this development of the egg inside the mother snake is not complete and the eggs are laid.

208. Are female snakes known to eat their infertile egg masses and still-births?

Yes. This may be Nature's way of recycling waste material.

209. Does the incubation temperature of snake eggs have a bearing on the sex of the young ones that emerge?

No. This is different from the case of crocodiles and turtles / tortoises where the incubating temperature influences the sex composition of the brood. In crocodiles, the higher the incubating temperature, the larger the ratio of males to females; in turtles / tortoises, the higher the incubating temperature the larger the ratio of females to males.

210. Which snake is reported to have produced the largest number of living young?

A puff adder (*Bitis arietans*) in the Dvur Kralove zoo in Czechoslovakia is reported to have given birth to 157 living young. The mother measured 1.1 m

211. How does the male garter snake ensure the success of its own genes?

The males of some animal species are known to resort to various stratagems to ensure that, in the procreation of their progeny, their own genes get precedence over that of rival males. Monogamous relationship and the male staying by the side of the female throughout the breeding season are ways of ensuring this. A strong sense of territory is another. In this process, some animals have been found to go to the extreme of resorting to infanticide as was observed and reported in 1974 by Sarah Hrdy (b.1946), the American anthropologist and primatologist, and her team of scientists, in the Hanuman langur monkeys (*Presbytis entellus*) in Mt. Abu, India. When a male langur takes over a troop of females and finds that the females are with infants and breast-feeding them, it proceeds to kill all the infants in the troop. This brings the females again into oestrus (which will not happen so long as they are lactating) and thus receptive to the new-comer. This also makes the new-comer ensure that it is its genes that will get passed on to the subsequent generations to the exclusion of that of the males that had preceded it.

In a paper entitled "A Review of Infanticide among Hanuman Langurs and other Primates" in the *Journal of the Bombay Natural History Society*, vol.83 (supplement), 1987, Y. Sugiyama of Kyoto University, Japan, says that the first report and discussion on conspecific infanticide in Hanuman langurs was by him based on observations in Dharwar, Karnataka, India in 1964. He also says that at about the same time as Hrdy's report and a little later, similar reports had appeared of such occurrences also in the purple-faced langurs (*Presbytis senex*) in Sri Lanka, and the red howler monkey (*Alouatta seniculus*) in S. America and in lions in Serengeti in E.Africa. Sugiyama adds that "other than [such] repeated and regular occurrences of infanticide mainly by an invading male after the replacement of the resident male… facultative infanticides have been confirmed atleast in 13 species of non-human primates" as reported by Itani, J. and others in *J. Social Biol. Struct.*5, 1982.

But, on a more elevated plane, some animals including at least one species of snakes have discovered that, instead of resorting to the slaughter of the innocents, a benign option is available to secure similar results, atleast in part. In *Nature*, 267 (May 1977), Michael C.D. Devine reported the use of 'copulatory plugs' (or 'vaginal plugs') by some garter snakes (*Thammophis serialis* and *T. butleri*). Once the male has deposited its sperm into a female's oviduct, it drops into the oviduct a 'plug'

formed from a fluid secretion of its (the male's) kidney which hardens and prevents the sperm from other males which may copulate with the female from reaching its ova. In fact, he found from evidence in the field that male garter snakes "recognize females with a copulatory plug and behave as if these females were unavailable". In due course, after the purpose is served, the plug disintegrates and is ejected. Though, in snakes, this seems to have been reported only in the garter snakes, it is likely that some other species of snakes may also resort to this especially since this ruse is found in many other taxa also such as the masked palm civet, guinea pigs, squirrels, rats and mice and even in scorpions and spiders.

The function of the copulatory plug is not, however, free from controversy.

CHAPTER - VI

SNAKE BITE

212. Which is the correct term: venomous snake or poisonous snake?

Venomous snake. 'Poison' is a generic term and may refer to material of animal or vegetable or mineral origin. 'Venom' is specifically of animal origin. But all materials of animal origin cannot be described as 'venoms'. For instance, the flesh of some animals, like some species of frogs (not found in India), can make one sick if eaten. The flesh is poisonous, not venomous. So also is the secretion on the skins of some frog species. Poison enters the body of the victim by ingestion; venom enters the body by injection.

213. How many persons die in India in a year from snakebite?

There are no reliable national statistics and there are conflicting estimates. This is because most of these deaths happen in villages and are, therefore, poorly documented. Going by all available accounts, an estimate of 20,000 deaths in India from snakebite annually may not be wide of the mark.

214. Which States in India record the highest number of deaths from snakebite?

Maharashtra has the highest, followed by Kerala, Tamil Nadu, Uttar Pradesh and West Bengal but not necessarily in that order.

215. List the main features of incidents of snakebite, particularly in Indian conditions

(i) They are mostly in rural areas.

(ii) The majority of the bites happen at night.

(iii) The incidents are more common in the rainy season.

(iv) The majority of the victims are males.

(v) Most victims are in the age group of 20 to 50.

(vi) Most of the bites are on the lower limbs, followed by the upper limbs.

216. How numerous are venomous snakes in the world?

Of a total of 2968 species of snakes in the world, some 560 species or 19 % are venomous.

Most venomous species are in the families of elapidae and viperidae, all front-fanged. There are some 535 venomous elapids and vipers. Colubridae, the most numerous family with some 1930 species, constituting 65 % of snake species, consist mostly of non-venomous snakes but also has many mildly venomous, rear- fanged,

snakes and a few venomous, rear-fanged, snakes including the well-known boomslang. Proportion of venomous and non-venomous snakes worldwide:

Venomous	Elapids	: 10 %	
	Vipers	: 8 %	19 %
	Venomous colubrids	: 1 %	
	Non-venomous colubrids	: 64 %	
Non-venomous	Blind snakes	: 12 %	81 %
	Boas and related species	: 5 %	

217. How numerous are venomous snakes in India?

Of the 276 species of Indian snakes, 62 are venomous i.e. about 26 % (42 species are mildly venomous and 172 are non-venomous). This figure of 62 species is, however, likely to give an impression that venomous snakes pose a serious threat in India. This is wrong. Of the 62, twentyone are sea snakes and, except fishermen, the rest of us have little chance of confronting any of them. Of the 42 land snakes, barring four, namely the spectacled cobra, the common krait, the Russell's viper and the saw-scaled viper, which are described as 'common', the remaining 38 have only a limited, sometimes very limited, distribution and the snake, if not found in a particular area, should not be a cause for worry in that area. Then again, of the 38 snakes found in a limited range, 16 alone are 'common'. To top it all, even if the snake is described in text books as 'common', it does not automatically mean that it poses a threat. It is 'common' only in a technical sense and the description does not imply that it is commonly come across. Snakes are secretive creatures and, as far as possible, avoid confrontations with men. In fact, few of us would have come across these 'common' snakes in a natural state (i.e. other than in zoos or with snakecharmers, *etc*.) unless the person had been searching for them.

218. Which are the venomous snakes of India and how common and how dangerous are they?

Sl. No.	Common name and Scientific name	Distribution range	Status within its distribution range	Potency of venom	Incidence of bites	Effect of bites
1	Himalayan keelback *(Rhabdophis himalayanus)*	The eastern Himalayas from Sikkim to Arunachal Pradesh	Common	It has no venom but has highly toxic saliva	Not many cases known	Severe reactions known from one case
2	Red-necked keelback *(Rhabdophis subminiatus)*	Eastern Himalayas from Sikkm and Assam to Arunachal Pradesh.	Common	It has no venom but has highly toxic saliva.	Not many cases known	Severe symptoms
3	Himalayan krait *(Bungarus bungaroides)*	Eastern Himalayas(Darjeeling district,;Sikkim); Assam(Khasi Hills); Cachar	Rare	NA But kraits generally have potent venom	NA	NA
4	Banded krait *(Bungarus fasciatus)*	West Bengal, Bihar, Orissa, Assam upwards to Arunachal Pradesh, parts of Madhya Pradesh, Maharashtra, Northern Andhra Pradesh and U.P.	Common	Potent but not as potent as No.5	Rare. Reluctant to bite	One case of death known.
5	Common krait *(Bungarus caeruleus)*	Most of mainland India.	Common	Highly potent	Many cases	Many fatalities
6	Andaman krait *(Bungarus andamanensis)*	Andaman Islands	Uncommon	N.A. But kraits generally have potent venom	Not many known	No fatalities known.

Sl. No.	Common name and Scientific name	Distribution Range	Status within its distribution range	Potency of venom	Incidence of bites	Effect of bites
7	Black krait *(Bungarus niger)*	Sikkim, West Bengal, Assam, Meghalaya and Arunachal Pradesh	Rare	N.A. But kraits generally have potent venom	N.A.	N.A.
8	Wall's Sind krait *(Bungarus sindanus walli)*	Gangetic plain, Central and Western India—Uttar Pradesh, Maharashtra, Bihar and Bengal	Rare	N.A. But may be as toxic as of No.5	N.A.	N.A.
9	Lesser black krait *(Bungarus lividus)*	West Bengal, Assam, Eastern Himalayas.	Rare	N.A.	N.A.	N.A.
10	Slender coral snake *(Calliophis melanurus)*	Probably most of Peninsular India. Definite records from Gujarat, Maharashtra, Karnataka, Tamilnadu. Also West Bengal	Rare	Mild	A few known	Slight swelling and itching.
11	Striped coral snake *(Calliophis nigrescens)*	Western Ghats (Kerala, Tamilnadu, Maharashtra) and Gujarat.	Rare	N.A.	N.A.	N.A.
12	Beddome's coral snake *(Calliophis beddomei)*	Shevaroy hills (Tamilnadu) and Karnataka.	Rare	N.A.	N.A.	N.A.
13	Macclelland's coral snake *(Sinomicrurus macclellandi)*	Northeast India from Darjeeling to Arunachal Pradesh.	Rare	N.A.	N.A.	N.A.

Sl. No.	Common name and Scientific name	Distribution Range	Status within its distribution range	Potency of venom	Incidence of bites	Effect of bites
14	Bibron's coral snake *(Calliophis bibroni)*	Western Ghats as far north as Coorg	Uncommon	N.A.	N.A.	N.A.
15	Spectacled cobra *(Naja naja)*	Throughout mainland India	Common	Highly toxic	Many cases	Severe. Only a small percentage of bites are fatal because not enough venom gets injected.
16	Monocled cobra *(Naja kaouthia)*	North and eastern India from Haryana, most of the Gangetic plains, West Bengal, Orissa, Sikkim, Assam to Arunachal Pradesh. Probably in Uttar Pradesh and Bihar also.	Common	Highly toxic	Many cases	Severe. Only a small percentage of bites are fatal because not enough venom gets injected.
17	Andaman cobra *(Naja sagittifera)*	Andaman Islands	Rare	N.A.	N.A.	N.A.
18	Central Asian cobra *(Naja oxiana)*	Jammu and Kashmir, Himachal Pradesh. Probably in Punjab, Rajasthan and Gujarat also.	Rare	N.A.	No record of bites from India.	N.A.

Sl. No.	Common name and Scientific name	Distribution Range	Status within its distribution range	Potency of venom	Incidence of bites	Effect of bites
19	King cobra *(Ophiophagus hannah)*	Western Ghats (Karnataka, Goa, Kerala, Tamil Nadu), UP, Bihar, Orissa, West Bengal, the Northeast to Arunachal Pradesh and the Andaman Islands.	Rare	Less toxic than No.15 and 16. But capable of injecting a large dose of venom.	Rare	Four deaths in the last 30 years all from South India.
20	Common sea krait *(Laticauda laticaudata)*	Off Kolkata coast and Nicobar Islands	Rare	N.A.	N.A.	N.A.
21	Yellow-lipped sea krait *(Laticauda colubrina)*	Andaman and Nicobar Islands	Common	Very potent	A few known	"One or two deaths reported"
22	Jerdon's sea snake *(Kerilia jerdonii)*	West coast (Kerala), East Coast from Chennai to Puri	Uncommon	N.A.	N.A.	No fatalities reported
23	Viperine sea snake *(Praescutata viperina)*	Indian coasts	Rare	N.A.	N.A.	N.A.
24	Hook-nosed sea snake *(Enhydrina schistosa)*	Indian coasts.	Common	Highly potent	Rare	Deaths reported
25	Black-banded sea snake *(Hydrophis nigrocinctus)*	Bay of Bengal(Sundarbans)	Rare	N.A.	N.A.	N.A.

Sl. No.	Common name and Scientific name	Distribution Range	Status within its distribution range	Potency of venom	Incidence of bites	Effect of bites
26	Yellow sea snake *(Hydrophis spiralis)*	East Coast and occasionally on West Coast.	Common	N.A.	Fatalities reported from outside India	N.A.
27	Annulated sea snake *(Hydrophis cyanocinctus)*	Indian coasts.	Uncommon	N.A.	N.A.	Fatalities reported
28	Estuarine sea snake *(Hydrophis obscurus)*	East Coast of India	Common	N.A.	N.A.	N.A.
29	Bengal sea snake *(Hydrophis stricticollis)*	East Coast of India, north of Orissa	N.A.	N.A.	N.A.	Fatalities reported
30	Cochin banded sea snake *(Hydrophis ornatus)*	Coasts of India	Rare	High	A few known	Fatalities reported
31	Persian Gulf sea snake *(Hydrophis lapemoides)*	Coasts of India.	Rare	N.A.	N.A.	N.A.
32	Bombay Gulf sea snake *(Hydrophis mamillaris)*	Coasts of India	Rare	N.A.	N.A.	N.A.
33	Malacca sea snake *(Hydrophis caerulescens)*	Between Mumbai and Karwar on the West Coast and from Chennai northwards to mouth of the Ganges on East Coast	Uncommon	N.A.	Generally inoffensive, but will bite if provoked	Fatalities reported

Sl. No.	Common name and Scientific name	Distribution Range	Status within its distribution range	Potency of venom	Incidence of bites	Effect of bites
34	Banded sea snake *(Hydrophis fasciatus)*	Coasts of India	Common	N.A.	N.A.	N.A.
35	Short sea snake *(Lapemis curtus)*	Coastal waters (more common on the West Coast)	Uncommon	Venom very toxic	Fatalities reported	Fatalities reported
36	Large-headed sea snake *(Astrotia stokesii)*	Bay of Bengal.	Rare	High	N.A.	N.A.
37	Common small-headed sea snake *(Hydrophis gracilis)*	Gujarat and coasts of India	Common	N.A.	N.A.	N.A.
38	Cantor's narrow-headed sea snake *(Hydrophis cantoris)*	Western Coast of India.	Common	N.A.	N.A.	N.A.
39	Black & yellow sea snake *(Pelamis platurus)*	Indian coastal waters and Andaman & Nicobar Islands	Uncommon	N.A.	Usually inoffensive - bites if handled	One death known from Sri Lanka

Sl. No.	Common name and Scientific name	Distribution Range	Status within its distribution range	Potency of venom	Incidence of bites	Effect of bites
40	Russel's viper *(Daboia russelii)*	Throughout India.	Common	Potent	"..they cause as many, or more, snakebites than cobras"(Whitaker and Captain)	"Usually not fatal" (Whitaker & Captain) but life-threatening
41	Levantine viper *(Macrovipera lebetina)*	A few localities in Kashmir including Srinagar and Dachigam.	Uncommon	Toxic venom but not much known	N.A.	No known fatalities from India
42	Saw-scaled viper *(Echis carinatus)*	Throughout mainland India except West Bengal and the Northeast.	Common	Very toxic	Many cases	Many fatalities
43	Himalayan pit viper *(Gloydius himalayanus)*	The Western Himalayas – Kashmir, Himachal Pradesh, Northern Punjab, Uttar Pradesh and Uttaranchal	Common in parts of range	Not particularly toxic	A few known	Localized pain and swelling, No fatalities reported

Sl. No.	Common name and Scientific name	Distribution Range	Status within its distribution range	Potency of venom	Incidence of bites	Effect of bites
44	Hump-nosed pit viper *(Hypnale hypnale)*	TheWestern Ghats as far North as Belgaum	Common	Quite toxic	A few known	Considerable swelling and pain. Life-threatening symptoms. But no fatalities reported from India.
45	Large-scaled pit viper *(Trimeresurus macrolepis)*	South India	Common	Not very toxic	N.A.	Local pain and swelling. No fatalities reported.
46	Brown-spotted pit viper *(Protobothrops mucrosquamatus)*	Assam (the Naga Hills)	Rare	N.A.	N.A.	N.A.
47	Mountain pit viper *(Ovophis monticola)*	Uttaranchal, Sikkim, West Bengal, Assam, Manipur, Meghalaya, Nagaland to East Arunchal Pradesh	Common	Little is known	A few known	Much pain. Swelling and continuous bleeding. No fatalities recorded in India.

Sl. No.	Common name and Scientific name	Distribution Range	Status within its distribution range	Potency of venom	Incidence of bites	Effect of bites
48	Jerdon's pit viper *(Protobothrops jerdonii)*	Northeast from Meghalaya to Arunachal Pradesh	Rare	N.A.	N.A.	N.A.
49	Malabar pit viper *(Trimeresurus malabaricus)*	Western Ghats from Maharashtra to Kanyakumari	Common	Low	A few known	Pain & swelling
50	Horseshoe pit viper *(Trimeresurus strigatus)*	Southern Western Ghats.	Uncommon	Low	A few known	Pain & swelling.
51	Bamboo pit viper *(Trimeresurus gramineus)*	Western Ghats and Eastern Ghats.	Common	Low	A few known	Pain & swelling.
52	Yunnan pit viper *(Trimeresurus yunnanensis)*	Uttaranchal, Assam, Himalayas	N.A.	N.A.	N.A.	N.A.
53	Medo pit viper *(Trimeresurus medoensis)*	Arunachal Pradesh	Rare	Low	A few known	Pain & swelling.
54	Pope's pit viper *(Trimeresurus popeiorum popeiorum)*	Sikkim, Meghalaya, West Bengal	Uncommon	Low	A few known	Pain & swelling. "Bite from a large snake could be lethal". (Whitaker & Captain)

Sl. No.	Common name and Scientific name	Distribution Range	Status within its distribution range	Potency of venom	Incidence of bites	Effect of bites
55	Cantor's pit viper *(Trimeresurus cantori)*	Central Nicobar group of Islands.	Common	Low	A few known	Not serious. One fatality reported from Central Nicobar.
56	Andaman pit viper *(Trimeresurus andersoni)*	Andaman Islands	Common	Low	A few known	Local pain, swelling and necrosis. No deaths reported.
57	Spot-tailed pit viper *(Trimeresurus erythrurus)*	Sikkim, Nagaland, West Bengal and probably more states in the Northeast	Uncommon	N.A.	N.A.	Effects unknown but a "bite from a large snake could be serious". (Whitaker & Captain)
58	White-lipped pit viper *(Trimeresurus albolabris)*	West Bengal and Assam	Uncommon	Low	A few known	Local pain and swelling. "Bite from a large snake could be serious or even fatal". (Whitaker & Captain)

Sl. No.	Common name and Scientific name	Distribution Range	Status within its distribution range	Potency of venom	Incidence of bites	Effect of bites
59	Nicobar pit viper *(Trimeresurus labialis)*	Nicobar Islands	Common	N.A.	N.A.	N.A.
60	Hutton's pit viper *(Trimeresurus huttoni)*	Highwavy mountains (Meghamalai) (South-east of Madurai, Tamilnadu)	N.A	N.A.	N.A.	N.A.
61	Himalayan white-lipped pit viper *(Trimeresurus septentrionalis)*	N.A.	N.A.	N.A.	N.A.	N.A.
62	Gumprecht's green pit viper *(Trimeresurus gumprechti)*	N.A.	N.A.	N.A.	N.A.	N.A.

[Sourced mostly form Whitaker and Captain : *Snakes of India : The Field Guide*, 2004]

N.A. : Information not available.

219. What are the three important families of venomous snakes in India?

The elapidae (cobras, kraits and coral snakes), the viperidae (vipers including pitvipers) and the hydrophidae (sea snakes).

220. Which is the most dangerous snake in India?

There is no one-word answer to this because the degree of danger posed by a snake depends on various factors:

a) How widespread the snake's distribution is.
b) How common the snake is within its range.
c) How dense the human population is within this range.
d) How often there are chances for humans to have confrontations with it.
e) How potent its venom is.
f) How readily it bites.
g) How often it injects sufficient venom for its bite to have fatal or life-threatening consequences.

If we consider sea snakes, the hook-nosed sea snake (*Enhydrina schistosa*) may be reckoned as the most dangerous sea snake for India (also worldwide). It is the most widespread on the Indian coast, it is the commonest in its range and it has the most potent venom. Though sea snakes are generally reluctant to bite, this one is more ready to do so than others. Fatalities are known, but the comparative data for sea snakes is not available. As is the case with all sea snakes, occasions for confrontations with humans are limited mostly to fishermen.

No one land snake of India qualifies to be counted as *'the* most dangerous' going by all the criteria listed above. The honours have to be shared by four snakes. The position is as follows:

a)	The most widespread in distribution	}	The Indian cobra i.e.
b)	The commonest within its range	}	the spectacled cobra and
c)	Occurrence in areas with the densest human population	}	the monocled cobra taken together .
d)	Frequency of chances for confrontations with humans		(*Naja naja* and *Naja kaouthia*)
e)	Potency of venom	:	The common krait

			(Bungarus caeruleus)
f)	Frequency of bites	:	The Russell's viper (*Daboia russelii*)
g)	Frequency of fatal or life-threatening envenomation by bites	:	The saw-scaled viper (*Echis carinatus)*

Thus the Indian cobra (i.e. the spectacled cobra and the monocled cobra), the common krait, the Russell's viper and the saw-scaled viper are together known as the "Big Four" venomous snakes of India.

221. What are the other principal venomous snakes of India which are not 'common' throughout most of India? (For clarification on 'common' see Q & A 217).

i. The king cobra (*Ophiophogus hannah*). Has a limited distribution though common within its range.

ii. The banded krait (*Bungarus fasciatus*) Has a limited distribution though common within its range.

iii. Pit vipers. These have a limited distribution. Of the 20 species in India, only nine are common in their ranges: the Himalayan pit viper *(Gloydius himalayanus*), hump-nosed pit viper (*Hypnale hypnale*), large-scaled pit viper (*Trimeresurus macrolepis*), mountain pit viper (*Ovophis monticola*), Malabar pit viper (*Trimeresurus malabaricus*), bamboo pit viper (*Trimeresuras gramineus*), Cantor's pit viper (*Trimeresurus cantori*), Andaman pit viper (*Trimeresurus andersoni*), Nicobar pit viper (*Trimeresurus labialis*)

iv. Sea snakes. 20 species in India. Found along the sea coast or off the coast. Of the 20, only two are common: the Yellow-lipped sea krait (*Laticauda colubrina*) and the hook-nosed sea snake (*Enhydrina schistosa*)

222. Based on the same or similar criteria as in Q & A 220 what snakes can be considered as the most dangerous snakes of the world?

Here again, the situation may differ from country to country or region to region depending on various factors. But, generally speaking, the following is the position:

- The saw-scaled viper (*Echis carinatus*) in much of Asia and Africa.

- The puff adder (*Bitis arietans*) in Africa.
- The Malayan pit viper (*Calloselasma rhodostoma*) in Asia.
- The fer de lance (*Bothrops atrox*) in Central and South America.

223. Are new-borns of venomous snakes dangerous?

Yes. They have venom glands, venom and fully functional fangs. It may appear paradoxical, but the venom of new-born and small juveniles is more potent than that of adults of the same species. This is Nature's way of making up for the smaller quantity. A young snake is also more irritable than an older one.

224. What is meant by a 'mildly venomous' snake?

Some snakes such as the cat snakes, vine snakes and estuarine snakes used to be described until recent times as 'non-venomous'. This was not strictly correct. It is true they do not have glands producing venom and hollow or grooved front fangs for venom delivery. But they have large grooved teeth in the back of the upper jaw (hence called rear-fanged or back-fanged) which can deliver toxic saliva to its prey from the Duvernoy's gland. This can paralyse the prey species. In humans, their bites can cause local symptoms but no serious complications or death. This is sometimes referred to as salivenomation.

The Duvernoy's gland is a modified salivary gland, but different in structure from a venom gland which too is a modified salivary gland. It varies in size from species to species.

225. What is meant by a 'dry bite'?

When the snake bites a non-prey species like humans, the intention is rarely to kill. The venom is a precious resource for the snake, being an aid to capture its prey and an enzyme to digest it and, therefore, the snake does not expend more venom than what is strictly necessary. Even when it bites a prey, it usually injects only just enough venom to paralyse it. The snake then allows the prey to run away and tracks it down by smelling the scent trail and finally captures it when it has become incapacitated. In the case of a human victim when the snake bites as a reflex action when it is trodden upon or otherwise hurt, a large quantity of venom may, perhaps, be injected. But, often, it is only a defensive action and the intention is only to warn in which case the venom may be insignificant in quantity or nil. A bite with little or no

venom injected is known as a ‘dry bite’. It is estimated that, in Indian conditions, nearly 50 % of bites are ‘dry bites’. In seasnakes ‘dry bites’ are as high as nearly 70 %. But this may vary depending on the species. Cobra bites are in many cases ‘dry’. But few bites of the saw-scaled viper are ‘dry’. It is estimated that only 10 % of saw-scaled viper bites are ‘dry’.

226. What are the different groups of toxins present in snake venom?

The venom of a snake is not just one kind of toxin. It is a cocktail of toxins with different properties and different effects on the body of the victim. These toxins are enzymes and 25 such enzymes have been isolated. The toxins are broadly as follows:

- Cytotoxins damage the tissues
- Haemotoxins cause heavy bleeding internally and externally
- Neurotoxins impair the nervous system
- Myotoxins damage the muscles.

There are also components whose functions we still do not know.

227. How is potency of snake venom measured?

A large number of mice are injected with a measured quantity of venom. The percentage of mortality within 24 hours is found out. The lethal dose for 50 % of the mice is specified as ∟D50 and this is expressed in ‘milligram of venom per kilogram of mouse’. For instance, a spectacled cobra’s (*Naja naja*) venom’s ∟D50 is 0.28. This means that the lethal dose of venom for 50 % of mice of a given sample is 0.28 mg for kg of mouse. The ∟D50 figures for different species of snakes will give an idea of the comparative potency of their venom. For instance, the ∟D50 for king cobra (*Ophiophagus hannah*) venom is 0.90 whereas for spectacled cobra, it is 0.28. This means that the potency of the king cobra’s venom is only about one-third of that of the spectacled cobra.

228. What is the principal difference between the venom of the vipers and the venom of cobras and kraits and the venom of sea snakes?

The venom of the vipers is haemotoxic and attacks the tissues and blood. The blood loses its ability to coagulate. There is profuse bleeding internally and externally and this is the principal cause of death.

The venom of the cobras and kraits is neurotoxic i.e. damaging or destroying nerve tissue. Death is due to respiratory failure.

The venom of sea snakes is predominantly myotoxic i.e. damaging the muscles. The venom's site of action is at the neuro-muscular junction.

But, these are not water-tight compartments. For instance, viper venom can cause neurotoxic effects also.

229. Why is it dangerous to handle a recently dead venomous snake?

Even after death, the jaws may sometimes snap shut in a reflex action and if a body part of the handler gets caught inside the mouth, a venomous bite may be the result. Such reflex action in dead snakes, and even in severed heads, has been noticed even one hour after the snake's death.

230. Can repeated injections of snake venom make a man immune to snakebite?

Though such claims are occasionally heard, no controlled experiments have been conducted in the matter, or are, indeed, possible for obvious reasons. While, theoretically, such immunity may be thought possible, this is unlikely to be achieved in practice because of the likelihood of even mild doses causing serious complications forcing the research to be abandoned, the uncertainty in determining when the immunity built up is adequate, the uncertainly of how long the immunity will last and the probability that, at some stage, the tolerance threshold may unwittingly be crossed leading to fatal results. Also, and not the least, is the possibility of someone getting entangled with the law on homicide or attempted suicide.

Moreover, the slow accumulation of venom in the blood, even if it does not prove fatal, can have very serious consequences in course of time. The case of Ram Chandra, the famed 'Taipan Man' of Australia, is a pointer (See Q & A 332).

231. What are the symptoms of bite by different venomous snakes?

Symptom	Cobra	Krait	Viper
Pain	Some pain at bite-site	Mild pain at bite-site or nil.	Burning pain at bite-site. Generalised pain, pain in the lower back and loins.
Haemorrhage (loss of blood)	Mild	Mild	Heavy–externally and internally. Blood in sputum, vomit, urine, faeces. Because of haemorrhage at bitesite, this area may become discoloured and take on various hues.
Drowsiness	Yes	Yes	Not likely
Inflammation	Moderate	Very little or nil	Severe to very severe
Oedema (Accumulation of fluid in cells)	Rare and light	Rare and light	Rapid swelling of bitten parts
Breathing	Difficult	Difficult	No noticeable difference
Abdominal pain	Not noticeable	Severe	Not noticeable
Eyes	Drooping eyelids (Ptosis). Double vision	Drooping eye lids (Ptosis). Double vision	Ptosis in Russell's viper bites. No ptosis in saw-scaled viper bites.
Swallowing	Difficult	Difficult	No particular problem
Breathing problem	Yes	Yes	Occasional

Necrosis (Death of cells in organs and tissues)	Severe	Not severe	Very severe
Paralysis	Yes	Yes	No
Frothing at the mouth	Yes	Occasionally	No
Nausea	Yes	Yes	Yes
Renal complications	No	No	Yes in Russell's viper bites. No in saw-scaled viper bites.

232. In the case of a snake bite, is absence of fang marks or pain or swelling an assurance that there is no envenomation?

No. There can be envenomation even in such cases. In all cases of snakebite, except where the snake is positively identified as non-venomous or only mildly venomous, all precautions should be taken and a watch kept for symptoms of envenomation which may set in later.

233. Why is it dangerous for the bitten person or anyone else to remain at the site where a snake has bitten someone?

This is because of the peculiar mode of hunting adopted by a venomous snake. (See Q & A 169). After biting its prey, the snake allows the prey to flee but follows the partly incapacitated prey by using the scent trail. Therefore, the snake will still be there in the vicinity. The snake may, likewise, be there in the vicinity even if it has bitten a human.

234. What is cryotherapy or cryopathy?

This involves application of icepacks or cold compresses to the site of a snakebite and was, for long, a recommended treatment for snakebite in the U.S. Cryotherapy now stands discredited. It is not only ineffective but will also destroy the tissues.

235. What is ELISA?

This acronym stands for Enzyme-Linked Immuno Sorbent Assay, also called Enzyme-Linked Immuno Assay (EIA). This is a bio-chemical research procedure by

which the identity of the snake species can be determined from a sample of the victim's blood. This becomes necessary when a monovalent antivenin is proposed to be used and the identity of the snake species had not been incontrovertibly established from other evidence. This procedure is not currently available in India.

236. What is the Sutherland technique?

Also called 'pressure immobilization method'. This is a practice in first aid in snakebite cases recommended by Dr. Struan K. Sutherland (1936 – 2002) of Australia. It consists of the application of a pressure bandage (crepe bandage) on the bitten limb, over the entire length of the limb, to impede the flow of lymph and venous blood, and the immobilization of the limb using a sling as in the case of a fracture. Once highly regarded as a first aid measure for snakebite, it is no longer so, for various reasons. For a detailed account, see the author's *Snakebite: A Book for India*, 2008.

237. Are herbal remedies effective against snakebite?

Belief in the efficacy of herbal extracts in the treatment of snakebite has existed in many countries from ancient times. This has an important place in the Indian systems of medicine also. But these claims have not been scientifically proved. The research done in India in this field by Dr. Patrick Russell in the 2nd half of the 18th Century and by Fr.J. Ferdinand Caius in the 1st half of the 20th Century yielded only negative results. But there is need for more extensive work in this field. For more on this, see the author's *Snakebite: A Book for India*, 2008.

238. Is the 'snake stone' an effective antidote for snakebite?

The 'snake stone' figures in a superstition widespread in India. The belief has been reported from other countries as well. e.g. some States like Virginia in U.S. Mexico, Philippines, S. Africa. The belief is that when it is placed on the bitesite, it sucks out the venom and then falls off. If it is then immersed in milk, the venom will drain out and the stone can be dried and re-used.

Many different substances have been identified as the 'snake stone': burnt bones, pumice, porous chalk, calcined antlers of deer and bezoars which are compacted hair-balls found sometimes in the stomachs of certain ruminants like the cow, buffalo, sheep, etc.

In *A Dictionary of English Folklore*, 2000, Jacqueline Simpson & Steve Roud, refer to beliefs about snake stones that have prevailed from the early 17th century in Great Britain, mostly in Wales. It is believed that snakes, by breathing on a stick of hazel, a kind of wood, make a blue stone ring in which appears a yellow figure of a snake and that water in which this is soaked is an antidote for snakebite. In most cases, these stones were actually pre-historic glass beads found in ancient burials.

Some of the so-called snake stones, when they consist of a porous substance, may have negligible powers of absorption of liquids including blood from the bitesite but they have no particular effect on the venom. Further, venom travels beyond the bitesite and into the blood stream very rapidly.

239. What are the once popular first aid measures in snakebite which are no longer recommended for one reason or the other?

Application of tourniquet, application of potassium permanganate, herbal extracts, and other substances to the bite site, cauterisation, slashing the bite site with a knife or razor blade, amputation of the bitten limb, suction of the wound by mouth or by devices, cryotherapy, electroshock therapy, consumption of alcohol, pressure immobilization method. For details, see the author's *Snakebite : A Book for India, 2008.*

240. Does a venomous snake 'chew' the flesh of a victim after a bite?

A viper usually withdraws its fangs immediately after its bite. While other front-fanged venomous snakes also mostly do so, some snakes like the cobras sometimes 'chew' the flesh after a bite, injecting more and more of the venom into the flesh. This behaviour is also typical of the rear-fanged snakes (see Q & A 88). This is because the venom is not injected as by the front fanged snakes and, therefore, it takes time to enable enough of the toxic secretion from the Duvernoy's gland to enter the victim's body.

241. What are the warning signals given by a snake?

When it confronts a human, the snake generally prefers to flee. But, if its escape route is blocked or it is facing harassment, or in the case of the few snakes which guard their eggs (see Q & A 198), it may choose to attack. But even here, the snake will ordinarily give certain warning signals before it strikes. Unless, of course,

it is taken by surprise as by someone stepping on it. The following are some of the warning signals:

a. The snake may show little tongue movement which means it is feeling uncomfortable.
b. Snakes like the cobra and the Russell's viper may hiss.
c. The saw-scaled viper may make a rasping sound by rubbing its scales together.
d. The cobra may spread its hood
e. Snakes like the saw-scaled viper may take up a coiled position.
f. The snake may vibrate its tail. e.g. the bamboo pit viper, the hump-nosed pit viper etc. and the rattlesnakes found in the Americas.

242. What is antivenin and how is it made?

Antivenin is the only scientifically proved antidote to snake venom. Previously spelt as anti venene, also called anti snake venom serum (ASV) or antivenom immunoglobulin. Injected intravenously into the body, this neutralizes snake venom.

Following up the research on anti-toxins in different countries, Albert Calmette (of BCG fame – Bacillus Calmette-Guerin, a vaccine discovered by him jointly with Camille Guerin, a path-breaking remedy against tuberculosis) who worked in the Pasteur Institute in Saigon, discovered antivenin in 1891. Antivenin first became available on a commercial scale in 1927 – in the U.S.

At the first stage, in the making of antivenin, venom is extracted from a snake by making it bite on a rubber or plastic diaphragm stretched over a receptacle. The venom is purified by centrifuging, freeze-dried and reduced to a powder form. As and when necessary, it is reconstituted as liquid and a very small quantity is injected into a horse and repeated doses given at periodic intervals. The horse's immune system produces anti-bodies in its blood to fight the venom. At a certain stage, the horse's blood is extracted and the blood serum which contains the anti-bodies is separated and purified. This is antivenin. This is usally stored in crystal form. As and when necessary, this is reconstituted with distilled water and used for injecting the victim of snakebite.

243. What is the difference between monovalent and polyvalent antivenin?

The venom of the cobra / krait and of the viper have different characteristics (See Q & A 228). Therefore, to get the best results, the antivenin has to be prepared specifically for cobra or krait or viper as the case may be. This is called monovalent antivenin. But this is effective and safe for use only if the identity of the snake that has bitten is clearly known which is rarely the case. Therefore, a polyvalent antivenin is prepared using a mix of the different venoms.

But polyvalent antivenin is not as effective as monovalent antivenin and also necessitates larger dosages which means more of possible side-effects and more of expenditure. (Antivenin is a very costly drug).

244. Is the antivenin currently available in India effective for bites by all Indian species of venomous snakes?

No. The polyvalent antivenin available currently in India is effective only against bites by the Indian cobras, Russell's viper, saw-scaled viper, common krait and, perhaps, banded krait..

It is not effective against bites by king cobra, pit vipers and sea snakes. No monovalent antivenin is also made in India for these species.

Polyvalent antivenin against king cobra bite is manufactured in China and a monovalent antivenin in Thailand. A polyvalent antivenin is manufactured in Indonesia which covers the bamboo pit viper only. (This is only one of the 20 venomous pit vipers in India). But the antivenin manufactured in other countries from snake venom collected there may not be effective in India even with respect to the same species of snakes because of the regional variations in the composition of the venom notwithstanding that the snakes belong to the same species.

CHAPTER - VII

NAMES

245. Are 'snake and 'serpent' the same?

Yes; both words denote the same creature. The word 'snake' is from the pre-historic Germanic base (Old High Germanic) *snachan* meaning 'to creep'. The Sanskrit word *nāg*, for snake, also has the same origin. The word 'serpent' is from the Latin *serpere* meaning 'to crawl' or ' to creep'. The Sanskrit word *sarpah* for snake also has the same origin.

In popular usage, however, the word 'serpent' is considered more impressive than the word 'snake'. 'Serpent' conjures up a vision of a majestic creature unlike 'snake'. This is an unjustified differentiation and shows nothing more than our general preference for a showy word when a simple word will do just as well.

246. What is the full form of 'cobra'?

Cobra de capello, Portuguese for 'snake with hood'.

247. Why is a viper so called?

From viviparous, meaning 'alive appear', i.e. 'giving birth to live young'.

248. What is the origin of the word 'krait'?

It is often explained as the Hindi name for the snakes in the genus *Bungarus*, but this is not free from doubt. Frank Wall (1868 -1950) in his series on Indian snakes in the *Journal of the Bombay Natural History Society*, quoting another author, presumes that the word is an English corruption of the Urudu word *Kalgundait* and adds that, otherwise, it might be a corruption of a word in Bengali (which he does not specify). He further quotes an Urudu work on medicine which explains the word as follows: 'Kala' = black. 'Gundait' refers to the white lines across the common krait's body.

249. What is the 'egg-eater snake'?

These are snakes which have eggs of birds and reptiles as their principal diet. Africa has three species of egg-eating snakes (four including one sub species) *Dasypeltis inornata, D. medici, D. scabra scabra (*and *D.s. lovebridgi).*

The Indian egg-eater (*Elachistodon westermanni*), one of the rarest of Indian snakes, was first discovered in 1863. The species had been reported from Bihar and North Bengal and the Corbett National Park, Uttaranchal. The snake was not seen since the early 1900s and was believed to have become extinct. But, since 2003, a few individuals have turned up in Maharashtra.

The egg-eaters of India and Africa belong to different genera. The three African species are in the genus *Dasypeltis.* The one Indian species is in the genus *Elachistodon*; no other species exists in this genus.

As the egg is swallowed, the sharp downward projections from the anterior thoracic vertebrae slit the egg so that the contents alone travel down the digestive tract. (See Q & A 61). This special feature of this sub-family is also known as gular or vertebral teeth. The remnants of the shell are regurgitated.

250. How did the python get its name?

The word is from Greek mythology. Hera, wife of the supreme god Zeus, commissioned a gigantic serpent to harass her husband's lover, Leto. Leto's infant son, Apollo, slayed the monster and decreed that it should not be given a burial but left to rot. *Pytho* is Greek for 'rot'. Hence Python.

251. What is the origin of the word 'anaconda'?

Interestingly, it could be Tamil and a garbled version of the Tamil expression for 'elephant killer' (ānai + konrān). Even though the name 'anaconda' is now applied to some South American boas – *Eunectes* spp. -- the word's origin is traced to Sri Lanka and from Sinhalese or Tamil, both being languages of Sri Lanka. If the origin was not Tamil, it could have been the Sinhalese *henekendeya* ('lightning' + 'stem') probably referring to a species of whip snake (*Ahaetullah* spp.). The 17th Century British scientist John Ray in a *List of Indian Serpents* used the word 'anaconda' to describe a snake (python?) "which crushed the limbs of buffaloes and yoke beasts". How the word traveled to South America and came to be conferred on a totally unrelated species is not clear. The person responsible was the 19th Century French zoologist, Francois Marie Daudin.

252. **What is the origin of 'braminus' and 'brahminy' in *Ramphotyphlops braminus* (brahminy worm snake)?**

Tough question. The nomen was given in 1808 by the French zoologist Francois Marie Daudin who furnished no clarification in the matter. (He was equally enigmatic in naming a S. American boa as 'anaconda' a name which had its origin in far-away Sri Lanka for some unrelated snake (See Q & A 251). Various theories can be advanced to explain this but the least implausible one is that its reddish brown colour (it can also be blackish brown) is reminiscent of the saffron robes of some

Hindu holy men. (For a detailed account on this, see the author's *Name-dropping – in Latin: An Enquiry into the Scientific Names of Indian Snakes,* 2005).

253. The Latin generic name of which Indian species of snakes has its origin in Telugu?

The kraits. *Bungarus* spp. *Bungaram* means 'gold' in Telugu, an allusion to the wide golden yellow bands on the body of the banded krait (*Bungarus fasciatus*). However, other species of kraits which are not coloured thus also, later on, came under the same generic name e.g. the common krait (*Bungarus caeruleus*) which is glossy black with narrow white bands, the black krait (*Bungarus niger*) which is uniformly black or dark chocolate brown, Wall's Sind krait (*Bungarus sindanus walli*) which is black or grayish or brownish black with narrow white bands.

254. Which snake has the same name in Telugu and in the language of the aborigines of Australia ?

The dog-faced water snake (*Cerberus rynchops*), a snake found extensively along the coast and tidal rivers of India and neighbouring countries and upto Australia.

It is called 'bokadam' in both Telugu and in the language of the aborigines of Australia. This is not as surprising as it may appear. Prof. Stuart Peygot says: "Current opinion tends to the view that Australia received her aboriginal population by migration through Ceylon and Melanesia [islands in the Western Pacific] from Southern India" (Quoted by Joseph Campbell: *Masks of God: Oriental Mythology,* 1962).

255. Which species of sea snakes had a former specific name in Latin which had a Tamil origin?

The hook-nosed sea snake (*Enhydrina schistosa*) at one time had its Latin name as *Enhydrina valakadien.* The specific name was from Tamil *valaikadiyan* meaning 'net-biter' because of the considerable damage it (inadvertently) causes to the fishing nets in which it gets caught along with the fishes. This name was given by Boulenger in 1896.

256. Why are pit vipers called c*uatro natrices* in parts of Latin America?

The word means 'four nostrils', evidently based on a misconception about the function of the two thermo-receptor pits (See Q & A 21).

257. Why is a 'shieldtail' so called?

In snakes of the family Uropeltidae, an enlarged, roughened, flat scale caps the short blunt tail. This resembles a shield. Its function has not been established for certain. One theory is that it helps the snake to burrow into the ground. Another theory is that the shield, which often has a large mass of soil adhering to it even when the rest of the body is clean, is used by the snake to close the opening of the tunnel into which it burrows, thus protecting it from predators.

While warding off predator-attack, uropelts always hide the head and display the tail (See Q & A 121).

The shieldtails – of which there are some 47 species – are confined to the forested mountainous regions of Western and Southwestern India and Sri Lanka except for one species (Ellict's shieldtail: *Uropeltis ellioti* found also in Eastern Ghats and in the hills of Central India). They are seen nowhere else in the world. They feed mainly on earthworms.

258. What are 'spitting cobras'?

There are eight species of spitting cobras in Africa. Some are found in Southeast Asian countries. One has, in recent years, been reported from Myanmar. They do not actually spit venom. They have specially adapted fangs that make it possible to eject venom in a stream for a distance of about 3 m. The stream is directed at the eyes of the victim and, if the eyes are not immediately washed, it can lead to severe complications like damage to the cornea and even blindness.

259. Why is the large shield-tail snake called *Pseudotyphlops philippinus* though it is not found in the Philippines?

This is explained by a quirk in the procedure governing scientific nomenclature. Once a specific name has been given, it cannot be changed, unlike a generic name, even if later it is found to be inappropriate, the only exception being when the name had already been conferred earlier on another animal. Even a misspelling in the specific name cannot be corrected.

The large shield-tail snake which is found only in Sri Lanka and not in the Philippines was wrongly given the name *Pseudotyphlops philippinus* by the original describer, Cuvier, under the mistaken assumption that the type specimen was from the Phillipines. And so it remains to this day. A case of 'pseudo philippinus'?

260. Do coral snakes inhabit coral reeves?

No. The name is misleading. They are land snakes and called coral snakes because of the bright coral-red colour of some of them. They are found in many countries. India has six species, all rare.

261. Is it the bridal snake or bridle snake?

The name bridal snake (*Dryocalamusnympha*) is sometimes misspelt as 'bridle snake'. A rare non-venomous snake found in north Kerala and part of east coast upto Orissa. Sometimes mistaken for the venomous common krait (*Bungarus caeruleus*). It has a yellow mark on the head which suggests a bridal veil, hence the common name. The specific name *mypha* also means bride in Latin.

This is not the only case of confusion between 'bridal' and 'bridle'. Sometimes, the converse happens. There are some pathways in the hills which are called bridle paths or bridleways to denote that horse riders (bridle=the headgear used to control a horse) have right of way. These are sometimes (rather romantically) called bridal paths.

262. Why was the scientific (Latin) name of the Cobra *Naja* earlier spelt as *Naia*?

Different explanations are available. One is that the consonant 'j' in Latin originally used to be written the same way as the vowel 'i', yet recognized as a separate letter. Therefore, though written as Naia, it was pronounced as Naja. Wall, (*Snakes of Ceylon,* 1921) who is generally helpful in understanding the origin and meaning of the Latin names of snakes, explains Naia as "a Latinized form of Naja, which is probably corrupted from the vernacular Nag". Later, the ambiguity was removed by changing the spelling from Naia to Naja.

The other explanation is that Naia was indeed the right spelling and also the right pronunciation. The noted Sri Lankan herpetologist, Anslem de Silva says (pers. comm. Mar.2008), " Naia is the Sinhala name for the cobra – and Linnaeus had used the Sinhala name. In fact, the Swedish 'j' is pronounced as 'i'. So Naja should actually be pronounced as Naia…".

On the issue being referred for his comments, herpetologist Aaron Bauer, says (pers. comm.. Nov.2009): "It is certainly true that there is no 'j' in classical Latin and thus 'i' could be used to represent this letter. However, the generic name 'Naja' with a 'j' was at first presented by Laurenti (1768). Only later, apparently with Merrem (1820) was 'Naia' employed. This is an unjustified emendation, perhaps made because Merrem felt he was 'correcting' Laurenti's original. Thus the use of Naia represents an incorrect usage that became established and the return to Naja is, in fact, a return to the original (correct) spelling".

Herpetologist Indraneil Das who too was consulted in the matter is also of the view (pers. comm.. Nov.2009) that the change from Naja to Naia in 1820 was "an unjustified (and, therefore, illegal) emendation". He adds: "Some Ceylonese authors (such as Deraniyagala) have attempted to argue that the spelling Naia is a Ceylonese (Sinhala) one, and tried (albeit illegally) to restrict the type locality to Ceylon".

Both schools of thought may, perhaps, derive some comfort from the fact that both Naja and Naia are from the same Sanskrit word: *Nāga*, meaning 'snake'.

263. What is the origin of the specific name 'kaouthia' for the monocled cobra (*Naja kaouthia*)?

Kaouthia is believed to be from 'Keutey' its Bengali name. Wall (1868-1950) in his *The Poisonous Terrestrial Snakes* (1908) also quotes Fayrer to this effect without mentioning the origin as Bengali. Fayrer's work referred to is most probably *Thanatophidia of India* (1872). I may hazard a guess that the name (and the Bengali name) have their origin in the Sanksrit Word 'kaudraveya' meaning son of Kadru. According to Hindu mythology, all serpents are the children of Kadru (See Q & A 373).

264. Why is the specific name of the common bronzeback tree snake '*tristis*'?

The common bronzeback tree snake found in India and elsewhere has the scientific name *Dendrelaphis tristis*. This arboreal snake has rightly been given its generic name which literally means 'tree snake'. But why *tristis*? *Tristis* in Latin means 'sad'. This snake does not appear to be any sadder than most other snakes. On the contrary, it is an active and energetic snake. The specific name of the common myna also is *'tristis'*. Certainly not a sad bird! A smart, perky, jaunty, vigorously

active bird with its incessant rowdy chatter and a whole repertoire of calls. It has been presumed that, in both cases, *'tristis'* refers to the sombre coloration.

265. Why is the cobra called the 'good snake' (*Nalla Pāmbu*) in Tamil?

Its graceful appearance and proud bearing when it majestically rears up and spreads its hood, its association in Hindu mythology with Vishnu and Siva and other gods and goddesses, all must have contributed to its noble reputation. But the decisive factor must have been its behaviour. It does no harm with intent to anyone except under grave provocation. This is, of course, true of most snakes, more or less, but the cobra is better appreciated for this trait because it is in sharp contrast to its awesome threat display. When the cobra spreads its hood, it looks fearful and threatening, but its intention is not to strike; the intention is, in fact, benevolent, namely, to warn. It is only when the warning is unheeded and the snake fears for its own life that it strikes. When its intention is to strike as when it attacks a prey, it does not spread its hood as a preliminary. Most often, cobra bites occur when it is hurt by someone stepping on it in the dark or surprises it by handling it, knowingly or unknowingly, or when it is harassed beyond endurance. Otherwise, it knows its strength but is reluctant to use it.

266. In the scientific name of the Russell's viper, *Daboia russelii,* what is the origin of the generic name *Daboia*?

Frank Wall himself gives two different explanations. In 'The Poisonous Snakes of India and How to Recognise Them' Part II, published in the *Journal of the Bombay Natural History Society* vol.XVII (2), (1906) he gives Daboia as one of the Russell's viper's common names. The language is not mentioned. On the contrary, in his 'A Popular Treatise on the Common Indian Snakes' also published in the same journal, vol.XVIII(1),(1907) he says that 'Le Daboia' was applied by Count De La Cepede (1789) to a W. African viper marked similar to the Russell's viper and was its local vernacular name in W. Africa and, therefore, the name was adopted for the Russell's viper. (The Russell's viper itself does not occur in Africa).

Herpetologist Indraneil Das in his *The Serpent's Tongue – A contribution to the Ethnoherpetology of India and Adjacent Countries,* 1998, gives *'daboia'* as the Hindi name for this snake, meaning 'spotted'. In a pers. comm. Nov.2009, Das

confirms this and adds: “the source is Russell (1796) who used vernacular names for snakes”.

J.C. Daniel in *The Book of Indian Reptiles and Amphibians,* 2002 gives *Daboia* as the Hindi name of Russell’s viper.

Herpetologist Aaron Bauer, who was consulted in the matter, says (pers. comm. Nov.2009): “The origin of the name was discussed rather extensively by Mac Diarmid *et al*. (1999) in *Snake Species of the World*. They conclude that ‘*daboia*’ or some similar word is of probable Indian origin and that La Cepede’s story of a West African Viper was somehow linked to this name incorrectly. However, my own reading of La Cepede as well as Sonnini (1801) and Daudin (1803) makes me think that the issue is still ambiguous as it seems that these authors associate the name quite intimately with the West African snake story. In this instance, I think that it may be impossible to determine the actual root of the name”.

In sum, the jury is still out!

267. Should the specific epithet in the scientific name for Russell’s viper be spelt *russellii* as in the English name or *russelii* as it currently is?

Much ado about nothing? Not any more than rules of grammar or many other conventions generally are!

The paper by Kraig Adler *et al*. titled “Russell’s viper: *Daboia russelii*, not *Daboia russellii*, due to classical Latin rules”, in *Hamadryad* 25 (2), 2000, gives the whole, rather convoluted, story. In brief here’s how it goes:

The snake was named in honour of Patrick Russell (See Q & A 331). In was in 1797 that Shaw and Nodder gave it the scientific name *Coluber russelii*. (The generic name underwent changes later and it now is *Daboia* – but that’s not relevant to the present discussion). They spelt the specific name with a single ‘l’ as they thought (wrongly) that that was how the English name was spelt. In 1849, Grey corrected this mistake since Russell himself spelt his name with two ‘l’s. Thus it became *russellii*. In 1993, Dowling questioned this change, but again on a wrong presumption that Russell spelt his name with a single ‘l’. In 1999, David and Ineich pointed out that, according to the then-prevailing custom -- perpetuated in Article 32 [e] [ii] of the International Code of Zoological Nomenclature of 1985 – a scientific name, as originally conferred, cannot be changed unless there is internal evidence of error and, further, that such change could be made only by the International

Commission on Zoological Nomenclature. They pointed out that not only there was no such evidence of error in the present case (and no such procedure followed), but, on the contrary, according to the code governing Latinization of English names, the English word Russell (with two 'l's) rightly became *russelii* (with a single 'l') in its Latinized form. (Double consonants such as 'll' can occur in classical Latin only in certain different circumstances. There is a lot here about secondary formations, assimilations, syncopations and so on – but don't bother!).

Hence, it remains *russelii*, as, indeed, it was originally spelt by Shaw and Nodder in 1797 though for the wrong reasons! But, then, Shaw, perhaps, knew what he was doing since he was well-trained in the use of Latin.

268. What snakes are these?

Adder. The term is generally used synonymously with viper but, more particularly, refers to *Vipera berus*, the only venomous snake found in Great Britain. It is one of the two northern-most species of snakes in the World, the other being the garter snake (*Thamnophis* spp.)

The word has a curious history. In Old English, the word was 'naedre' meaning 'serpent'. In Middle English it became nadder. In course of time 'a nadder' became 'an adder' by a process known in linguistics as 'metanalysis'. (That was also how 'a napron' became 'an apron', 'a nauger' became 'an auger', 'a noumpre' became 'an umpire').

Anaconda. South America. Four species in the genus *Eunectus*: green anaconda (*E. murinus*) yellow anaconda *(E. notaeus)*, dark-spotted anaconda (E. *deschauen-seei*) and Beni river anaconda (*E. beniensis*). The green anaconda is the one usually referred to as *the* anaconda.

E. murinus is the world's largest snake if overall size is considered, i.e. length and girth, and the second longest, the first being the reticulated python (*Python reticulatus*). Grows to atleast 9 m. Semi-aquatic species. Aggressive and dangerous. Occasional man-eaters.

Aspic viper. *Vipera aspis*. France and Italy and elsewhere in southern Europe. Belongs to the group of European nose-horned vipers which exhibit upturned snouts. Varies in colouration form area to area.

Ball python. *Python regius*. Also called royal python. Africa. Average length 1.5 m. Popular as pets.

Bandy bandy. *Vermicella annulata*. A small (40 cm) venomous snake of Australia. Named for its distinctive black and white rings. Small fangs and small quantity of venom cause no major harm to humans.

Blind snake Also called worm snake. See below. See also Q & A 27.

Blood python. The common name of both the Sumatran short-tailed python (*Python curtus*) and the Malaysian short-tailed python (*Python brongersmai*). So called because some individuals are suffused with orange or red colour.

Boa constrictor. Also called the common boa. *Boa constrictor* is the scientific name. S. America and the island of Trinidad. Maximum length 4 m.

Boomslang. *Dispholidus typus.* Sub-saharan Africa. 1.5 m long. One of the two rear-fanged species of Africa that are venomous. Though not easily irritated, the snake is dangerous because its fangs are close enough to the front as to inflict an effective bite on humans. 'Boomslang' means tree snake in Afrikaans.

Brahminy worm snake: One of the species of worm snakes (*Rampotyphlops braminus*). See 'worm snakes' below. For the appellation 'brahminy', see Q & A 252.

Burrowing cobra. *Paranaja multifasciata.* Central African rainforests 0.5 to 0.8. m Not a true cobra. Also called 'shield-nose snake' because of the enlarged shield-like plate on its snout for digging through loose soil and leaf-litter in search of prey. If threatened, will raise its forebody and slightly flatten its neck and hiss. Habits poorly known.

Bushmasters. *Lachesis* spp. Forest pit vipers of Costa Rica, Panama, Tainidad, Guyana and Brazil. The longest vipers in the world, often exceeding 2 m. in length. The longest venomous snake in the New World and the second longest venomous snake in the world (the first being the king cobra). The only American pit vipers to lay eggs. Dangerous because of their large fangs (upto 3.8 cm.) and large quantities of venom. Called *surucucu* in Brazil. Its other names outside Brazil are *shushupe, mapana, verrugosa* and *caseabela muta* (silent rattle snake).

The latin name of one of the bushmasters, *Lachesis muta,* means 'silent bringer of death'.

Captain's wood snake. *Xylophis captaini* Described in 2007 by Grower and Winkler from Kottayam district, Kerala. It was found in 2000. Named for Ashok Captain for his work on Indian snakes.

Carpet python.. *Morelia argus*. Australia and New Guinea. A single-genus, single-species python with different sub species. Named for the patterns on its body.

Carpet vipers. *Echis* spp. A general name for different species of small (less than 1 m.), dangerously venomous, pitless, vipers similar to the saw-scaled viper (*Echis carinatus*) found commonly throughout main-land India. Named thus for the patterns on the body. Examples: painted carpet viper (*Echis coloratus*) found in Israel, Sinai, Middle East Peninsula and Northwest Africa, West African carpet viper (*Echis ocellatus*) found in West Africa, Pakistani carpet viper (*Echis sochureki*) found in Rajasthan and possibly Gujarat in India and in Pakistan. Their threat-display is a rasping sound produced by rubbing the saw-edged scales together.

The large, 1 m. long., Russell's viper (*Daboia russelii*), found throughout India and in neighbouring countries, which is not saw-scaled, is also sometimes included under this omnibus term 'carpet viper'.

Cascaval. *Crotalus durissus*. Also called tropical rattlesnake or South American rattlesnake. "Probably the most dangerous rattlesnake species of all", according to Grzimek (*Animal Encyclopedia,* Vol.6, 1971).

Catsnakes. *Boiga* spp. India has 15 of them. Mildly venomous. So-called because of the very prominent large eyes with vertical pupils that resemble a cat's. Species vary in length from 60 cm. to 1.20 m.

Children's python. *Antaresia childreni.* 75 cm. long. Australian python. Breeds readily in captivity. Favoured as a pet and for this reason, the specific epithet, conserved in the common name is, sometimes, mistakenly assumed to refer to children. In fact, it was conferred by J.E. Gray in 1842 in honour of his mentor John George Children, a curator of the British Museum.

Coachwhip. *Masticophis flagellum***.** Mexico and Southern U.S. The rear parts of its body and its tail resemble a plaited whip because of the structure of the scales. This is the basis for the superstition that the snake lashes people with its tail after chasing them and wrapping round their bodies.

Copperhead. *Agkistrodon contortrix mokasen***.** Also known as 'northern copperhead' and 'highland moccasin'. Venomous pit viper of eastern U.S. 60 to 90 cm. The snake has a series of dark chestnut crossbands between the crossbars and at the sides of the belly are dark spots. Perhaps illustrates the 'harlequin principle' in camouflage (See Q & A 53).

Corn snake. *Elaphe guttata***.** Also called red rat snake. 1 m long. A common and beautiful species of the south-eastern U.S. A very popular pet in America. Selective breeding for the pet trade has produced many forms.

Cottonmouth. *Agkistrodon piscivorous***.** Southern and south-central USA. Gets its common name from the white interior of its mouth. Also called 'water moccasin' because of its aquatic habitat.

Death adder. *Acanthophis* spp. Australia. Not a true adder (which term means 'viper'). An elapid which resembles a viper in appearance and behaviour (See Q & A 94). The name is believed to be a corruption of 'deaf adder'. It is a common observation that while other snakes flee on hearing approaching foot falls, this snake will stay put because, so it is believed, it is deaf. All snakes are, of course, deaf to most air-borne vibrations, i.e. except some of low frequency. The other snakes flee because they sense the footfalls or hear the low-frequency sounds of the footsteps. The deaf adder stays put because, being viper-like in disposition, that is its natural mode of hunting its prey. Unlike other elapids, this snake which too is an elapid, has adopted the sit-and-wait ambushing technique of the vipers for catching its prey.

Struan Sutherland (1936-2002), an acknowledged authority on Australian snakes and envenomation, says (*Venomous creatures of Australia*, 1981) that "there is evidence that the death adder only bites [a human] when it is touched, and many people have stood close to a death adder which made no attempt to strike".

For another explanation for the name, see Q & A 361.

Dog-faced water snake. *Cerberus rynchops.* A common, mildly venomous, 60 cm. long water snake found along the coast and tidal rivers of India and neighbouring countries and upto Australia. It gets its common name from its narrow snout and prominent lower jaw. Its generic name in Latin is also for the some reason. In mythology, Cerberus is the three-headed dog which keeps guard in hell.

Elephant's trunk snake. *Acrochordus* spp. Common name because of its stout body. 1 m. Also called file snake because of its rough scales, and wart snake for its appearance. There are three species. The one found along the coast of India and river estuaries is *A. granulatus*. Also rest of South and Southeast Asia. The snake has an odd appearance because of its loose and shaggy skin. Expert swimmer, but almost helpless on land. For another peculiarity of this snake, see Q & A 64.

Eyelash boas. *Trachyba boulengeri* and *T. gularis.* Southern Central America and northern South America. Rarely seen and little known. So-called because of small protruding scales above the eyes.

False cobra. *Pseudoxenodon macrops*. An uncommon, mildly venomous snake found in Northeast India from Darjeeling to Arunachal Pradesh and also in Nepal, Bhutan, China, Myanmar, Thailand and Malaysia. About 1.28 m. long. In threat display, spreads a hood, very much as a cobra does.

False habu. Also called 'false viper'. *Macropisthodon rudis*. China, Taiwan. 1m. long. Easily confused with a pit viper. Rear-fanged. Potentially dangerous. India has a related species, the green keelback (*Macropisthodon plumbicolor*) which can be mistaken for one of the many green pitvipers. This is a non-venomous snake and is found throughout most of mainland India.

Fer de Lance. *Bothrops atrax* and related species. Central and S.America. Large venomous pit vipers. Some 30 species. The name is from French for 'iron (head) of a lance'. *Bothrops atrax atrax* is the main cause of serious snakebite incidents in Amazonian S. America.

Fierce Snake. Another name for the inland taipan. See taipan, below.

File snake. See elephant's trunk snake.

Flowerpot snake. *Ramphotyplops braminus.* The brahminy worm snake (see above). Found worldwide. Since they are small (about 12 cm.) and often found in the wet soil of potted plants, they are believed to have spread far and wide through flower pots transported from country to country.

Gaboon viper. *Vipera gabonica.* W.Africa. One of the largest vipers reaching to a length of more than 1.80 m. Has fangs measuring upto 13 cm., the largest for any viper.

Garter snake. A term, based on appearance, used confusingly for entirely different species. In N. America, garter snakes are the non-venomous, fish-and frog-eating colubrid snakes, the most widely distributed species there. It is the only snake found in the cold climate of ahaska and is one of the two northernmost species of snakes in the World, the other being the adder (*Vipera berus*).

In South Africa the name is given to *Elapsoidea* spp. belonging to the cobra family (Elapidae). Venomous, but generally disinclined to bite.

Grass snake. *Natrix natrix***.** Found extensively in many countries of Europe, Africa, Asia. In meadows, marshes, river banks. Expert swimmer, though not exactly an

aquatic species. Non-venomous. Also called the ringed snake or water snake . If cornered, it may 'play dead' (See Q & A 119).

In N. America, the term, 'grass snake' is used for the smooth green snake (*Opheodrys vernalis*) and the rough green snake (*Opheodrys aestivus*).

Hamadryad. *Ophiophagus hannah***.** A.k.a. king cobra. India and neighbouring countries and other South and Southeast Asian Countries. The largest venomous snake (3.05 m.). In Greek mythology, the hamadryads are nymphs or spirits of nature which preside over trees with which they are said to live and die. In Greek, *hama* denotes 'together with' and 'drug' is the origin of 'tree'. The hamadryad, though normally confronted in terrestrial habitats, is at home on trees too.

Harlequin snake. *Homoroselaps* spp. S. Africa. Two species. Small (0.3 to 0.6 m) and secretive. Venomous but little venom.

In the U.S. the name 'harlequin snake' is used for the venomous coral snakes (*Micrurus* spp.) about 1 m. long.

'Harlequin', probably in the sense 'variegated in colour'. The name may also have something to do with the 'harlequin principle' in camouflage(See Q & A 53).

Hognose snake. A common name for snakes of three distantly related genera: *Heterodon,* found in North America and Northern Mexico, *Leioheterodon* found in Madagascar and *Lystrophis* found in South America. So-called because of their upturned snouts. 65 to 80 cm. in length. Rear-fanged and mildly venomous (see Q & A 88 and 224). Noted for 'death-feigning' (See Q & A 112 and 119).

Hoop snake. There is a superstition in America that the so-called 'hoop snake' puts its tail into its mouth and rolls down an incline like a wheel while chasing its adversary or prey or escaping from a predator. The belief relates mostly to the rainbow snake (*Farancia erytrogramma*) and the mud snake (*Farancia abacura*).

Horned vipers. *Cerastes* spp. Deserts of N. and Southwest Africa. The horn located over each eye is really a long scale. The 'horn' probably permits a build-up of sand above the eye without impairing vision. While passing through narrow burrows, the snake can fold back the 'horn'. Horned and hornless individuals occur within the same population.

Indigo snake. *Drymarchen corais.* North, Central and South America 2 m. Largest snake of North America. Non-venomous. Feeds on snakes, among other prey items.

Jararaca. *Bothrops jararaca.* Southern Brazil to Argenthina. The common name and the specific name are derived from Amerindian meaning 'long pit viper'.

King snake. *Lampropeltis getula.* N.America and Mexico. Popular as pets in U.S. Nearly 2 m. long. Feeds on snakes, lizards, mice and birds. The appellation 'king' is probably because it feeds on other snakes, the same as in the case of the snake-eating king cobra.

Kukri snakes. *Oligodon* spp. India and neighbouring countries. Non-venomous. 22 species in India. Frank Wall gave the English name because of the compressed posterior teeth, shaped like a Gurkha's kukri knife.

Leopard snake. *Elaphe situla* Southern Europe and Western Asia. 66 cm. Slender and dainty. Usually cream, yellowish or light grey with red markings outlined in black. Arguably the most attractive of all European snakes.

Mamushi. *Gloydius blomhoffii.* Japan. Venomous pit viper.

Mangrove snake. *Boiga dendraphila.* South-east Asia. Found in forests, mangroves. 2.5 m long. Slender body, beautifully marked. Primarily arboreal. Rear-fanged. Mildly venomous.

Massasuaga. *Crotalinus catenatus.* N.American rattle snake that favours swamps. Name of a town in Southern Ontario, Canada.

Milk snake. *Lampropeltis triangulum.* U.S., Canada. 50 cm. Brightly coloured with red, white and black bands around the body. Popular as pets in U.S. When frightened, the snake moves quickly and the red, white and black bands appear to flicker, confusing the predators. Often found in and around farm yards where they prey on rats and mice. Hence the misbelief that they come to suck milk from cows. See Q & A 354. Also called king snake.

It shares parts of its geographic range with several species of similar looking venomous coral snakes. This is considered a typical example of Batesian mimicry (See Q & A 336).

Mole viper. *Atractaspis* spp. Burrowing asps. Africa. Venomous. Also known as 'side-stabbing snakes' or 'stiletto snakes'. For details, see Q & A 341.

Mussarana. *Clelia clelia.* Six species distributed from Guatemala to Brazil. 1.6m, but can grow up to 2.4 m. Snake-eaters. Kills by both constriction and venomous bite. See Q & A 170. Usually does not bite humans.

Oenpelli python. *Morelia oenpelliensis.* Found in Arnhem Land, a peninsula in Northern Territory, Australia. Named for a small town where it was first collected. In spite of it being so large and conspicuous, it was first described only as recently as in 1977.

Okinawa habu. *Protobothrops flavoviridis*. Found in the Ryukyu Islands of Japan and in China and Taiwan. The longest Asian viper. Enters homes in search of rats. Was once a major cause of serious and fatal snakebite cases. Eradication of their prey species, biological controls using parasites to snake-sniffing dogs and the mongoose, chemical agents – all have been tried to combat the menace, but with limited success. The development of a specific antivenin has helped. According to Mark O'Shea (*Venomous Snakes of the World*, 2005), "the Okinawa habu has become one of the most studied venomous snakes in the world and probably the one with the largest database of snakebite statistics, documented religiously in the Japanese Snake Institute Journal, *The Snake".*

Pseudoboa. Same as mussurana, See above.

Puff adder. *Bitis arietans*. Perhaps the commonest and the most widespread of snakes in Africa. Average size: 1 m. with girth of 40 cm. Weighs over 6 kg. One of the biggest vipers. Responsible for more fatalities than any other African snake.

Rainbow snake. *Farancia erytrogramma. S.* Carolin*a*, U.S. Large (upto about 1.20 m.), heavy bodied snake. Streams, lakes and marshes. Iridescent scales, hence the common name. See Q & A 52.

Rat snakes: A large and widespread group, formerly all placed in the genus *Elaphe*. Now split up into different genera. The main sub groups are Asian rat snakes, European rat snakes and North American rat snakes. India has 3 species: Indian rat snake (*Ptyas mucosa*), Indo-chinese rat snake (*P.korros*) and green rat snake (*P. nigromarginata*). Of these, the first is found throughout India; the other two are confined to the northeast.

Rinkhals. Also spelt as ringhals. *Hemachatus haemachatus.* South Africa. One of the spitting cobras. The only live-bearing elapid in Africa. The only keeled-scaled cobra. Well-known for death-feigning. (See Q & A 112).

River Jack. Another name for the rhinoceros viper (*Bitis nascicornis*) found in Africa. So-called because of its preference for wet biotopes.

Salmusu. *Gloydius brevicaudus.* A venomous pit viper found in Korea and north-eastern China.

Salvadora. Also called patch-nosed snakes. Eight species. North and Central America.

Shieldnose snake. See 'burrowing cobra'.

Shieldtails. See Q & A 257.

Sidewinder. *Crotalus cerastes.* A medium-sized (43-82 cm) agile pit viper. Southwest USA and Mexico. It has a distinctive horn-like projection over each eye. This is not the only snake that moves about by sidewinding. See Q & A 117.

Sunbeam snake. Family Xenopeltidae. Genus *Xenopeltis.* Two species. South and Southeast Asia. Named so because of its highly iridescent scales. Also called 'iridescent earth snake'. 1.22 m. in length. Stout and muscular body. In India, occurs only in the Nicobar islands. Spends time mostly underground and emerges at dusk. Burrows with its chisel-shaped head. Non-venomous. Kills prey by constriction. See Q & A 52.

Taipan. Australia and New Guinea. There are two of them: the coastal taipan (*Oxyuranus scutellatus*) and the inland taipan (*Oxyuranus microlepidotus)* (Regarding the recent discovery of a third species, see *infra*) The taipan can reach a maximum length of about 3 to 4 m. Both extremely venomous, the latter more so. A single coastal taipan bite can inject enough venom to kill 27 humans and an inland taipan bite 62 humans. The Inland taipan is also known as the Fierce Snake. It produces the most potent venom of any land snake in the world.

In 2007, Paul Doughty, Brad Maryani *et al.* have reported the discovery of a third species of taipan from the central ranges of Western Australia. Only one known specimen. Maximum body size and venom potency not known. *Zootaxa* 1422: 45-58 (2007). www.mapress.com/zootaxa/

Tiger snake. *Notechis* spp. A group of Australian snakes responsible for many deaths before the antivenin for its bite was discovered.

Trinket snake. 12 species belonging to the genera *Coelognathus, Elaphe, Gonyosoma, Orthriophis, Euprepiophis.* Found in India and the neighbouring countries and southeast Asia. Generally do not exceed about 1.5 m. in length. Non-venomous. Named for its pretty markings. 'Trinket' means a small ornament. The specific name of the common trinket snake, *Coelognathus helena,* is also a tribute to its looks, Helen (of Troy) being the classic example of female beauty.

Twigsnake. *Thelotornis capensis.* East and South Africa. One of the two rear-fanged snakes of Africa that are venomous. See Q & A 88.

Vusimanzi. Much-feared in South Africa, but, actually, a harmless freshwater snake.

Vine snake. *Ahaetulla* spp. Six species found in India and neighbouring countries and Southeast Asia. Variously coloured, mostly green, tree snakes. When hanging

from a branch, can be mistaken for a vine, fresh or withered. Mildly venomous. Also called 'whip snake'. *Oxybelis fulgidus* found in Central America and Northern S.America, similar to the above, is also called 'vine snake'.

Wartsnake. See 'elephant's trunk snake'.

Water cobra. *Boulengerina* spp. Central Africa. In water bodies in the rain forests. Dives down to a depth of 25 m. in pursuit of fish, but generally prefers shallow waters. Can remain submerged for 20 minutes. Can also move freely on land. Spreads its hood even under water. An exclusive fish-eater.

Water moccasin. See 'cottonmouth'.

Whip snake. See 'vine snake'.

Wolf snake. *Lycodon* spp. India and neighbouring countries and southeast Asia. 11 species in India. These snakes have an enlarged tooth near the front of both jaws, resembling the canine teeth in wolves, foxes and dogs. The generic name is based on *lukos*, Greek for 'wolf'.

Worm snake. Snakes belonging to the genera *Typhlops*, *Ramphotyphlops*, *Grypotyphlops* and *Leptotyphlops*. Very small burrowing snakes. *Ramphotyphlops braminus* or the brahminy worm snake, found all over the world, is the tiniest of the lot measuring 12.5 cm. (See, however, Q & A 102) Because of their size, they can easily be mistaken for worms. But, scrutiny with a magnifying glass will show that, unlike worms, they have scales and a tongue.

Yamakagashi. Asian tiger snake. *Rhabdophis tigrinus*. Japan and South-east Asia. One of the three rear-fanged colubrids which are venomous and have caused human deaths, the other two being the boomslang (*Dispholidus typus*) and the twig snake (*Thelotornis capensis*), both from Africa.

CHAPTER - VIII

MISCELLANEOUS

269. Are there countries where no snakes are found?

Yes. Apart from the continent of Antarctica, which is the only continent with no snakes, countries where no snakes are found include Ireland, Iceland, New Zealand, Greenland and many of the islands.

Snakes generally are not found on islands. There are many reasons for this and other oddities of island flora and fauna -- may be different reasons sometimes for different islands. For more on this, see *The Song of the Dodo: Island Biogeography in an Age of Extinctions* by David Quammen, 1996.

270. Why does Ireland have no snakes?

This is attributed to a miracle performed by St. Patrick, the 5th century Christian apostle who, according to legend, commanded all the snakes on the island to cast themselves into the sea (St. Patrick became the patron saint of Ireland, though for different reasons).

But the truth is something less than a miracle. Ireland is not the only island that has no snakes and different islands may have different explanations. Ireland not only has no snakes of its own but only a single reptile — the common lizard, probably a stowaway, as elsewhere in the world, from more recent times. England which is only some 24 km. away has three species of snakes. When the last Ice Age ended, some 12,000 years ago, the glaciers melted and the sea level rose. The bridge of land and ice that connected Ireland to England went under what is now the Irish Sea. All those animals which had not by then crossed over to Ireland could no longer do so. The bridge of land connecting England to the European continent was there for another 5,000 years and, therefore, new species continued to cross over to England from the continent until England was also cut off from the continent by the sea. Snakes and other reptiles, being cold-blooded animals, are not fond of very cold climates and were thus the last species to arrive in England from the continent, but, by then, they were 5,000 years too late to cross over to Ireland.

271. Which parts of the world have the largest number of snake species?

The tropics. As one proceeds north or south into the temperate zones, the species become fewer and fewer.

272. Which snake has the most widespread distribution?

The black and yellow sea snake (*Pelamis platurus*) has the most widespread distribution taking both terrestrial and sea snakes together. It is also the most pelagic (=found on the top layers of the sea) of sea snakes, sometimes seen in aggregations of several hundreds, for reasons not clear.

273. What is special about Australian snake fauna?

For a territory of its size, Australia has the largest number of snakes – some 167 species:

File snakes	:	2
Blind snakes	:	30
Colubrids	:	10
Pythons	:	15
Elapids	:	110

		167

Australia has the largest number of pythons among all continents: 15 species compared to less than a dozen in Asia and Africa together (India has only two).

Australia among all continents has the largest number of venomous snakes: over 110, all elapids.

Unlike Asia, Africa and North and South America, there are no vipers in Australia.

Australian snakes also demonstrate the phenomenon of convergence in evolution (See Q & A 94). Though this phenomenon can be found elsewhere also, it is more pronounced in Australia.

274. Which snake occurs above the Arctic circle?

The range of the adder (*Vipera berus*) extends to above the Arctic Cricle (68º North latitude) in Scandinavia.

275. Which snake has the southern-most distribution?

The snouted lance-head (*Bothrops ammodytoides*) is found almost to the southern tip of South America (50º South latitude).

276. Why are no sea snakes found in the Atlantic ocean?

We do not know for sure. Sea snakes are found only in the Pacific and Indian oceans and not in the Atlantic Ocean (or in the Caribbean sea). Four to five million years ago, the two oceans were interconnected and the narrow strip of land, the isthmus of Panama, between North and South America, which now separates the two oceans was not there. It is likely that the sea snakes had not reached the western coast of America by the time the isthmus was formed and the oceans got separated and hence could not cross over to the Atlantic.

The sea snakes do not also find it possible to travel the 11,000 km. long route, circumnavigating the southern tip of Africa and the South-western coast of S. America because of the very cold waters in these stretches.

Even though the Panama Canal across the isthmus was constructed in 1914, the six pairs of locks in the canal installed to regulate ship movement prevent the passage of sea snakes.

Some 30 – 40 years ago, there was a proposal to construct a 'sea level canal' connecting the Pacific Ocean and the Caribbean (Atlantic ocean) in Panama. This had led to protests from environmentalists among others and one of the grounds was that this would lead to the invasion of the Atlantic by the prolific sea snake *Pelamis platurus* which has a massive presence in the Pacific and this would, in turn, result in ecological damage to the native fauna of the Atlantic and would also prove a deterrent to the tourist business in the islands of the Caribbean. The proposal is no longer alive.

277. Are there giant sea or fresh water serpents?

Fables and legends about gigantic see serpents have existed from pre-historic times. Some have been reported even in recent times with a great deal of conviction. Two examples given by Curran and Kauffeld in *Snakes and Their Ways,* 1937, are the 'Old Faithful' from near the Vancouver Island and the Lake Koochiching sea serpent. Many aquatic monsters have been reported from large lakes. Examples are 'Nessie', the monster of Loch Ness, Scotland, the most famous of them all, 'Champ', the monster of Lak Champlain on the US-Canada border, 'Ogopogo' of the Okanagan Lake in British Columbia, Canada, and the monsters in Lake Hanas, China.

Incidentally, the Loch Ness monster is the only 'animal' that has been given a scientific name, though not following established procedure, even though the existence itself of the animal at any time has not been proved or the animal described scientifically. The famed British naturalist, Sir Peter Scott gave it the scientific name *Nessiteras rhombopteryx*, meaning 'the wonder of Ness with the diamond-shaped fin'. It took some time to discover that it was an anagram of 'monster hoax by Sir Peter S'.

Stories about giant serpents in the sea and in large lakes are generally dismissed as optical illusions, hallucinations (sometimes aided by too much booze), erroneous observations of shoals of fish or dolphins or just plain hoaxes. There are no aquatic snakes known to science larger than the anacondas, the green anaconda (*Eunectes murinus*) measuring 9 m. (See Q & A 101). The longest sea snake is the yellow sea snake (*Hydrophis spiralis*) measuring just 2.75 m. In the yellow-lipped sea krait (*Laticauda colubrina*), the maximum length is noted as 1.52 m. by Whitaker & Captain (*Snakes of India: The Field Guide*, 2004). Whitaker and Captain mention the maximum size of the hook-nosed sea snake (*Enhydrina schistosa*) as 1.58 m. and annulated sea snake (*Hydrophis cyanocinctus*) as 1.88 m.

Heatwole, (*Sea snakes*, 1987/1999) after a discussion of the topic of 'giant sea serpents', concludes: " It is probably wise to maintain a healthy scepticism about the existence of 'sea serpents' and to regard them as mythical until better evidence is brought forward. Even if they do exist, the appellation is probably a misnomer as they almost certainly are not serpents or reptiles of any kind".

278. Why are desert snakes as a group more venomous than snakes elsewhere?

Not snakes alone. It has been noticed that desert species of insects, spiders, scorpions and snakes etc. generally have very potent venoms compared to their counterparts elsewhere. As for lizards, the only two venomous ones, the beaded lizards, both belonging to the genus *Heloderma* – the gila monster and the Mexican beaded lizard – are also desert species. Food being scarce in desert areas, the animals in deserts have to speedily despatch any prey that comes along.

279. Which are the largest venomous snakes, continent-wise?

The king cobra for Asia, the gaboon viper for Africa, the bushmaster for South and Central America, the eastern diamondback rattlesnake for North America (above Costa Rica).

280. How many species of cobra are found in India?

There are four species of cobra, conventionally called the Indian cobra, found in India. Till recently, all these were considered to be the same species. Now they are distinguished as four different species belonging to the same genus.

The spectacled cobra *(Naja naja*)

The monocled cobra (*Naja kaouthia*)

The Central Asian cobra (*Naja oxiana*)

The Andaman cobra (*Naja sagittifera)*

281. Which is the longest snake in captivity?

'Delilah', a Burmese python (*Python molurus bivittatus*) in Serpent Safari, near Chicago, which measures 7.6 m. So says a report by Ed Ferrer in *The Monitor*, Newsletter of the Hoosier Herpetological Society, Nov. 2009.

There have been longer snakes in captivity in recent times. Serpent safari itself had 'Baby', a Burmese python (*P.molurus bevittatus*) which measured 8.3 m. It died in 2006. The Bronx zoo in New York had 'Samantha' a reticulated python (*Python reticulatus*) which measured 7.92 m. It died in 2002

Incidentally, the June 2003 issue of *The Monitor* had reported on a standing (uncollected) reward of $50,000 for anyone who could find a snake that exceeded 9 m. in length.

282. Which are the zoos in India that have a significant number (more than 10) of snake species (as of 2009)?

i)	Chennai Snake Park, Chennai	24
ii)	Calcutta Snake Park, Kolkata	22
iii)	Pililkaula Biological Park, Mangalore	19
iv)	Rajiv Gandhi Zoological Park, Pune	17
v)	Bondla Zoo, Goa	15
vi)	Arignar Anna Zoological Park, Chennai	14
vii)	Nisargakavi Bahinbai Choudhary Zoo, Pune	13

viii)	Assam State Zoo, Gawhati	11
ix)	Nehru Zoological Park, Hyderabad	11

(Source : Central Zoo Authority : Inventory of animals … Indian zoos 2008-2009).

283. Are there pythons in the New World?

Pythons are not found in the New World (North and South America), but only in the Old World (Asia, Africa, Australia). In the Americas, there are boas instead of pythons and these are also large constrictors like the pythons. But, for long, one snake in the New World, *Loxocamus bicolor,* was considered to be a python. No longer so. It is now classified as a relative of the sunbeam snake (Family Xenopeltidae). See Q & A 268.

284. Which snakes are endemic to (that is, found only in) India?

i. Diard's worm snake (*Typhlops diardii*)
ii. Beddome's worm snake (*Typhlops beddomei*)
iii. Beaked worm snake (*Grypotyphlops acutus*)
iv. Pied-belly shieldtail (*Melanophidium punctatum*)
v. Yellow-striped shieldtail (*Melanophidium bilineatum*)
vi. Wynad shieldtail (*Melanophidium wynaudense*)
vii. Three-lined shieldtail (*Platypectrurus trilineatus*)
viii. Madurai shieldtail (*Platyplectrurus madurensis*)
ix. Wall's shieldtail (*Brachyophidium rhodogaster*)
x. Perrotet's shieldtail (*Plectrurus perrotetii*)
xi. Purple shieldtail (*Plectrurus guentheri*)
xii. Golden shieldtail (*Plectrurus aureus*)
xiii. Kanara shieldtail (*Plectrurus canaricus*)
xiv. Elliot's shieldtail (*Uropeltis ellioti*)
xv. Cochin shieldtail (*Uropeltis nitida*)
xvi. Nilgiri shieldtail (*Uropeltis ocellata*)
xvii. Dindigul shieldtail (*Uropeltis dindigalensis*)
xviii. Beddome's shieldtail (*Uropeltis beddomii*)
xix. Anamalai shieldtail (*Uropeltis macrorhyncha*)
xx. Black-bellied shieldtail (*Uropeltis woodmasoni*)

xxi. Large-scaled shieldtail (*Uropeltis macrolepis*)

xxii. Kerala shieldtail (*Uropeltis ceylanica*)

xxiii. Tirunelveli shieldtail (*Uropeltis arcticeps*)

xxiv. Red-spotted shieldtail (*Uropeltis rubromaculata*)

xxv. Red-lined shieldtail (*Uropeltis rubrolineata*)

xxvi. Phipson's shieldtail (*Uropeltis phipsonii*)

xxvii. Barred shieldtail (*Uropeltis myhendrae*)

xxviii. Sirumalai shieldtail (*Uropeltis broughami*)

xxix. Red-sided shieldtail (*Uropeltis maculata*)

xxx. Peters' shieldtail (*Uropeltis petersi*)

xxxi. Ashambu shieldtail (*Uropeltis liura*)

xxxii. Palni shieldtail (*Uropeltis pulneyensis*)

xxxiii. Violet shieldtail (*Uropeltis smithi*)

xxxiv. Red-bellied shieldtail (*Rhinophis sanguineus*)

xxxv. Cardamom shieldtail (*Rhinophis fergusonianus*)

xxxvi. Travancore shieldtail (*Rhinophis travancoricus*)

xxxvii. Whitaker's sand boa (*Eryx whitakeri*)

xxxviii. Montane trinket snake (*Coelognathus helena monticollaris*)

xxxix. Indian smooth snake (*Coronella brachyura*)

xl. Western kukri snake (*Oligodon affinis*)

xli. Nikhil's kukri snake (*Oligodon nikhili*)

xlii. Painted bronzeback tree snake (*Dendrelaphis pictus*)

xliii. Large-eyed bronzeback tree snake (*Dendrelaphis grandoculis*)

xliv. Travancore wolf snake (*Lycodon travancoricus*)

xlv. Yellow-spotted wolf snake (*Lycodon flavomaculatus*)

xlvi. Cherrapunji keelback (*Amphesma xenura*)

xlvii. Beddome's keelback (*Amphiesma beddomei*)

xlviii. Hill keelback (Amp*h*iesma *monticola*)

xlix. Olive forest snake (*Rhabdops olivaceous*)

l. Striped narrow-headed snake (*Xylophis perroteti*)

li. Gunther's narrow-headed snake (*Xylophis stenorhynchus*)

lii. Andaman cat snake (*Boiga andamanensis*)

liii. Nicobar cat snake (*Boiga wallachi*)

liv. Gunther's vine snake (*Ahaetulla dispar*)

lv. Andaman krait (*Bungarus andamanensis*)

lvi. Wall's sind krait (*Bungarus sindanus walli*)

lvii. Striped coral snake (*Calliophis nigrescens*)

lviii. Andaman cobra (*Naja sagittifera*)

lix. Large-scaled pit viper (*Trimeresurus macrolepis*)

lx. Malabar pit viper (*Trimeresurus malabaricus*)

lxi. Horseshoe pit viper (*Trimeresurus strigatus*)

lxii. Bamboo pit viper (*Trimeresurus gramineus*)

lxiii. Cantor's pit viper (*Trimeresurus cantori*)

lxiv. Andaman pit viper (*Trimeresurus andersoni*)

lxv. Nicobar pit viper (*Trimeresurus labialis*)

[Based on Whitaker & Captain: *Snakes of India: The Field Guide*, 2004]

Note: Some species related to the above may also be endemic to India

There are some species found in India about which information is not available on whether they are found elsewhere: e.g. Stout sand snake (*Psammophis longifrons*), Leith's sand snake (*Psammophis leithii*)

285. Which is the most abundant snake of India?

Perhaps, the checkered keelback (*Xenochrophis piscator*), according to Whitaker and Captain (*Snakes of India: The Field Guide*, 2004). A 60 cm. long, non-venomous snake found in and around fresh-water bodies and paddy fields. Found throughout India.

286. What snakes are likely to be found in or near human habitations in India within their respective ranges?

1. Brahminy worm snake (*Ramphotyphlops braminus*).
   In garden soil. Non-venomous
2. Rat snakes (*Ptyas* spp.). In gardens, cattle-sheds, *etc*. Non-venomous.
3. Russell's kukri snake (*Oligodon taeniolatus*). Climbs walls. Non venomous.
4. Common bronzeback (*Dendrelaphis tristis*). In low bushes. Enters houses in search of geckos. Non-venomous.
5. Travancore wolf snake (*Lycodon travancoricus*). In hill areas. Enters tea estate bunglows in search of geckos. Non-venomous.

6. Bridal snake (*Dryocalamus nymphus*). Enters houses in search of geckos. Non-venomous.
7. Checkered keelback (*Xenochrophis piscator*). In and near ponds in homesteads *etc.* Non-venomous.
8. Striped keelback (*Amphiesma stolatum*). In grass, bushes and gardens. Non-venomous.
9. Olive keelback (*Atretium schistosum*). In grass, bushes and gardens. Non-venomous.
10. Green keelback (*Macropisthodan plumbicolor*). In grass, low vegetation, gardens. Non-venomous.
11. Common cat snake (*Boiga trigonata*). In gardens and bushes. Mildly venomous.
12. Common vine snake (*Ahaetulla nasuta*). In bushes and on trees. Mildly venomous.
13. Banded krait (*Bungarus fasciatus*). Usually found in open, plains country in burrows. But can also be seen rarely in human habitations. Wall says (*Journal of the Bombay Natural History Society*, Vol.xx). "It is no infrequent visitor or inhabitant of cantonments, and is often to be encountered in well-populated localities, getting into the bazaars, native huts and cantonment houses". Venomous.
14. Common krait (*Bungarus caeruleus*). In courtyards and gardens. Enters houses. Venomous.
15. Common trinket snake (*Coelognathus helena*). On trees and in bushes. Often enters houses. Non-venomous.
16. Common kukri snake (*Oligodon arnensis*). Found in termite mounds crevices, treeholes and old houses. Non-venomous.
17. Spectacled cobra (*Naja naja*). In gardens, cattle sheds, etc. Venomous.
18. Monocled cobra (*Naja kaouthia*). In gardens, cattle sheds, etc. Venomous.
19. Russell's viper (*Daboia russelii*). Though usually found in open, grassy areas, scrub jungles, thorny hedgerows etc., it can be found sometimes near human habitations because of its partiality for rats. Venomous.
20. Saw-scaled viper (Echis carinatus). Though essentially a snake of sandy or rocky open terrain, Wall refers to it having been found inside houses on a few occasions. Venomous.

287. Are snakes protected species in India?

Yes. Under the Wildlife (Protection) Act, 1972, all snakes along with many other animals come under one or the other of the schedules to the Act. The Act prohibits the killing of any animal listed in these schedules except in defence of oneself or of any other person. The Act also allows the killing of any snake (or any other scheduled animal) when it has becomes dangerous to human life or is so disabled or diseased as to be beyond recovery but this is subject to a permit being obtained from the wildlife authorities. The Act allows a snake (or any other scheduled animal) to be captured only if permitted by the wildlife authorities and only for specified purposes such as education, scientific management, research, for recognized zoos, etc. Violations of these provisions are punishable with imprisonment or fine or both.

Similarly, trading in products of scheduled animals, including snake venom and snakeskins, without a licence obtained from the wildlife authorities, is an offence punishable with imprisonment or fine or both.

288. How does CITES protect snakes?

CITES is the acronym for the Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora. India is one of the participating countries. The convention came into force in 1975 and is administered by the United Nations. This regulates international trade in fauna and flora (including products thereof) which are listed as needing different degrees of protection and placed accordingly in different appendices. Trade in these is not necessarily prohibited but is governed by a strict procedure of licensing depending on the degree of protection needed.

Appendix I lists the most endangered species i.e. those threatened with extinction. International trade in these species is prohibited except for certain non-commercial purposes such as scientific research.

Appendix II lists species that, though not now threatened with extinction, may became so unless trade in them is closely controlled.

Appendix III lists species are those included at the request of a country that considers cooperation of other countries necessary for their protection.

Indian snakes in the Appendices:-

Appendix-I	Appendix-II	Appendix-III
Indian rock python *(Python molurus molurus)*	Common sand boa *(Gongylophis conicus)*	Olive keelback *(Atretium schistosum)*
	Red sand boa *(Eryx johnii)*	Dog-faced water snake *(Cerberus rynchops)*
	Whitaker's boa *(Eryx whitakeri)*	Checkered keelback *(Xenochrophis piscator)*
	Indian egg-eater *(Elachistodon westermanni)*	Russell's viper *(Daboia russelii)*
	Indian rat snake *(Ptyas mucosa)*	
	Monocled cobra *(Naja kaouthia)*	
	Spectacled cobra *(Naja naja)*	
	Central Asian cobra *(Naja oxiana)*	
	King cobra *(Ophiophagus hannah)*	
	Indian rock python *(Python molurus molurus)*	
	Burmese python *(Python molurus bivittatus)*	
	Reticulated python *(Python reticulatus)*	

289. What are the snake species listed in the Red Data Book of I.U.C.N.?

I.U.C.N. (International Union for Conservation of Nature and Natural Resources) publishes a Red Data Book listing the animal taxa belonging to threatened categories – critically endangered, endangered and vulnerable. The criteria for evaluating a taxon for this purpose are detailed in the book.

According to the 2009.1 version of the I.U.C.N. Redlist, the following 18 snakes come under these categories (Vulnerable: 7, Endangered: 7, Critically endangered : 4).

Species Name	Common Name	Status	Distribution
Hierophis cypriensis	Cyprus whipsnake	Endangered	Cyprus
Macrovipera schweizeri	Cyclades blunt-nosed viper	Endangered	Greece
Motivipera albicornuta		Vulnerable	Iran
Montivipera albizona	Mountain viper	Endangered	Turkey
Montivipera wagneri	Wagner's viper	Critically endangered	Turkey
Natrix megalocephala	Large-headed water snake	Vulnerable	Azerbaijan, Georgia, Russian Federation, Turkey
Vipera anatolica	Anatolian steppe viper	Critically endangered	Turkey
Vipera darevskii	Darevsky's viper	Critically endangered	Armenia, Turkey, Georgia?
Vipera dinniki	Caucasus subalpine viper	Vulnerable	Azerbaijan, Georgia, Russian Federation
Vipera ebneri	Iranian mountain steppe viper	Vulnerable	Iran
Vipera eriwanensis	Armenian steppe viper	Vulnerable	Armenia, Azerbaijan, Turkey
Vipera kzznakovi	Caucasian viper	Endangered	Georgia, Russian Federation, Turkey
Vipera latastei	Lataste's viper	Vulnerable	Algeria, Morocco, Portugal, Spain
Vipera latifii	Latifi's viper	Endangered	Iran
Vipera magnifica	Magnificent viper	Endangered	Russian Federation
Vipera orlovi	Orlov's viper	Critically endangered	Russian Federation
Vipera pontica	Black sea viper	Endangered	Turkey
Vipera ursinii	Orsini's viper	Vulnerable	Albania, Bosnia and Herzegovina, Croatia, France, Greece, Hungary, Italy, Macedonia, Romania; Serbia

None of the Indian species of snakes comes under these categories. The position is, however, different under the Indian Wildlife (Protection) Act 1972 (See Q & A 287).

290. What are 'true vipers'?

A term used to refer to the group of three of the four subfamilies of family Viperidae: Viperinae, Causinae and Azemiopinae. Also called 'pitless vipers'. 14 genera and 85 species, all restricted to the Old World (Asia, Europe and Africa).

The true vipers lack the thermo-receptive pits (See Q & A 21) between the nostril and the eye. Only the members of the subfamily Crotalinae, which is outside this group of true vipers, have 'pits' and these are found in both the Old World (Asia, Europe, Africa) and the New World (North and South America).

Of the 85 species of true vipers, only three occur in India:

Saw-scaled viper (*Echis carinatus*)

Russell's viper (*Daboia russelii*)

Levantine viper (*Macrovipera labetina*)

The first two are commonly found throughout India. The third is uncommon and found in a few localities in Kashmir.

One sub species of *Echis carinatus* – Sochurek's saw-scaled viper (*Echis carinatus sochureki*) – found in parts of Northern India (and also in Pakistan, Afghanistan, South and Central Iran, Oman and UAE), is considered by some as deserving the status of a separate species, but there is no finality on this as yet.

291. Why are there reports of large numbers of pythons being discovered in the parks and woodlands in places like Florida, USA though no pythons occur in the wild in USA?

Some snake-lovers, mainly in the U.S., as elsewhere, adopt baby pythons brought from other countries as pets little realizing that the cute, adorable creature will one day become a large, unmanageable python. The better-informed of the owners then gift them to a zoo though it is not always that the zoo will accept the gift. The owners who are unable to fund a willing zoo or who are plain irresponsible and will not even try to find a willing zoo will surreptitiously release the pythons into some nearby wild area as in a park. They become a menace to local wild species of

fauna and domestic pets, poultry and even little children. This problem has been reported from parts of U.S. like Florida. (U.S. has no wild pythons). Pythons – mostly the Burmese python (*Python molurus bivittatus*) – are imported illicitly through pet trade channels.

292. Is there a 'spitting viper'?

It is generally believed that only some species of cobras can spit venom (See Q & A: 258). But there is atleast one species of viper that has been reported to do so – the Mangshan pit viper (*Zhaoermia mangshanensis*) found in the Mangshan area in the Hunan province of China. Mark O'Shea (*Venomous Snakes of the World*, 2005) fears that this snake may be on the verge of extinction.

Even though the spitting habit of this snake finds mention in Gumprecht A. e*t al., Asian Pit Vipers*, 2004, and Mark O'Shea, *Venomous Snakes of the World*, 2005, Chris Mattison (*The New Encyclopedia of Snakes*, 2007) seems to have some reservations on this.

293. Can snakes predict earthquakes?

Reports have appeared in the press occasionally of the queer behaviour of many species of mammals, birds and snakes well ahead of earthquakes even as the humans had no idea of the impending doom. Similar reports had come also after the tsunami of Dec.2004. The earliest such account seems to be of the earthquake in 373 BC which wrecked the port city of Helice. According to the Roman scholar, Pliny the Elder (23-79 AD), one of the signs of a coming earthquake is "the excitation and terror of animals with no apparent reason".

There are accounts of such phenomena down to the present times. Most of the observations, understandably, relate to cats and dogs, farm animals and commonly seen birds. The historian Diodorus Siculus records animals leaving the city of Helice in droves days ahead of the earthquake of 373 BC much to the puzzlement of the human inhabitants. And, in this exodus, he includes snakes also.

On 4 February 1975, there was a major earthquake in the Liaoning province of China causing widespread damage and loss of lives. This had been preceded for some two months by the unusual behaviour of many species of animals and birds. It had been reported in this context that "snakes came out of hibernation, crawled from their burrows and froze to death on the snow-covered surface".

Various theories have been advanced to explain this phenomenon but none that will stand scrutiny. There has been no consistent research on this except some attempts by the Chinese State Seismological Bureau from the 1970s and some studies by Rupert Sheldrake and Daniel Jay Brown in California from the 1980s which have not led to any significant findings so far (For more on this subject, see *Dogs That Know When Their Owners Are Coming Home and Other Unexplained Powers of Animals* by Rupert Sheldrake, 1999, particularly the chapter captioned 'Forebodings of earthquakes and other disasters').

While attempting to answer a similar question about cats, Desmond Morris gives possible explanations in his *Catwatching*, 1986 : (i) sensitivity to very minute vibrations of the earth that precede an earthquake which are not apparent to us or .capable of being registered on our instruments, (ii) responsiveness to the sudden increase in static electricity that apparently precedes earthquakes (iii) responsiveness to sudden shifts in the earth's magnetic field that accompany earthquakes (iv) detection of all three phenomena at the same time.

A report from Reuters appeared in the Press in December 2006 on the observations made by the earthquake bureau in Nanning, capital of the Guangki autonomous region in Southern China, about the curious behaviour of snakes before an earthquake. "Of all the creatures on earth, snakes are perhaps the most sensitive to earthquakes", bureau director Jiang Weisong was quoted as saying. Jiang said snakes could sense an earthquake 120 km away, three to five days before it happens. "Their erratic behaviour would be an indication of the quake to come".

There is need for more study on this subject.

294. Do pythons or other such large snakes eat or attempt to eat humans?

Folklore may say so, but authentic accounts are extremely rare. The chances of a healthy man or woman being caught in a position that facilitates such a process is improbable although someone who is badly injured or resting or sleeping or incapacitated by alcohol might be vulnerable. Further, even though snakes, especially pythons, can swallow very large prey items (see Q & A 148), the broad shoulders of an adult human will pose a problem for the snake. But children are not unlikely victims.

295. Is there a snake that pecks at the eye?

There is a belief in South India and Sri Lanka that the common vine snake or the whip snake (*Ahaetulla nasuta*) will peck at the eye of the beholder. For this reason, it is called the 'eye –pecking snake' (*Kankuthi pāmbu*) in Tamil and Malayalam. Its name in Sinhalese is *ehetulla* meaning 'eye-pecker' and it is this that is the basis for its generic name in Latin. While many dismiss this as a superstition, published literature has a few anecdotal accounts from well-known herpetologists about a strange behaviour of this snake. When held in front of the face it lunges at the eyes and at no other part of the face. For more on this, see the author's paper in *Cobra* Vol.II Issue 1, 2008. For the many special features of the vine snake's vision, see Q & A 26.

296. Are there two-headed snakes?

These are freaks and occur rarely. Two-headed snakes—both heads at the same end – have been reported from India in the checkered keelback (*Xenochropis piscator*), dog-faced water snake (*Cerberus rhynchops*), common sand boa (*Gongylophis conicus*), wolf snake (*Lycodon aulicus*), Indian cobra (*Naja naja*) and Russell's viper (*Daboia russelii*). Such defective individuals do not survive for long. But in rare cases they have survived for fairly long periods in captivity.

The red sand boa (*Eryx johnii*) is sometimes mistakenly believed to have a second head at its tail end. It is its very blunt tail with a rounded tip that is responsible for this misunderstanding. The blunt tail may serve a purpose in fooling a predator into attacking the tail believing it to be the head thus enabling the snake to escape with only minor consequences.

297. Do snakes emit a foul odour?

It is a widespread belief that some snakes emit a foul smell. Snakes are normally odourless. But they have special scent glands situated at the base of their tail which exude a musk-like substance at certain times, to attract a mate or, sometimes, as a defence tactic. The smell of this varies from snake to snake and, in some cases, it may be unpleasant (to humans and predators). See also Q & A 95.

298. Is a snake whose fangs have been removed safe to be handled?

No. In snakes, all teeth including fangs, are shed regularly and replaced regularly. This may be in cycles of 10 to 70 days depending on the species and the health of the snake. In a venomous snake, when an active fang gets ripped off either

by accident or by human intervention or is shed in course of time, the next most-mature fang will take its place.

299. Why should a snake never be defanged?

Defanging a venomous snake is often resorted to by snake-charmers and others who handle snakes in a mistaken attempt to make them 'safe' to handle. This is a cruel practice. The defanging is almost always done in a crude manner causing injury to the snake making it difficult for the snake to eat and also causing infections in the mouth. That apart, since the venom is an enzyme to aid digestion, a defanged snake, even if, being a captive specimen, it does not have to hunt its prey, it will be in distress. In any case, this practice does not help the snake charmer or snake handler since another fang will soon take the place of the lost fang.

300. Is venom dangerous when swallowed?

Venom is dangerous when it gets into the blood stream. Therefore, if there are no lacerations in the mouth or the digestive tract and no cavities in the teeth, venom can safely be swallowed, but not in very large quantities since, in that case, it is not unlikely that a little of it (but enough to be dangerous) may be absorbed. But, then, why try it at all?

301. Is a snake immune to its own venom or venom of other species?

The snake is generally immune to its own venom and of related species. However, a bite from an unrelated species may prove fatal though, sometimes, there could be a partial immunity. The habitually snake-eating king cobra is not safe from the bite of a Russell's viper. The snake-eating mussarana of Central and S. America (See Q & A 268) is immune to the venom of the central and S. American pit-vipers but not to the venom of the coral snakes. King snakes of America are immune to the venom of rattle snakes on which they prey, but the immunity is not total.

302. Is there a relationship between the size of a snake species and the virulence of its venom?

Yes, but, paradoxically, it is in the inverse proportion. In related species of snakes, the general observation is that the larger the species, the less virulent the venom. Conversely, the smaller the species, the more virulent the venom. But,

really, this is not surprising since this is Nature's way of compensating for the smaller quantity of venom in a small snake.

Examples :

-- The large-sized banded krait (*Bungarus fasciatus*) and its smaller relative, the common krait (*Bungarus caeruleus*).

-- The large-sized Russell's viper (*Daboia russelii*) and its smaller relative, the saw-scaled viper (*Echis carinatus*).

-- The large-sized king cobra (*Ophiophagus hannah*) and the (somewhat distantly) related Indian cobra (*Naja naja*).

303. What is the reason for the venom of some snakes to have very high potency?

There could be two reasons for this. Firstly, coevolution. As the prey species, in the course of evolution, develop greater and greater resistance to the snake's venom, the snake has to develop venom with greater and greater potency. This is a vicious circle and holds good for all venomous snakes. Secondly, the nature of the prey species. Fast-swimming fishes being the prey of sea snakes, it is necessary for sea snakes to quickly kill or incapacitate or the prey may be lost, and for this, very high potency of venom is essential. The two reasons could also interact taking the process forward.

304. Are there male snakes which produce the scent of females and, if so, why?

Richard Shine and Robert Mason have given an account of the queer behaviour (no pun intended) of the red-sided garter snake (*Thamnophis sirtalis parietalis*) in Manitoba, Canada. During the eight-month long severe winter, these snakes in their thousands take shelter in hibernacula (See Q & A 134), sometimes more than 10,000 huddled together in rocky depressions no more than 100 square metre. in size. The mating season starts immediately after the hibernation is over. Males emerge first from the hibernaculum and wait in huge numbers at the exit for the females to appear. As soon as a female emerges, hundreds of males cluster round her in a huge 'mating ball' and the 'mating balls' move *en masse* (like 'live spaghetti') over rocks and vegetation until the female has mated. Curiously, some 'mating balls' contain no females. In 1985, Bob Mason and David crew found that such odd 'mating balls' consist of desperate males attempting to mate with certain other males which they seem to mistake for females notwithstanding that they cannot be so

mistaken by size or markings. The two scientists discovered that the mix-up happened because the males mistaken for females were exuding what resembled the female pheromones (See Q & A 177).

The reasons for some of the males thus mimicking females are not very clear. The two scientists hypothesize that since the females are far fewer in number than males in this species, there is intense competition among the males to secure a female. In this process, some of the males who are not as yet ready for mating try to mislead the other males and lure them away from the females by exuding the female pheromones so that the females will be available to them later on.

This phenomenon of male snakes mimicking females has not been noticed in any other species.

(Shine, R. & Mason, R. 2001. *Serpentine cross dressers*, Natural History. 2/01 (12 Sept 09; http://oregonstateedu/~masonr/pdfs/057serpentinecross.pdf).

305. Do large snakes live longer than small ones?

Opinions differ. Bernhard Grzimek in his *Animal Encyclopedia, Vol.6* 1971 says that "generally there is a relationship between size and life expectancy in snakes" and that the large-sized members of Boidae live the longest. Carl H., Ernest and George R., Zug (*Snakes in Question*, 1996) say, on the other hand, that "contrary to expectations … small-bodied species were not found to have shorter life spans than long-bodied species". The fact of the matter is that while we have some information on the life span of large snakes (in the zoos), there is an acute dearth of similar information on the smaller snakes. Therefore, there is little scientific basis for making any comparison.

306. Can the length of a snake be estimated from its whole moulted skin?

This is not a safe method. The snake's skin is elastic and a moulted skin can be stretched to an additional one-fourth of its actual length. In fact, a moulted skin found in the natural state, that is, even without being stretched, will be longer than the snake from which it came.

307. Can the length of a snake be estimated from a preserved specimen?

Not very correctly. Snakes preserved in alcohol, formalin etc. (as do other animals) usually shrink.

308. Is the king cobra (*Ophiophagus hannah*) as ferocious as it is commonly believed to be?

Its huge size (3m. or more), the large quantity of venom it holds (10 to 40 times what is required to kill a human), its extremely fast movements when provoked – all these have contributed to the belief that it is a most ferocious snake. But the fact is that it is slow to attack except when provoked or unless disturbed while guarding its nest (see Q & A 198).

It should be borne in mind here that, if it chooses to do so, it can cover a considerable distance in one leap forward.

309. Are there hybrids in snakes?

A hybrid is a cross between two different species. Generally, this does not occur in the wild. There may be exceptions, however. For instance, different species of king snakes in the U.S. are known to interbreed in the wild. In the pet trade, hybrids are produced in artificial conditions but they are not considered as new species.

310. How common are albinos and melanistic forms in snakes?

Albinos (all white) and melanistic forms (all black) occur in many species of animals. The colour difference may be full or partial. The true mark of a total albino is that it will have pink eyes. Snakes (or other animals) which are white-skinned and pattern-less but have normally pigmented eyes are known as leucistic. Albinism is the result of a lack of pigmentation in the skin. (Absence of melanin is a genetic mutation). In melanism, on the contrary, there is a preponderance of the black pigment melanin. Albinism is very rare in snakes (as in other animals) whereas melanism is not so rare. The explanation, perhaps, is that an all-white and hence very conspicuous snake has comparatively little chance of survival in the wild — both prey and predator spot them quicker.

However, there is one strange curious case of an entire population of a snake species being albinos. This is in the city of Iwakumi, Japan which has a whole population of the rat snake *Elaphe climacophora*, all albinos. See Q & A 398).

311. What should you do to escape from a python's coils?

In case you ever happen to get entangled with a python or *vice versa*, remember that the coils are the real danger, not the head. There is a saying in Tamil:

"to let go the head and hold the tail". This bespeaks the folly of trying to tackle a problem from the wrong end. But, in case of a python attack, this is precisely what you should do. Grab the tail and unwind the coils. It is more difficult to unwind it from the other end. Simultaneously, keep an eye on the head too lest it gives a bite which can be nasty though not venomous. And best of luck!

312. Is 'snake charming' fact or fiction?

There are two aspects to 'snake charming'. One is 'charming' by touch and the other 'charming' by sound.

I do not propose to deal with the patently absurd claims of 'charming' with the aid of amulets and such other knick-knacks, allegedly having magical properties, worn on the body. 'Charming' by touch and 'charming' with sound stand on a different footing.

There are not many accounts of 'charming' by touch. There have been persons with a reputation for freely handling venomous snakes with bare hands. We are not referring here to captive snakes some species of which often become tame from repeated handling, but to wild ones. There was, for instance, Henry Brusher Mills (1828-1905) of Hampshire, England, who had to his credit capture of some six thousand snakes, many of them venomous, which he used to supply to various institutions. Not that he caught all of them with his bare hands, but he was known for his ability to handle venomous snakes without any protection. In cases like this what is involved could be more a keen knowledge of the snake's behaviour and adroit handling.

Paul Brunton (1898-1981), the British philosopher – traveller, had spent years in exploring the spiritual mysteries of India and Egypt as evidenced by the many books narrating his experiences. In his book *A Search in Secret Egypt* (1935), he devotes two chapters to the snake charmers he encountered in Egypt. He begins his account by debunking most of them as fakes and tricksters. But, then he proceeds to give an extensive account of his adventures with Sheikh Moussa, "that man who in the empire of the snakes ruled as a king", who tackled "all manner of serpents by means of nothing less than old-fashioned magical power", that is, charms and incantations, how he tracked down and caught cobras whose very existence in the particular spot was not suspected by anyone, how the snakes hiding deep inside a hole emerged obediently to nothing more than his verbal commands and did his bidding,

how he handled with impunity venomous snakes and so on. Moussa initiated Brunton into the jealously guarded secrets of his incredible powers through the utterance of magical phrases and the use of charms worn on the body, so much so Brunton himself could perform some of these miracles. "I handled deadly cobras and poisonous vipers several times, and even put them round my neck, yet they never once attacked me". As he goes on, Brunton taxes the reader's credulity more and more. While Brunton's sincerity cannot be doubted, he was, perhaps, not beyond hallucinations. For instance, he says in *A Search in Secret India*, 1934, about a strange experience of his in the presence of Ramana Maharshi (undoubtedly, a great saint revered by many) at the ashram in Tiruvannamalai, South India: "I find myself outside the rim of world consciousness. The planet which has so far harboured me disappears. I am in the midst of an ocean of blazing light. The latter, I feel rather than think, is the primeval stuff out of which worlds are created, the first state of matter. It stretches away into untellable infinite space, incredibly alive".

There have, of course, been persons in many cultures who have given us graphic accounts of their out-of-the body or near-death or similar mystical or paranormal or psychic experiences. Whatever may be the reality, it will be uncharitable to suspect the honesty of every one of them; atleast some of them genuinely believe in what they say of the adventures of their minds or altered states of consciousness or whatever; they have no intention to deceive others. At the same time, they are not the most reliable persons to tell us objectively of the world external to them whether it be in respect of animal behaviour or anything else.

Ramona and Desmond Morris (*Men and Snakes*, 1965) who had made a study of the serpent cult in many parts of the world, who also make a reference to Brunton's accounts, have nothing very clear to say on whether snake charming has any scientific basis. They, however, say: "Some zoologists have suggested that snake charmers have a special knowledge of snake psychology and are able to manipulate the natural behaviour of the snake so effectively that it appears to be well-trained. Their secret power over the snake is, therefore, a deep understanding of the [snake's] habits". But this does not satisfactorily explain all that we are told by Brunton or even by the Morrises themselves.

Some interesting observations about 'charming' by touch have been made by Raymond Ditmars and these deserve to be studied with care. He was a noted herpetologist and curator of mammals and reptiles in New York's Bronx Zoo. In a

paper on snake charming included in his 1931 book *Strange Animals I have known*, he expresses his belief from personal observation that some persons who handled snakes had a soothing effect on them. He draws an analogy with dogs and monkeys that sometimes display an instinctive liking for a stranger's touch and allow themselves to be petted. They do not display the same amiability towards all strangers. "Clad in clean overlapping scales which are soft and thin and which, under microscopic examination, seem to be extremely sensitive to the array of delicate nerves, a touch [to a snake] is probably magnified in its influence over the effect upon a monkey or a dog. There may be just a brush of relationship here to sound vibrations as the invisible but constant nerve tremor of the human and other living creatures surely varies in its 'frequencies'. Bearing the serpent's sensitive scales in mind we come to what I define as true 'snake charming'". He goes on to say: "Among the Hindus and Arabs [two peoples with a history of snake charmers] are some men, a few, who seem to have mysterious power in handling snakes. They can pick up *wild* (emphasis added**)** specimens of the deadly types and the reptiles become calm and submit to handling. This power is not altogether limited to men of oriental origin. I have watched men of American birth [Amerindians] handle rattlesnakes with impunity. They did not claim to be snake charmers… The reptiles were quiet and clung to their hands… Placed on the ground, they coiled, rattled and prepared to strike when onlookers made a threatening step in their direction".

There is a hypothesis that the manner in which a snake is handled by the charmer may, whether intentionally or otherwise, induce in the snake a neurological state resulting in it becoming comatose. In this context, mention must be made of the research done by Domin Svorad on animal hypnosis (results published in *Archives of Neurology and Psychiatry*, 77 : 533-39).

Balaji Mundkur in *The Cult of the Serpent*, 1983 refers to this. "Svorad investigated the peculiarities of simple, repeated, mechanical movements as stimuli affecting the neocortical part of the brains of representatives of those classes of vertebrates which possess the neocortex". Snakes possess the neocortex. Svorad found that prolonged stupor could be induced in lizards and birds by such movements. By inference, this could be extended to snakes as well, though Svorad himself does not appear to have experimented with snakes.

(See also Q & A 342, 372, 383, 388)

As regards charming by sound, we may include in it the 'incantations' already referred to. But what comes to mind more readily is the claim of charming snakes by music (See Q & A 342). Contrary to the long-held view that the snake charmer makes the cobra dance to the music played on his pipe, it has now been established that the snake cannot hear the music and that its movements are nothing more than its defensive response to the movement of the pipe, which it finds threatening. However, there is also a view that the peculiar kind of pipe played by the snake charmer produces, apart from the music we hear and which the snake cannot, also certain low-pitched notes, less than 200 Hz, which may have an effect on it. Here again, Ditmars, in the paper quoted above, has some interesting things to say. He readily concedes that most of the cases of cobras dancing to music have nothing to do with the music but are visual responses to the movements of the snake charmer and his pipe. But, he is not prepared to leave the matter at that. He adds: '[Music affecting snakes] has been doubted by some scientific men, but I believe in it after close observation. Certain sound vibrations attract a serpent, and others momentarily render it helpless. I am inclined to think that the latter are pitches so strident to the snake that they are magnified a hundred-fold over those, which, to the human ear, seem merely to irritate". He had also observed how certain notes of a sitar and a piano had the effect of rendering a king cobra temporarily inert. Ditmars says: "It was probably a note in the song that produced the affecting pitch. I am *convinced* (emphasis added) that the production of such pitches at will is understood by some of the Hindu snake charmers". Ditmars concludes: "There are mysteries about true snake charming – and there is something to it".

Sadly, no one seems to have pursued Ditmars's suggestion for the past nearly 80 years notwithstanding that it had come not from some casual or credulous or excitable layperson, but from one of Ditmars's eminence and experience.

313. What are the main reasons for the dearth of research-based information on behaviour of snakes compared to other animals?

Carpenter and Ferguson in a paper in *Biology of the Reptilia,* 1977 ed. Carl Gans Vol.7 lists the main reasons for this : "(1) poor observational data (generally due to the lack of knowledge of what to look for on the part of the observer), (2) few attempts to study behaviour in detail, (3) absence of obvious appendages, (4) few visually discernible stereotyped signals, (5) lack of observable outstanding behaviour

patterns characterizing the families of snakes, (6) the secretive nature of snakes, (7) a general fear, even among biologists, of snakes, and (8) the 'unwillingness' of snakes to perform under laboratory conditions".

Nevertheless, the authors, based on the available literature, mention as many as 108 types of behaviour "which are thought to be, or may be, stereotyped actions, acts or act systems relating primarily to intra-specific aggression, courtship and mating".

To what Carpenter and Ferguson have said, we should add the sedentary habits of snakes, especially in captivity, and unlike in the case of birds and mammals, the difficulty of using food as a stimulus in experiments considering that snakes are 'poor' and infrequent feeders.

Apart from all these, it should be borne in mind that caution is needed while extrapolating observations in captivity to the wild.

314. Is our unusually intense fear of snakes inborn or learnt?

It must be stated at the outset that the instantaneous fear that a snake evokes is widespread in the animal kingdom. In fact, it is so widespread that some animals ranging from caterpillars to birds to mammals have even evolved appearances and habits to mimic snakes in order to scare their adversaries (See Q & A 336).

It has been noticed that children upto the age of about three have no particular fear of snakes. The intense fear of snakes is developed later on by the child after watching the reaction of adults to snakes or upon being told exaggerated accounts of how dangerous snakes are. In other words, it is the result of 'emotional conditioning'. This is, however, a grey area; the sensitivity of the subject precludes research. But, experiments have been conducted with non-human primates vs. snakes and the results can, to a large extent, be extrapolated to humans.

The kind of fear that many humans exhibit at the very sight of a snake is not just ordinary fear. Ordinary fear is a natural and healthy reaction towards any source of potential danger as, for example, fear of an unpredictable wild animal or a growling dog or fear of fire or of heights. It is also controlled—moderated or enhanced -- by many factors such as the proximity to the source, the degree of protection one has, past experiences and so on. But, where snakes are concerned, there is something unusually intense and irrational about our fear. Psychologists describe such intense

and irrational fears as ‘phobias’. But is this phobic response to snakes inborn in us or learnt?

Experiments with animals have shown that anti-predator responses are often imprinted at birth. The ornithologist Susan Smith demonstrated this with hand-reared mot-mots (tropical birds related to kingfishers) which feed on lizards and small snakes. Hand-reared mot-mots would peck at even thin painted wooden rods resembling snakes mistaking them for prey. But if these rods were painted with alternating red, yellow and black rings to resemble a deadly coral snake, the hand-reared birds would refuse to touch them. This behaviour has been recorded also in the inexperienced young of the great kiskadee, another predatory bird species.

Steven Pinker, the well-known professor of brain and cognitive sciences, says (*How the Mind Works,* 1997) : “Laboratory-raised rhesus macaques are not afraid of snakes when they first see them but if they watch a film of another monkey being frightened by a snake, they fear it too. The monkey in the movie, *does not instil the fear so much as awakens it* [emphasis added] for if the film shows the monkey recoiling from a flower or a bunny instead of a snake, the viewer develops no fear”. In other words, a mere exposure of a monkey to another monkey reacting with fear towards a snake is enough to trigger in it some deep-hidden atavistic terror of snakes.

The great ethologist Konrad Lorenz (1903 -1989), in his experiements with greylag geese, had demonstrated how incubator-hatched goslings would imprint on the first suitable moving stimulus they saw within a ‘critical period’ of about 36 hours after hatching. This is how the new-born learns the characteristics and the behaviour patterns of its parent (Lorenz proved that he could make the goslings get fixated even on himself by such imprinting, so much so they would obediently follow him as if he were the mother goose itself). Imprinting is not by sight alone but may also be by touch, smell, sound or taste.

In the 1960s, Martin Seligman developed the concept of ‘prepared learning’ which is different from ‘imprinting’. In ‘prepared learning’, unlike in imprinting, the new-born or the young *instinctively* show a certain measure of discrimination. The inexperienced young, for instance, comes to learn to fear a particular object, animal or otherwise, spontaneously but not other objects. The learning process attaches itself to a narrow range of targets and the response has nothing to do with earlier observations or prior experience. The finding was not very conclusive.

Susan Mineka, a student of Seligman, designed an experiment to test the idea of 'prepared learning' with regard to monkeys vs. snakes. It had already been noticed since 1964 that monkeys born in captivity showed, in their early years, no fear of snakes whereas monkeys born in the wild would jump out of their skins on seeing a snake. It could not be that the wild monkey had learnt to fear snakes from its own direct experience since experience with a lethal snake could well be its last experience. Mineka hypothesized that infant monkeys must acquire a fear of snakes vicariously by observing the reactions of other monkeys to snakes. Monkeys born in captivity and reared in isolation, not having had this opportunity, were thus free of this acquired fear unlike monkeys born in the wild. She exposed batches of lab-reared monkeys to snakes both in the presence of experienced (i.e. knowledgeable about snakes) adults and in the absence of the adults. It was seen that when the captive-born monkey had its first experience of a snake, that is, without the company of the experienced adult monkey, it was not afraid of the snake. But, when it was with an adult monkey which became terrified of the snake, the infant monkey also responded likewise. At the same time, when the adult monkey did not react with fear to some other object, say a flower, the infant monkey also showed no fear.

Mineka did not stop with this and what followed was the definitive part. Through a doctored video tape it was made to appear that the adult monkey recoiled with fear on seeing a flower (It was actually reacting to a snake which was not on the video). Strangely, when the little monkey watched this video and the adult's scared response, it did not show any similar terror of the flower. Then the converse was demonstrated with a doctored video tape showing the adult monkey watching a snake with nonchalance (Actually, there was no snake but only a flower). When the little monkey watched this video, and the adult's nonchalant response, it showed no fear of snakes of the earlier proportions.

Mineka's experiments thus showed that while the learning process with positive or negative or neutral response was a strong determinant of behaviour, it depended also on instinct and is rooted in our evolutionary history.

What is given in the preceding three paras is a highly simplified account of the experiments conducted and the hypothesis that emerged. For full details, see the paper titled "Fears, Phobias, and Preparedness: Toward an Evolved Module of Fear and Fear Learning" by Arna Ohman and Susan Mineka published in *Psychological Review,* July 2001, Vol.108, No.3, 483-522.

Matt Ridley (*Nature via Nurture: Genes, Experience and what makes us Human,* 2003) also points out the relevance of the human experience in primordial times in determining our fear response to various objects. Many objects which were perceived as serious threats to stone-age people such as spiders, the dark, heights, deep water, confined spaces, thunder and, of course, snakes are the cause of phobias in many people even in our own times whereas, paradoxically, "the much greater threats of modern life —cars*, skis, guns, electric sockets – simply do not induce such phobias". Ridley concludes: "It defies common sense not to see the handiwork of evolution here: the human brain is pre-wired to learn fears that were of relevance to the stone age". Scientists Carl Sagan and Ann Druyan also concur with this hypothesis in *Shadows of Forgotten Ancestors*, 1992.

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* Even in a country like India which has the largest incidence of death from snake bite and which has less of vehicular traffic than the advanced countries, motorised vehicles kill four times the number killed by snakes. Still, snakes evoke, in many of us atleast, a panic fear which motor vehicles do not.

It must, however, be noted here that not all phobias can be explained in terms of such genetic determinism; nor are they comparable in their intensity or pervasiveness and many of them are of recent origin. In fact, even in psychology, the term seems to be used rather loosely. *The Oxford Dictionary of Psychology* by Andrew M. Colman, 2001, lists some 370 phobias many of which may appear absurd or laughable (e.g. ablutophobia (bathing), alektorophobia (chickens), clinophobia (going to bed), bibliophobia (books), nephrophobia (clouds), chorophobia (dancing), phagophobia (eating) and so on).

Incidentally, *The Oxford Dictionary of Psychology* says that the National Phobics Society of England has listed the eight most common phobias in U.K. in the descending order, as arachnophobia (spiders), social phobia (scrutiny by or attention from others), aeronausiphobia (flying in an aircraft), agoraphobia (public places, crowds), carcinophobia (cancer), brontophobia (thunderstorms), thanatophobia (death) and cardiophobia (heart attack). Ophidiophobia (snakes) does not figure in this list. But, then, the incidence of snakebites in U.K. must be negligible, with only a

single venomous snake – the adder—in England, Wales and Scotland and no snake at all in Ireland.

To sum up: fear of snakes is hard-wired in the human brain and we are born with it and it has something to do with our remote ancestors and the primordial times they lived in when, in the midst of all-pervasive wilderness and their habitation in dark caves, snakes with their surreptitious habits and their terrible ability to deliver death were a formidable threat to the survival of the stone-age man. Also, this fear which is ingrained in animals, particularly primates, must have been passed on to humans in the course of evolution. In the present times, emotional conditioning in childhood can trigger that inborn but slumbering fear and either exacerbate it and take it to phobic proportions or, in the alternative, moderate it to make it informed and controlled. There the controversy must rest until proof is produced to support a better hypothesis.

315. Which snake can be reckoned as the most successful snake?

Arguably, the adder, *Vipera berus.* It has the largest geographical range of any terrestrial snake species and the second largest geographical range of any snake species (the first place going to the sea snake *Pelamis platurus*). It is found from Britain and Scandinavia through central Europe, across northern Asia as far east as the Pacific ocean. The distribution is almost continuous and covers a wide variety of habitats. One interesting feature is that while in other snakes such vast and widespread distribution over diverse habitats would have resulted in the evolution of many different sub-species, the adder has only three sub-species, which speak to a felicitous adaptation to different environments.

Further, in the northern parts of its range (it has been recorded at a latitude of 69º N in Scandinavia), it is the only snake to be found; for all others the climate is too inhospitable. This is a remarkable achievement for a cold-blooded animal. It does not mind hibernating in parts of this range for eight months in the year, that is, two-thirds of its life span.

316. Are the cobras and the king cobra related?

Yes, but not closely. They belong to different genera, the cobras to the genus *Naja* and the king cobra to the genus *Ophiophagus*.

317. Are there snakes other than the cobras and the king cobra which also spread hoods?

Yes. Such species in India are the banded racer (*Argyrogena fasciolata*), found throughout most of peninsular India, St John's keelback (*Xenochrophis sanctijohannis*) found in Jammu & Kashmir, Arunachal Pradesh, West Bengal, Andaman keelback (*X. melanzostus*) found in the Andaman, checkered keelback (*X. piscator*) found throughout India, false cobra (*Pseudoxenodon macrops*) found in parts of northeast India, green keelback (*Macropisthodon plumbicolor*) found in most of mainland India, olive keelback (*Atretium schistosum*) found in parts of India.

But their hoods, except in the case of the false cobra, are narrow and a poor imitation of the cobra's hood.

One example of a hooded snake which is not a cobra, outside India, is the shield-nose snake (*Aspidelaps scutatus*) of Central South Africa. (See Q & A 268).

318. How does a rattlesnake grow its rattle?

The rattle consists of a series of rings of dry keratinized skin that remain on the tail every time the snake sheds the rest of its skin (keratin is the main constituent of hair, hoofs, claw and horns in animals and of feathers in birds).

319. Is there a rattle snake without a rattle?

Scientists generally agree that the rattle snake developed its rattle in the course of its long evolution as a mechanism to warn unwanted visitors like the larger mammals as it lay coiled up on the great plains of northern and central America waiting for rats, mice and other small animals to pass by.

In the Feb.1998 issue of *The Monitor*, the Newsletter of the Hoosier Herpetological Society, Ed. Ferrer writes about one species of rattlesnake, the Santa Clara rattlesnake (*Crotalus catalinensis*) which has, in the course of further evolution, moved in the reverse direction and shed its rattle. It had reached its present habitat in Santa Catalina island probably by rafting from the mainland. In its new environment, the rattle was not only not necessary but could be an impediment. The island does not have large animals who could trample on the snake by accident and, therefore, had to be 'rattled' away. Also, the snake seems to have changed its diet and hunting habits. Instead of 'sitting and waiting' as other rattlesnakes do, this species hunts at night for

spiny lizards and sparrows roosting in the shrubs. While out on such a trip, a noisy rattle might prove a liability.

320. Can the age of a rattlesnake be determined by the number of segments in the rattle?

No. This is a common error. Every time the rattle snake sheds its skin, a segment is added to the rattle. But the number of times the snake sheds its skin will vary from three to five in a year, the younger ones shedding more often. Further, as the snake grows older, some of the rattle segments may be lost by wear and tear.

321. What is the 'rattlesnake round-up'?

When the colonists settled in America in the early decades of the 18th Century, they found large parts infested by the rattlesnake, most of the species being extremely lethal. There are 31 species of them distributed from S. Canada to Central South America. They were hunted down in order to make the place habitable for humans. Soon, this was carried to excess and became an annual rodeo-like event on a specified day of the year particularly in Texas, Georgia and the Midwest and a great attraction for visitors. Men organized themselves into large bands, armed with assorted weapons, searching for rattlesnakes far and wide and mercilessly slaughtering them in unimaginable numbers. Rocky outcrops were demolished causing huge ecological damage. Petrol was poured down burrows to drive out the snakes, a particularly insidious practice since it killed many harmless snakes as well and other wildlife . When the rattlesnake population dwindled in a particular State, because of this massacre, the show was kept going by importing the snakes from neighbouring States. Prizes were offered for the largest number of kills. This became a multi-million-dollar tourist attraction.

In recent times, there has been widespread condemnation of this senseless massacre which has decimated the rattlesnake population, with grave ecological consequences. But the show still goes on in States like Alabama, Florida, Georgia and Oklahoma.

322. Can spitting cobras also inflict a venomous bite?

Yes, they can, just as other cobras.

323. Can the venom that is spat by the spitting cobras kill the victim?

No. 'Spitting' is a defensive behaviour and not intended to kill the victim. If the venom lands on a healthy, unruptured skin, then nothing happens. But if it hits the eyes of the victim, as intended by the snake, then it can cause intense pain, temporary blindness and corneal damage that can lead to permanent blindness unless the eyes are quickly washed clean. If it hits an open wound also, it can envenomate.

324. Does the spitting cobra rear up and spread its hood before it 'spits'?

Normally, yes, but not always necessarily. Some of the spitting cobras like *Naja nigricollis* and *Naja mossambica* are known to spit even without 'hooding'. The latter is known even to lie on its back and spit.

325. Why should snakes be conserved?

Snakes have an irreplaceable role in ecology as the natural predators of rats and agricultural pests. (See, however, back cover inside for a more enlightened view). Particularly in predominantly agricultural economies like India, the burgeoning rodent population, made worse by human over-crowding, proliferation of garbage and our unhygienic habits, has become one of the greatest scourges.

It is estimated that 10 % to 25 % of India's food crops is destroyed every year by rats. Rats multiply fast. They produce every year six litters with an average of eight per litter. They breed when only three months old. Hypothetically, this means that if the progeny is of equal sexes, and all the young survive, a single pair of rats will multiply to 880 in one year! Such an explosion is prevented by snakes and birds like owls.

This apart, rats are well-known carriers of disease. That they harbour the fleas which harbour the bacterium which causes the deadly plague in humans has been known for centuries. But it is only in recent decades that rats have been found responsible for spreading many other major diseases. More than twenty such illnesses have been identified in different parts of the world. The efforts of public authorities to exterminate or reduce the rodent population through artificial means have not succeeded beyond a point.

Snakes are singularly designed and equipped to hunt for rats in their narrow subterranean burrows and hiding places in the open and in the granaries, storages etc.

Similarly, those snakes which regularly feed on insects have been responsible for destroying vast number of insects which are pests in the farms.

326. What was the 'St. Pierre snake invasion'?

When in 1902, volcanic activity in Mt. Pelee towering over St. Pierre Martinique, an island in the West Indies, made the mountainside uninhabitable for snakes, more than 100 fer-de- lance snakes slithered down and invaded the town. The 2 m. long serpents killed 50 people and innumerable animals before they were destroyed by the town's street cats. (Within a month, however, the volcano finally exploded engulfing the town with white hot lava and wiping out 30,000 of its population and leaving just two survivors).

Source: *The Book of Lists* by David Wallechinsky & Amy Wallace, 1977.

327. What do the place-names in the scientific names of some snakes signify?

Scientific names of various animals generally consist of two words in Latin or a Latinised form: first the name of the genus or the generic name, the second the name of the species or the specific name. Sometimes, there may be a third name which is of the subspecies. The specific name may be either based on the features of the animal or refer to the person who first described the animal or another person chosen by him for the honour or refer to a place or the location which yielded the type specimen, that is, the specimen based on which the taxon was originally described. Some examples in Indian snakes of place names in the scientific names of snakes:

Typhlops andamanensis (Andaman worm snakes)

(Andamans: islands off the east coast of India)

Malanophidium wyanaudense (Wynad shield tail)

(Wynad: The region in the north of Kerala State bordering Tamil Nadu)

Platyplactrurus madurensis (Madurai shield tail)

(Madurai : In the State of Tamil Nadu)

Uropeltis dindigalensis (Dindigul shield tail)

(Dindigul: In the State of Tamil Nadu)

Oligadon arnensis: (Common kukri snake)

(Arni: In the State of Tamil Nadu)

328. When was the emblem of the rattlesnake used in warfare?

When America was first colonised in the early decades of the 18th century, there was an abundance of rattlesnakes in the country. In the American war of independence (

1775-1783), the rattlesnake with the slogan 'Don't Tread on Me' was depicted on the flags flown on the warships of the American colonies as a warning to the British Government. There was also a proposal advocated by the irate colonists that if the British Government continued to export cargoes of convicts to the colonies, they should retaliate by shipping rattlesnakes to Britain. Though some Americans wanted the rattlesnake to be the emblem of America, finally opinion prevailed in favour of the bald eagle.

329. Is the mongoose immune to snake venom?

Rudyard Kipling's "Rikki-Tikki-Tavi" notwithstanding (see Q & A 392), the mongoose and the cobra are not sworn to eternal enmity. Nor is the mongoose totally immune to snake venom. The mongoose is a carnivorous animal that subsists on a variety of prey – insects, spiders and many small reptiles, mammals and birds. The snake is only one of the items on its menu and not a preponderant one. The mongoose can and does kill cobras and other snakes in its search for food and not because of any particular enmity.

The belief that the mongoose is immune to snake venom is not entirely true. Nor does the belief that it acquires the immunity by eating the root of a particular plant have any basis, even though this belief is embodied in the English, Sanskrit, Tamil and scientific names of this plant: mongoose plant, Indian snake-root, *Sarpāri* in Sanskrit, *Keeripoontu* in Tamil, *Ophiorrhiza mangos* in Latin. The fact is that the mongoose does not enjoy any absolute immunity to snake venom though it has a high level of resistance. But, then, some others animals too have different levels of resistance to snake venom such as the south African meerkat (which, of course, belongs to the same family as the mongoose), the hedgehog, the cangamba or the hognosed skunk of the South-western U.S., the pig, the genet (a cat-like African carnivore) etc.

The mongoose generally escapes being bitten by a cobra for various reasons:

a. By its extreme agility, the mongoose dodges the snake's strike.

b. The mongoose stays away from the striking distance of a reared-up cobra which is the height of the reared-up portion. The reared-up portion is about one-third of the snake's body length. This means that even a six foot cobra reared-up cannot strike beyond two feet. The mongoose, except when it pounces on the snake to attack keeps itself beyond this distance.

c. The mongoose takes advantage of the cobra's habit of striking only in a line straight with the forward part of the body and not to the sides.

d. The reared-up cobra only strikes downwards, so the mongoose is safe to attack it from above.

e. The mongoose is safe to attack it from the rear since the cobra concentrates on the front of it.

f. The stiffly-erected long thick hair of the mongoose tricks the snake and the bite misses the skin.

g. By prolonging the combat, the mongoose tires out the cobra. When it gets exhausted, the snake becomes careless and thus vulnerable to the ever-alert and energetic mongoose.

h. At every opportunity, the mongoose inflicts a bite on the head or neck of the cobra, ultimately killing it.

However, cases are not unknown of the cobra being luckier than the mongoose. Also, the mongoose is not as lucky with a viper or a krait as with a cobra since the viper and the krait are not as vulnerable as the cobra is to the mongoose's mode of attack. The viper and the krait strike from an angle different from the cobra and their striking range cannot also be predicted as in a cobra.

330. What is '*thanatophidia*'?

This is a term that is sometimes found in books on snakes, particularly of previous centuries. Fayrer wrote The *Thanatophidia of India, (*1872). The term merely means 'venomous snakes'.

The Greek words *thanatos* means death and *ophidian* means snakes.

331. Who is known as the 'Father of Indian Ophiology?

Dr. Patrick Russell (1727-1805). 'Ophiology' is the scientific study of snakes. Partrick Russell, born on 6 Feb 1727 in Scotland, graduated as a Doctor of Medicine and worked as a Medical practitioner in Aleppo (now Halab) in Syria for 18 years. In 1781, he came to Vizagapatam (now Visakhapatnam in the State of Andhra Pradesh), then part of Madras Presidency. In 1785, the Governor of Madras appointed him as 'Botanist and Naturalist' in the East India Company. Using the Company's network to gather information, he worked extensively on plants, fishes and snakes. He also studied the effect of indigenous plant remedies claimed as specifics to snake venom.

In 1791, he returned to England. His monumental and pioneering account of Indian snakes containing many plates was published in different volumes and parts from 1796 to 1809 (the last two parts after his death). The book was titled *An Account of the Indian Serpents Collected on the coast of Coromandal*. Dr.Russell died on 2 July 1805, aged 78 years. [For details, see the author's paper 'A Brief History of Indian Ophiology' published in *Snake Studies: India, 2005*].

332. Who was known as the "Taipan Man of Australia"?

Ram Chandra (1921-1998). Born in New South Wales, Australia. His parents had migrated to Australia from South India (Pondicherry?) and settled down to farming. Edward Royce Ramsamy, as his original name was, after trying his hand at many jobs, joined up with an Indian magician and juggler in Australia, named Nazir Shah, who also used to display snakes. Soon, he started handling snakes as part of the show and, soon after, independently. Snake-handling became his passion and his profession for fifty years. The inland taipan (See Q & A 268), was a favourite of his. The confidence and dexterity with which he handled this deadliest snake of all brought him the appellation 'Taipan Man'. He is recognized as primarily responsible for the development of an antivenin for the venom of this snake and this has saved many lives including his own. For his work, he was honoured with the British Empire Medal and the Order of Australia. In later life, he became partially paralysed because of the cumulative effect of the many snakebites he had received in the course of his work.

333. What creatures are the enemies of snakes?

For all its fearsome reputation, the snake has to fear the most from others of the animal kingdom. The enemies of snakes range from tiny ants to large mammals, not to mention humans.

The army ants or driver ants or safari ants in countries like S. America and central and eastern Africa sometimes go on extensive migrations. The marching columns, whose members may be upto 50 million, painstakingly kill whatever comes in their way. No animal is too big or too formidable for them, they overpower (and devour) them all by the force of sheer numbers and tenacity. Snakes are among their victims.

Even humbler species of ants are known to make short work of snakes though such instances have been rarely reported. Wall (*Journal of the Bombay Natural History Society* Vol.XVII 1906) reports about a captive green keelback (*Macropisthodon plumbicolor*) being reduced to a skeleton by ants in the course of a night.

Young snakes fall a prey to centipedes and spiders such as the large mygalomorphs and the black widow or red-backed spider *Lacterodectus mactans* and certain species of North American scorpions.

Frogs and toads are known to eat snakes. The common Indian toad (*Bufo melanostictus*), the longest Indian toad (150 mm), though mostly an insect-feeder has been known to eat worm snakes. The large-sized (160 mm.) Indian bull frog (*Hoplobatrachus tigerinus*) with its voracious appetite and catholic tastes finds snakes quite acceptable as food. Examples from other countries are the Western toad (*Bufo boreas*) and the S. American bull frog (*Leptodactylus pentadactylus*). Chris Mattison in *The New Encyclopedia of Snakes,* 2007, refers to a record of an African bull frog (*Pyxicephalus adspersus*) consuming a new born litter of 16 rinkhals.

Snakes have to fear other snakes like the king cobra, kraits, mussurana etc. which feed on snakes. (See Q & A 147).

Some predatory fishes, particularly the tiger shark, prey on sea snakes.

Various species of lizards like the monitor lizards find snakes quite tempting.

Birds like ostriches, rheas, the short-toed eagle, serpent eagles, fish eagles and sea eagles have an uncanny knack of locating snakes and seizing them. The sparrow hawk, different species of owls, shrikes, adjutant stork, various waterbirds like cranes, egrets, herons and bitterns, peafowls, some species of kingfishers, some species of hornbills, treepies, blue-jays, the blackwinged kite and so on — the snake is fair game to all of them. Even domestic poultry. The secretary bird (*Sagittarius serpentarius)* of West and South Africa and the road runner (*Geococcyx californianus*) of southern U.S. and Central America have quite a reputation as snake-killers.

(According to an old wives' tale in the U.S., the roadrunner has a safe way to dispatch the deadly rattle snake. Whenever it finds a rattler sleeping, the roadrunner would fence it in with cactus thorns, then awaken the snake with a quick jab and move away. In a rage, the rattler would then thrash about and get impaled on the cactus spines).

And mammals? Too numerous and diverse to make out a satisfactory list: tiger, domestic cats, wild cats, dogs, mongoose, deer, goats, pigs, rats and mice readily come to mind.

And, most of all, man!

334. Why do some birds stuff shed snake skins into their nests?

This habit has been reported in more than 30 species of birds the world over. Examples from India are the common myna (*Acridotheres tristis*), the bank myna (*Acridotheres ginginianus*) and the Indian robin (*Saxicoloides fulicata*). Among North American birds, this has been noticed in the Cardinal (*Richmondena cardinalis*), the kiskadaee flycatcher (*Pitangus sulphuratus*), the blue grosbeak (*Guiraca caerulea*), the Indigo bunting (*Passerina cynea*), the great crested flycatcher (*Myiarchus crinitus*), the western house wren, (*Troglodytes aedon*) the Carolina wren (*Thryothorus ludovicanus*), the roadrunner (G*eococcyx californianus*) and so on.

Some of these species regularly do so and it is difficult to believe that the presence of snake skins in their nests is accidental. But, what is the purpose? It used to be believed that this was to scare away predators. But, experiments have not confirmed this.

Is it for decoration? At least one group of birds, the bower birds (18 species) of Australasia, is known to have an artistic sense. While the nest constructed by the female on a tree is an unimpressive affair, the male constructs a 'bower' on the forest floor with twigs and sticks and grass stumps which it decorates with flowers, berries, stones, coloured insects, spider webs, snail shells, broken glass, coloured paper, matchboxes and snake skins. The bower is used by the male for advertising itself before the female during courtship display. Though snake skins may also be found among these gewgaws, a similar artistic sense cannot be the concern of the other birds using snake skin especially considering that there is no evidence of such an aesthetic sense in the construction of nests by these birds. Particularly, in the case of a bird like the common myna whose nest is a most untidy mass of all sorts of rubbish!

Perhaps, there is no purpose in the use of snake skins by these birds and this is on a par with the presence of shiny bits of paper, cellophane etc. in the nests of some birds which seem to have an attraction for shiny objects though not for aesthetic reasons. Perhaps, we are not alone in our fascination for worthless objects!

Incidentally, there is the curious case of the baya weaver bird (*Ploceus philippinus*) whose pendent, retort-shaped nests made of grass and long strips of paddy blades can commonly be seen in India which, in many cases, have a small pellet of mud stuck inside. Why? We do not know, though there is no dearth of theories*.

335. Are there creatures which can be mistaken for snakes?

There are some long, slender, legless creatures that can be confused with snakes. It is easy to mistake some of the larger caecilians for snakes. They range in size upto 1.5 m. (*Caecilia thompsoni* found in Columbia). The longest found in India – *Ichthyophis bombayensis* – measures 63 cm. Caecilians are legless amphibians. Amphibians (e.g. frogs) are vertebrates which spend part of their life in water and part on land. Caecilians live under loose soil, under rocks and in leaf litter and decaying vegetation. They have an elongated body like a snake's but, unlike a snake, their skin is smooth and slimy. They have tiny eyes (in common with burrowing snakes like blind worms (See Q & A 27). The Indian caecilians number some 27 species and are known mostly from the Western Ghats.

In Central and South America, parts of North America and from the Mediterranean area to Asia Minor and Africa, i.e. the warmer parts of the world, are found certain reptiles known as amphisbaenians or worm lizards (about 165 species)

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* Including the fanciful one that the bird sticks glow worms into the mud to illuminate the interior of the nest! Lamenting the demise of this legend, the inimitable EHA (Edward Hamilton Aitken, 1851-1909 – whom Salim Ali called India's greatest naturalist – writer), says in *The Birds of Bombay*: "The scientific spirit which we of this century worship with its relentless demand for whole burnt offerings of sentiment and oblations of proof is a spirit of a dry wind withering the garden of the soul".

which have some characteristics typical of snakes. These legless reptiles, also known as worm lizards, measure from 8 to 80 cm and the longer ones can be mistaken for snakes. Their head and tail look alike. They are burrowing creatures and have tiny eyes. In some Portuguese--speaking regions, amphisbaenians are known as *cobras de dois cabecas* which means 'two-headed snakes'. They spend most of their lives below the ground.

There are also many species of legless lizards which can be mistaken for snakes. The dibamid lizards are some such, found in Mexico, Southeast Asia,

Indonesia, the Philippine islands and western New Guinea. While the females are entirely limbless, the males retain small, flap-like, hind limbs.

The pygopid snake–lizards or scaly-foots or flap-foots (about 13 species) are very long, slender and legless. They are native to Australia and New Guinea. Grzimek (*Animal Encyclopedia*, Vol.61, 1971) says that "even experienced herpetologists" can mistake some of them for snakes. There are many species belonging to different genera. Some of the Pygopid lizards are even known to mimic snakes. The western scaly foot, when confronted, "draws back the head, bending the neck into an 'S', blows out its throat slightly, and hisses…[and] hurls its head forward as an adder does …"

There are some legless lizards which are endemic to Sri Lanka which have a superficial resemblance to snakes. E.g. Dereniyagala's snake skink (*Nessia deraniyagalai*), shark–head snake skink (*Nessia hickanela*), Layard's snake skink (*Nessia layardi*)

According to news reports of May – June, 2007, a 19 cm long legless lizard was found in the Khandadhar hills in Sundergarh, Orissa, India. This species of skink, new to science, was discovered by a team of researchers led by Sushil Kumar Dutta of North Orissa University, Baripada. Preliminary study showed that it belonged to the genus *Sepsophis* of Family Scincidae, species not yet determined. This limbless scaly lizard was reported to look like a snake.

In the sea, eels which are long and slender fishes can be mistaken for sea snakes.

There is a legged lizard, named snake-skink (its vernacular names in India are also similar) – *Riopa punctata* -- an 85 mm long, slender skink, brown above which occurs widely in South India but is rarely seen because it spends its life mostly underground. The juvenile of this lizard has a bright red tail and is, therefore, noticed more often. Despite its long, slender shape and its name, it hardly resembles a snake. See also Q & A 19.

336. Do other creatures mimic snakes to scare away adversaries?

Yes. Interestingly, such behaviour is found almost across the animal kingdom – in caterpillars, birds and mammals. Mimicry is the resemblance of one animal (the mimic) to another animal (the model) in order to confuse or put off or scare away a

predator or enemy. The most important types of mimicry are Batesian, Mullerian, aggressive and intraspecific.

We are here concerned with Batesian mimicry, named after the British naturalist, Henry Bates (1825 – 1892) who did pioneering work in the Amazonian forests. This type of mimicry is of advantage to the mimic but of no advantage to the model.

Some creatures mimic snakes through appearance and / or posture and / or vocalization.

Strange as it may sound, some of the most remarkable mimics of snakes are the caterpillars of some of the butterflies and moths. Common examples are found among the caterpillars of hawk moths (Sphingidae). The larvae of the elephant hawk moth, for instance, has large eyespots on the upper parts of its body making it closely resemble a snake.

The 'snake caterpillar' found in America and elsewhere, if touched, will form a triangular 'snake-head' very much like a viper's, complete with coloured patches resembling the eyes of the snake. The illusion is made perfect when it strikes accurately, as it promptly does, the object that touched it.

There are caterpillars that try to scare away their enemies by raising themselves up to resemble small snakes. In some cases, the effect is accentuated by the rear-ends looking very like snake-heads with snake-eyes.

A most remarkable case is that of the caterpillar of the citrus swallowtail butterfly which not only has false serpentine eyes but also has, near the front end of the body, an appendage that looks like the forked tongue of a snake. This is bright red in colour and, when the caterpillar is disturbed, the appendage is extended and flickered just like the tongue of a snake.

A combination of postural and acoustic mimicry of snakes is found in certain mammals and birds. This can be observed even in the domestic cat. A cat cornered by, say, a dog will produce an explosive spit that will startle the dog and this will be followed by a hissing resembling that of a snake. The cat completes the illusion by thrashing its tail about in a serpentine imitation. This, especially when it happens in dim light, is enough to scare away the dog or other enemy.

There are instances of acoustic mimcry of snakes resorted to by birds. This is especially so in the case of the cavity-nesting ones. When a hissing sound comes

from inside a cavity, few predators or busybodies will take the risk of closely peering into the cavity to make out who is making the sound.

The burrowing owl of America (*Speotyto cunicularis*), found in the Western Plains and Florida, nests in underground tunnels either dug by it or by prairie dogs. This terrain is also frequented by rattle snakes. If the burrowing owl inside its tunnel is disturbed, it will produce a call that closely resembles the rattle snake's rattle. In *Animal Behaviour (* 4th edn. 1989), John Alcock says, " As a comparative test of this hypothesis, Matthew Rowe and his co-workers pointed out that the burrowing owl is the only member of its family that nests underground [in rattle snake habitat] and is the only owl in its family that possesses a rattling call".

The cavity-nesting African cut- throat finch, if disturbed while inside its nest, will not only hiss like a snake but will also perform a bizarre 'snake-dance' by writhing its body. In the dim light of the cavity, it will look like the real McCoy.

In a 1928 (Vol.XLV) issue of the well-known bird journal *The Auk*, there is a reference to hissing in young flickers, adult geese and brooding Caroline chickadee (*Penthestes carolinensis*). In a 1966 paper, Julian Huxley quotes Sibley, 1955, on 'snake-display' in the tits (Paridae), the wryneck (*Lynx torquilla*) and other cavity-nesting birds, involving both postural and hissing mimicry of snakes.

Among birds nesting in holes in trees that mimic the hissing of snakes, the commonly quoted examples are the different tits of family Paridae, and such reports have come from different countries. As far as Indian species of tits are concerned, Salim Ali and Dillon Ripley (*Handbook of the Birds of India and Pakistan*, vol.9, 1973) refer to hissing mimicry while brooding in the case of the great tit (*Parus major*), white-naped tit (*Parus nuchalis),* spot-winged tit (*Parus melanophis*) and fire-capped tit (*Cephalopyrus flammiceps*). (Common names altered to conform to current nomenclature).

On the white-naped tit (under the old name, white-winged black tit), Salim Ali says in a paper in the *Journal of the Bombay Natural History Society* (52: 785) that when he peeped into a nest-hole, "the bird swayed its head and neck deliberately from side to side. In the dim light of the hole, the white cheek and the streaks down the neck heightened the snake-like effect [of the hissing]".

There are also unpublished accounts of such hissing behaviour in some other Indian birds like short-eared owl (*Asio flammeus*), Eurasian eagle-owl (*Bubo bubo*) and chicks of barn owl (*Tyto alba*) and squabs of rock pigeon (*Columba livia*).

337. How can snakes be distinguished from snake-like creatures like caecilians, amphisbaenians and legless lizards?

All snakes have a backbone. They lack limbs, eye lids and external ear openings. Some lizards and most amphisbaenians also have no legs. Most snakes have a specialized row of scales, called ventrals, along the underside whereas lizards have various patterns of verntrals but not a single row. The scales of amphisbaenians are arranged in rings around the body, making them resemble earthworms to some extent. The legless lizards and the amphisbaenians, which too have no legs, have retained their pectoral and pelvic girdles. Though some families of snakes (e.g. boidae, pythonidae) have vestiges of the pelvic girdle, no snake has any vestige of the pectoral girdle. See Q & A 335.

338. Have any snakes benefited from humans?

Yes, the rat snake for one. In places where our unhygienic habits lead to a proliferation of rats, the rat snakes thrive.

339. Are there 'snake stones' other than those used as antidote for snakebite?

Regarding 'snake stones' used as antidote for snakebite, See Q & A 238.

Pliny in his *Natural History* (AD 77) refers to a belief among the Druids that "in summer, at a certain phase of the moon, numerous snakes entwine and form a stony 'egg' from a sticky slime issued from their mouths".

Another type of snake stone is ammonite which is an extinct marine cephalopod mollusc with a flat-coiled spiral shell found as fossils chiefly in Jurassic and Cretaceous deposits. There is an old belief that they are coiled snakes decapitated and turned to stone by St. Hilda, Abbess of Whitby, or alternatively, by St. Cuthbert. Simpson and Roud (*A Dictionary of English Folklore,* 2000) say that, at one time, trade in ammonites flourished at Whitby (Yorkshire) and Keynsham.

Serpents had been symbolized in the form of fossil ammonites from prehistoric times. There is an effigy of a coiled serpent in clay, resembling an ammonite in appearance, from the Vinca culture of Neolithic Europe of the sixth millennium B.C. in Balaji Mundkur's *The cult of the Serpent,* 1983.

In India, fossil ammonites, mostly black in colour (sometimes yellow), under the name *salagramam* are worshiped as a representation of Lord Vishnu. These 'sacred stones' are collected from the river Gandaki (Narayani) which originates from a place called Salagramam, 75 km. away from Katmandu in Nepal. Purānas mention 19 kinds of *salagramam*. The interesting fact is that these molluscs or their fossils were in ocean sediments and had come to occupy the top of the Himalayas when the mountain range was formed some ten million years ago due to geologic activity and plate tectonics when the Indo Australian plate moved northwards and crashed into the Eurasian plate uplifting to 'Himalayan heights' the bed of the Tethys sea that separated India from Eurasia..

340. What is so irregular about the brown tree snake?

The brown tree snake (*Boiga irregularis*) has gained a formidable reputation for the havoc it has caused in U.S. - owned island of Guam in the Marianas islands in Western Pacific ocean, north of Australia. This mildly venomous, rear-fanged, aggressive, nocturnal, arboreal predator of vertebrates is a native of the nearby New Guinea and the Solomons where its population is held in check by the environment and competition from other species. During World War II, the snake reached Guam unnoticed, possibly as eggs inside military equipment transported from New Guinea or clinging to the underside of an aircraft. (Guam is a major base for the U.S. Navy and Air Force). Since the snake had no predators on this island and had plenty of prey species, it very soon multiplied to alarming proportions making short work of Guam's flightless birds, fruit bats and lizards. It drove into extinction all of the ten endemic bird species including a rail, a kingfisher and a flycatcher. It did not spare poultry either. There have been may cases of snakebite though no fatalities. The snake has brought about numerous power interruptions by entering electric installations and causing short circuits. The public authorities and the citizens have been trying all possible methods including traps and poison and snake –detector dogs to exterminate the snake but with very little success. There is every danger of the snake making a clandestine entry into the other islands nearby including the tourist resort of Hawai and even the U.S. mainland with alarming consequences. In fact, in the recent past, several individuals have been intercepted at the Honolulu airport. There is, atleast, one documented instance of it entering continental U.S. (in Texas) through a military shipment.

The brown tree snake has figured as the subject of several conferences in the U.S. As was urged at the 'Brown Tree Snake Conference' hosted at Texas by the U.S. Fish and Wildlife Service in June 2000, "the permanence of a brown tree snake population in the continental U.S. is a frightening possibility".

While most snakes, venomous or otherwise, generally do not intrude on humans if they have a choice, there are two snakes (one mildly venomous and the other venomous) which have posed a threat of pestilential proportions to humanity. These are the mildly venomous brown tree snake described here and the venomous Okinawa habu (See Q & A 268).

341. Which snake can inject venom without opening its mouth?

The burrowing asps of genus *Atractaspis* (there are some 30 species)—also called mole vipers (they are not true vipers) or side-stabbing snakes or stiletto snakes – found in North Africa, southeastern Arabia and Israel. They possess the longest fangs relative to head length.

This snake can inject its venom without opening its mouth. This it does by arching its back so that the snout touches the ground and then it retracts its chin allowing the horizontal fang to protrude sideways from its closed mouth. It then strikes the victim sideways stabbing the victim. Because of this peculiar mode of attack, only one fang is used at a time. This is the only fanged snake which can erect or fold its two fangs independently of each other.

Writing about one of these species from Gabon, W.Africa, in *Hamadryad* vol.33 Oct.2008, Olivier S.G. Pauwels *et al*. narrate a common and widespread misbelief in Gabon concerning these snakes which is that it envenomates its victim by the sand that it scatters with its head. When biting, the fang of Atractaspis is hardly visible, and sand or soil is sometimes scattered by the sharp movement of the head sideways. Since, unlike all other snakes, this snake does not open its mouth when striking, it is understandable that the locals believe that the venom is contained in the sand or soil particles that hit the victim.

342. What kind of music is played by the snake charmers in India?

When William Congreve (1670-1729) wrote, "music hath charms to soothe a savage breast", he could not have had the Indian snake charmer and his cobra in mind, but that would have been a fitting commentary on the snake-charmer's feat. The

snake charmer squatting before a reared-up, swaying, cobra and playing on a pipe has for long been an icon of India. This was a familiar sight in our villages and towns and particularly on festival grounds and in fairs and tourist spots till the strict enforcement of the Wildlife (Protection) Act, 1972, made the snake charmer an endangered species. The cobra swaying with its hood spread is believed to dance to the music of the pipe. (Interestingly, the old scientific name for the Indian cobra was *Naja tripudians*, the Latin *tripudium* denoting different kinds of dances.) In actual fact, the cobra cannot hear the music, being deaf to (most) air-borne sounds (See Q & A 29) and its swaying is only a defensive response to the movement of the pipe. (See however, Q & A 312).

There is something distinctive about the music played by the traditional snake charmers in India who mostly belong to different nomadic tribes some of whom are also snake-catchers. The instrument used is a kind of pipe called *magudi* in the south, *pungi* in the north, *sanpurer bansi* in the east and *been* in the west and the north. The instrument has many variations. It consists basically of a round gourd or calabash with an extended neck into which the snake-charmer blows. At the other end of the gourd there may be one, two or three pipes. One pipe has six to eight holes in it and is played with the fingers to produce the tune. The other pipe(s) simultaneously produce(s) a constant drone. The drone pipe(s) has (have) only one or two holes.

In the south, snake charmers play a tune that closely resembles the *punnāga varāli* rāga of carnatic music. In the rest of India, the folk tunes played on the pipe are based on Hindustani rāgās like des, sarang, mand, khamaj, durga, kalingda, etc. but the tunes are limited to four or five notes of the middle octave.

In 1954, Nandlal Jaswantlal's Hindi film *Nagin* was released. A story of two clans of snake charmers, it had a 'snake dance' by Vyjayantimala to the accompaniment of Lata Mangeshkar's haunting melody *mann dole mera tan dole.* Though the hero was shown as playing the tune on a *pungi*, it was, in fact, played in the background on a clavioline, an early generation electronic keyboard instrument. The *pungi* effect was remarkable. Soon, this tune became a rage with snake charmers and the traditional tunes were often given short shrift.

Incidentally, the *pungi* shown in the film is different from the ones mentioned above. It has two gourds connected by a pipe with holes in it.

343. To what extent does the use of agricultural pesticides impact snake populations?

Even though studies have been made in India of the harmful effect of agricultural pesticides on populations of fish, amphibians and birds, virtually no such studies have been made on snakes. Some such studies have been made in other countries though even here they are rather perfunctory.

Richard Shine (*Australian Snakes: A Natural History*, 1991 / 1993) says: "In some agricultural (especially cotton farming) areas [in Australia], snakes have been found to contain high levels of pesticide residues. There are reports of death adders found dead in the bush, after strychnine baits were laid for mice".

On other kinds of chemical contamination, he says: "A large and thriving population of tiger snakes around a lagoon near Uralla, New South Wales, declined precipitously several years after a single chemical spill poisoned all of the frogs in the lagoon".

344. Which toad has been blamed for the decline of a snake species?

The toad: The cane toad (*Bufo marinus*). Also known as the marine toad.

The snake : The death adder (*Acanthophis* spp.) of Australia.

Snakes, as is well known, eat frogs and toads. But frogs and toads eat snakes too. Among the snake-eating frogs and toads are the common Indian toad (*Bufo melanostictus*), the Indian bullfrog (*Hoplobatrachus tigerinus*), the Western toad (*Bufo boreas*) found in western North Australia, North America, the African bull frog (*Pyxicephalus adspersus*) and the S. American bull frog (*Leptodactylus pentadactylus*). And so also the cane toad.

But, if the cane toad has been responsible for the decimation of the death adder, it is by being both predator and prey – a double whammy unparalleled in the Animal Kingdom. The cane toad is a voracious and indiscriminate forager and it actively hunts the young of snakes including that of the death adder. But the death adder also preys on the cane toad and the cane toad as prey has proved deadly to the death adder because of the toxic secretion on its skin.

The cane toad, a native of Central and South America, 10.16 cm - 15.24 cm. in length, was introduced into coastal Queensland, Australia, in 1935 in an attempt to control cane beetles. But, very soon, it conquered the continent. Its rapid multiplication, long life expectancy (10 – 15 years), prodigious appetite for all kinds

of living things, its ability to withstand very high population density, its ability to travel long distances (average of 40 km per year) and the toxicity of all of its life stages -- eggs, tadpoles, juveniles and adults -- spelt disaster to Australian fauna. Both as predator and as prey, it is deadly – as predator because of its voracious feeding habits; as prey because of the poison glands on its skin. But, no animal has suffered as a consequence as much as the death adder.

There are three species of death adder (genus: *Acanthophis*) in Australia and they are together spread over the whole of the Australian mainland. Or, so it used to be. In recent decades their population has precipitously declined. Apart from human-related interference, particularly habitat destruction, the cane toad is believed to have played a major role in this. So much so, fears have even been expressed about the future of the death adder in Australia.

But the fact is that the death adder's misfortune seems to be self-inflicted to a large extent – even though the cane toad in the story is certainly no innocent. It is not so much as the cane toad going hunting after the death adder as the death adder inviting the toad to its table, so to say, that has been responsible for the plight of the death adder. Unlike the other elapid snakes in Australia which move about in search of prey, the death adder, which too is an elapid but an elapid that is 'quite contrary' (See Q & A 94), is a sit- and- wait ambusher. It lies concealed on the ground, or among the leaf litter, holding up its slender tail which has a leaf-like appendage and wiggling it to lure birds, frogs, lizards and small mammals which mistake the tail for a succulent worm making it easy for the snake to take a quick bite. If, in the process, it is a cane toad that comes along, it is 'finis' for both since the toad has highly toxic secretions on its skin.

As a species, the snake is the loser in the bargain: The death adder takes a few years to mature and bears just about 8 to 15 young at a time; the cane toad matures in a few months and produces 30,000 eggs at a time!

345. Apart from the plight of the death adder, what is the impact of the cane toad on the snakes of Australia?

In a paper titled "Assessing the potential impact of cane toad on Australian snakes" in *Conservation Biology,* vol.17, No.6, Dec. 2003, Ben L. Phillips *et al.* identify 49 snake taxa of Australia as potentially at risk from cane toads. Among the 10 taxa of vulnerable snakes studied, it was seen that 7 could ingest a fatal dose of

toxin *in a single meal of the toad*. The exceptions were 2 colubrid taxa, both keelbacks (*Tropidonophis mairii* and *Stegonotus cucullatus*), with high resistance to the toad toxins and one elapid, a swamp snake (*Hemiaspis signata*), with low resistance but a small relative head size and, therefore, low maximum prey-size. The authors conclude: "Overall, our analysis suggests that cane toads threaten populations of approximately 30 % of terrestrial Australian snake species".

346. In fighting the danger posed by the cane toad in Australia, is there a hope for the future?

Australia has shown a remarkable awareness, though a little belatedly, to the danger posed by the cane toad to the country's fauna. Various measures have been implemented from time to time but with little success. A National Toad Task Force was constituted in Sept. 2004 to review the threat from the cane toad and to assess the costs and benefits of various options for control and to evolve a National Action Plan. The Task Force, after a detailed examination of various options, identified four appropriate options (i) introduction of a *Bufo*-specific pathogen, (ii) release of sterile males (iii) introduction of a cane-toad specific toxin and (iv) introducing a disseminating or non-disseminating genetically-modified organism. This was, perhaps, a tall order and not much progress seems to have been made.

In the meantime, Mother Nature seems to be working out her own strategy to restore the balance. In a paper published in *Proceedings of Biological Sciences*, 2006. 273 (1593), titled "An invasive species induces rapid adaptive changes in a native predator. Cane toads and black snakes in Australia", Ben Phillips and Richard Shine detail how the Australian black snake (*Pseudechis porphyriacus*) has, in fewer than 23 snake generations, developed increased resistance to the toxin of the cane toad and a decreased preference for toads as prey. Will the rest of the afflicted taxa be equally lucky?

347. Apart from Australia, what has been the fall-out in other countries to which the cane toad has spread?

The can toad is said to have spread to more than 20 countries, apart from Australia, during the last 150 years. But, unlike in the case of Australia, no details are available as to the damage caused by this toad to the indigenous fauna in these countries or the measures taken to combat the menace.

348. Were there ever government schemes of rewards for destruction of venomous snakes in India?

In the 1880^{s}, some states in India had schemes of rewards for the destruction of venomous snakes. In vol.IV (1890) of the *Journal of the Bombay Natural History Society,* G.W.Vidal gives an account of this programme. During the six years 1882 to 1887, a total of 16,39,120 venomous snakes were destroyed in Bombay Presidency alone (Average per year: 2,73,186). The all India figure for 1885 and 1886 was an average of 4,18,820 in a year. Of the venomous snakes destroyed in Bombay presidency during this period, the six year total for the saw scaled viper *(Echis carinatus*) alone came to 13,54,330 (average of six years : 2,25,721 per year) and these entirely from a single district: Ratnagiri.

Notwithstanding such drastic measures, the snake seems to have held its ground. Whitaker and Captain (*The Snakes of India – The Field Guide,* 2004) say that in the same Ratnagiri district, over 2000 saw-scaled vipers were recorded in just one week in July (year not mentioned, but, presumably, a recent year).

349. How does one kiss a king cobra on its hood?

There are instances of this having been done and being done. No one seems to be sure how this is done with impunity.

The most famous example is the practice in the Myingyan district of Burma where this feat has been performed by certain families of snake charmers for a very long time.

One peculiarity of the cobra species and the king cobra is that when it raises its hood, it will be concentrating on the front and is oblivious to what is going on at its back. One can then slowly bring one's hand behind the snake and touch its hood. But what is remarkable about the act with the king cobra referred to is, firstly, that the person who kisses it on top of the hood (or on the mouth, according to one account) stands in front of the reared-up snake and does it in full view of the snake, and, secondly, from some of the photographs of the spectacle, it would appear that the person is standing or squatting quite close to the snake. When a king cobra (or a cobra) rears up, erects about one-third of its body length and spreads its hood and strikes, its striking distance is about the length of the reared-up portion only and,

therefore, one is reasonably safe if he keeps himself outside this range. But, in the afore-mentioned feat, the person seems to be well within the striking range of the snake at the moment it is kissed on its head.

Ramona and Desmond Morris, in *Men and Snakes*, 1965, refer to a description of the feat, given by one Captain Frank Outram in *Travel*: "Some days before the demonstration, the charmers went on a snake hunt in the forests surrounding the volcano Mount Popa [in the Burmese district of Myingyan] … When a king cobra is captured the charmers give a solemn promise to the [snake] spirits that it will not be harmed… The snake is then subjected to a ten-day period of fasting in order to subdue its high spirits. [The show is held in the bazaar to the accompaniment of band music] … The leading performer, often a woman, teases and provokes the cobra so that it rears up and strikes at her repeatedly. With split-second timing and great agility, she moves out of range each time the snake lunges… As a climax to the remarkable display, the woman kisses the giant cobra on the mouth".

The New Indian Express of 8 Oct. 2006 carried a report, complete with a photograph, on a snake charmer in Thailand kissing the hood of a reared-up king cobra. He kissed the king cobras 19 times in a row in an attempt to set a world record. "One by one [nineteen king cobras] were released onto a stage set up in the Thai beach resort town [of Pattaya] as the snake charmer, Khum Chaibuddee, kissed [the top of the reared-up head of] each beast…". The previous record in the Guinness Book was 11 kisses. This record was set by an American in 1999.

Balaji Mundkur (*The Cult of the Serpent*, 1983) also refers to a similar feat, relying on an earlier account given by T.H. Gillespie in *The Way of a Serpent*, 1938. Mundkur says, presumably quoting Gillspie, "that the cobras are not insensitized by drags or harsh confinement is apparent from records of attacks and bites during some of the performances. It may be that, in general, strong sunlight or direction and angle of the sun, and other inhibitions produced by captivity may mitigate the animal's aggressiveness". Mundkur concludes: "A scientific explanation of her success, however, is impossible because of a lack of sufficiently detailed information".

There are images on the internet and of this feat displayed by some snake charmers, but one cannot be sure how authetic these are since many kinds of feats shown by snake charmers are generally suspect: the snake mught have been defanged or its lips sewn together. This casts a shadow over even genuine cases.

350. How are snakes radio-tracked?

Snakes in the wild are most difficult to study because their movements are rarely noticeable and are unpredictable. This problem has been solved to some extent by radio-tracking them. Miniaturised transmitters containing a tiny battery are attached to the snake and this transmits signals as 'beeps' every few seconds which can be picked up by a receiver. An antenna held aloft by the researcher who walks about helps. The transmitter can not only identify the location of the snake and the pattern of its movement but also convey other information such as temperature. The transmitter is in the form of a tiny capsule which is force-fed to the snake in which case it will last only till it is voided as in the case of a regular meal. Better still, it is inserted surgically by making a minor incision between the skin and the body wall.

351. "Can I keep a snake as a pet?"

A question sometimes asked by visitors to a snake park or a zoo, especially children. In other countries, particularly the U.S., snakes like the corn snakes (*Pantherophis guttata*) , king snake and milk snake (both *Lampropeltis* spp.), ball pythons (*Python regius*) etc. are favourite pets.

In these countries, some find themselves so committed to their pet snakes that in a paper titled "Understanding the Human – Reptile Relationship", Douglas R. Mader and Bonnie S. Mader–Weidner and included in *Reptile Medicine and Surgery* Ed.Douglas Mader, 1996 / 2006 point out: "People have been known to decline lucrative job offers because they were not allowed to bring their pet reptiles with them (import / export restrictions in overseas locations). Relationships have ended because one of the pair objected to the other having reptiles in the house (or feeding live prey, etc.)".

Then again, in these countries, snake-keeping as a hobby has become so popular that 'designer snakes' are produced by selective breeding as in the case of pigeons, dogs, cats, etc. It is said that more than three dozen varieties of corn snake (*Pantherophis guttata*) have been produced with different colours and patterns by selective breeding taking advantage of their multiple colour forms in the wild.

Snakes commend themselves as pets to many keepers. Paulette Cooper and Pinar Temelli speak for them.

"You don't have to walk a snake three times a day

You don't have to clean a litter box each day

If you forget to feed your snake one day, it probably won't matter*.

They shed all in one piece**, so they don't cause allergy problems.

They're generally inexpensive.

They don't bark or meow, or generally make any noise at all.

They're happy in small confined areas.

You don't have to buy them a lot of expensive toys.

They don't get rabies.

You can go away for a while and your snake doesn't care.

They don't scratch your furniture or ruin your carpet.

They don't die on you frequently like fish".

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* In fact, they can be off feed for much longer intervals.

** Not entirely correct.

Witty, no doubt! But, the care of snakes in captivity is no joke. Their safe keeping itself can cause problems, great escape artistes that they are. Their response to feed, at times unpredictable and ununderstandable, can cause concern to the keeper. Their veterinary care, if they do fall ill, may prove quite intractable particularly because they are 'dumber' than cats or dogs and rarely give easily noticeable signs of illness till it is too late; they may also be slow to respond to treatment.

In India, snake-keeping has never been popular as a hobby – it hardly exists.

Keeping snakes as pets raises two issues, mainly. Firstly, is it legally permissible? Secondly, is it safe?

As far as legal issues are concerned, the position in India is that all species of snakes are protected under the Wildlife (Protection) Act, 1972. Acquisition and possession of snakes require the permission of the Wildlife Authorities under one section or the other of the Act.

The other question is, is it safe? There is no doubt that, for obvious reasons, it is not advisable to keep as pets venomous snakes (e.g.cobras, vipers and kraits) or even mildly venomous snakes (e.g.vine snake, cat snakes, etc.). Similarly, it is unsafe to keep pythons(except the 'dwarf' species such as Children's python or ball python, both exotic species) as pets even though they are non-venomous. It is necessary to remember here that in keeping snakes as pets what is involved is not one's own safety

alone, but, more so, the safety of the visitors some of whom may even try to handle the snake. Even if it is a non- venomous snake, a bite, especially if the person bitten is a child, is bound to raise a hullabaloo and the owner will have much to answer for. He may even get involved in a criminal case or in civil litigation

All things considered, the sane advice will be not to keep snakes as pets. If you are fortunate enough to have an interest in snakes, you should visit a snake park or a zoo with a good collection of snakes, as often as possible, and study them. It can be a fascinating experience. You should also read up all the literature on snakes that you can lay your hands on. There is so much to learn; I should know because this book which started with some 40 questions, intended primarily for children, has grown to encyclopaediac proportions with 400 questions and would have kept growing but for a self-imposed deadline for publication.

352. "Should I be a zoologist to study snakes?"

Not, repeat not, necessary. One of the curious facts about the study of Natural History, whether it be of mammals or birds or reptiles or butterflies or any other, is that the greatest contributions have been made not by professional zoologists or those with academic qualifications in zoology but by lay persons. Numerous examples can be given from across the globe and across the life sciences. But, talking of the study of Indian snakes in particular, there are several persons remembered for their contributions to our knowledge of Indian snakes who were not zoologists. To give a few examples:

Dr. Patrick Russell, the 'Father of Indian Ophiology' himself, Francis Buchanan Hamilton, Joseph Fayrer, T.C. Jerdon, Joseph Ewart, Frank Wall, Malcolm Smith, K.G. Gharpurey – all belonged to the medical profession; Thomas Hardwicke and Richard Beddome were in the army; James Emerson Tennant was a politician; William Thomas Blanford was a geologist. Romulus Whitaker, the best-known contemporary authority on Indian snakes too never studied any zoology.

Therefore, dear reader, even if you have not studied zoology in your college, you have no reason to feel diffident. Enter the world of snakes with confidence. What matters is aptitude, commitment and hard work. No doubt, a little knowledge of zoology may come in handy – but that you will pick up as you go along.

CHAPTER - IX

TRIVIA

353. Does the blind snake crawl inside human ears?

Richard Shine (*Australian Snakes, A Natural History*, 1991/1993) refers to the "annoying habit of one tiny Indian species [of blind snakes or worm snakes – *Typhlops* spp.] that apparently likes to crawl inside the ears of people sleeping on the ground". That 'apparently' saves him, perhaps!

There is a belief in some parts of India about a creature that crawls into ears of sleeping humans. For this reason it is called *Cheviyān* or *Chevippoorān* (ear-centipede) in Tamil, *Chevippāmbu* (ear-snake) in Malayalam and *Karnakeetah* (ear-worm) in Sanskrit. The Tamil and Malayalam lexicons describe it as a centipede-like creature with numerous legs. It is also called *thottāratti* or *thottālotti* or *rākkāni* in Malayalam. Its identity is not clear.

In *Snakes of Sri Lanka*, 2009, Anslem de Silva says that in Sri Lanka many believe that the brahminy worm snake (*Ramphotyphlops braminus*) – blind snake – creeps into the ears of sleeping people and one meaning of its Sinhala name *Kanaullā* (kana = ear) refers to this. There is no evidence of the blind snake doing so.

There is a similar superstition in the West about an insect of the Order Dermaptera whose common name, for this reason, is 'earwig'. Its Latin name *Forficula auricularia* also reflects this belief. The same is the case with its German name *Ohrwurm* and its French name *Perceoreille*.

Having written thus far, I happened to look up *The Encyclopaedia of Insects and Invertebrates* by Maurice Burton & Robert Burton 1968 / 2002, and was somewhat surprised to find the following observation, surprised because Maurice Burton is a well-known zoologist and nature–author. "Entomologists seem to discredit the notion of earwigs entering ears, but there are authentic accounts of its having happened in medical journals and in the case-books of medical practitioners. Moreover, there is a consistent note in the descriptions of the discomfort experienced by the patients who complain of a 'noise of thunder' in the ear. It must be agreed with the sceptics that the earwig has no special passion for ears, but it does have an instinct to insinuate itself into cracks and crevices, under loose barks or in folds of curtains – so why not on rare occasions in the ear of an unwary camper or, more often perhaps in the past, in the ears of our ancestors who lived closer to nature?".

Shall we, then, in respect of the 'ear snake' too (or whatever the creepy-crawly is) keep an open mind (and closed ears)?

354. Do snakes suck milk from cows?

This is a superstition, but, interestingly, it occurs in different countries. In Asian countries, it is the Indian rat snake (*Ptyas mucosa*). In the Mediterranean, it is the European rat snake (*Zamenis situla*). In Ṇ America, it is the *Lampropeltis triangulam* which is appropriately (or, rather, inappropriately) called the 'milk snake'.

The superstition is fortified by the frequent presence of these snakes in or near cowsheds which, in fact, is only because they move about there in search of rats. Snakes have no powers of suction and with their numerous, sharp, backward curved teeth, they will surely not be obliged by any cow. Nor do snakes have any particular fondness for milk though a very thirsty snake may, perhaps, find it a substitute for water if milk is offered to it (See Q & A 150).

A grotesque modification of the story is found in parts of S. America. According to Curran and Kauffeld (*Snakes and their Ways*, 1937), the belief in these parts is that the snake secures its supply of milk not from cattle but from nursing mothers. "According to this legend, the snake interrupts the feeding of the baby while the mother sleeps, inserting the tail into the child's mouth in order to soothe it". The authors do not mention the species, but Grzimek (*Animal Encyclopedia*, Vol.6, 1971) says about the bush master (See Q & A 268) that, according to a legend in Brazil, the snake "suckles from cows and sleeping women".

Similar is the British superstition about birds of the nightjar family (Caprimulgidae) which are, for this reason, also called 'goatsuckers'. These birds are found in India too, but there is no such belief in India.

355. What is the highest price demanded for a snake?

Time of Jan.16, 2006 reported $ 150,000 as the asking price for a six year old two-headed albino rat snake, owned by the World Aquarium in St. Louis, Missourie, and offered for sale in Reptile Auctions.com

356. Is there a snake whose venom is said to kill a person by the time he walks a certain number of steps?

There is a belief in parts of South India and in Sri Lanka about the existence of a highly venomous snake whose bite will kill the victim by the time he moves eight steps ahead. This has been variously identified as a cobra or the common krait (*Bungarus caeruleus*) or the striped coral snake (*Calliophis nigrescens*), a rare 1m. long venomous snake of the Western Ghats. The snake is, for this reason, called *ettati moorkhan* in Malayalam and *ettati viriyan* or *ettati veeran* in Tamil — *ettati* means 'eight steps' and the second half of the name denotes the snake species.

There are similar beliefs about such snakes elsewhere. The African subspecies of the Arabian burrowing asp (*Atractaspis microlepidota*) is known in the Somali language as 'seven steps'.

The pit viper *Deinagkistrodon acutus* or the Chinese copperhead, found in Northern Vietnam, China and Taiwan, is called the 'five-pacer' by the Chinese for the same reason. Its other name, the 'hundred pace pit viper' is somewhat more comforting.

There is a similar belief, but time-based, in Mexico about the coral snakes which are known as "20-minute snakes". A similar time-based name for the Arabian burrowing asp (See Q & A 341) is 'father of ten minutes'.

In all these cases, the venom of the snake can kill, but not that fast.

357. Why is the snake's look considered 'hypnotic'?

There is nothing hypnotic about it. Because it has no eye-lids, the poor thing cannot blink and so it appears to be staring intensely at you. Some find this intimidating or, atleast, off-putting, especially when the snake is a cobra or a king cobra with its hood raised.

The superstition that snakes can 'hypnotise' birds has, perhaps, some basis in the 'broken wing trick' performed by certain ground-nesting birds like the little ringed plover (*Charadrius dubius*), Kentish plover (*Charadrius alexandrinus*) *etc*. This is also known as the 'injury-feigning display' or 'distraction display'. When the bird notices a snake (or any other intruder) too near its nest on the ground, it pretends to be injured and walks slowly away from the nest dragging its wing. The snake, hoping to get an easy meal, follows the bird, the bird always keeping itself out of the snake's striking distance. When the snake is thus lured to move far away from the nest, the bird flies away. The bird's apparent helplessness when it sees the snake, perhaps, makes one attribute it to the snake's mesmerising powers.

Another explanation is that the bird or any other prey is terror-struck by the snake's immediate presence and finds itself unable to move. Also, 'freezing' is a natural reaction to danger in many species as this might deflect the predator's attention. Stationery objects are less visible than moving objects. Or, may be, the snake, if a venomous one, has already bitten the prey paralyzing it and the incapacitated animal is mistaken by the onlooker for being hypnotised.

We often say how fascinating snakes are without realizing that one of the meanings of the word 'fascinate' itself is "deprive (prey) of the ability to resist or escape by the power of a gaze" (*Oxford English Dictionary*).

358. Can the Law be an Ass even where snakes are concerned?

Yes, according to some entries in *A Fieldguide to Reptiles and the Law (1995)* by John P. Lerral (as quoted in *The Cold Blooded News* – The Newsletter of the Colarado Herpetological Society. Vol.27 No.11 Jan.2000).

In Georgia, by state law, you cannot keep any native species of snake as a pet, but a venomous one is legal.

In Kansas, you can hunt upto five reptiles if you have a hunting licence. You can use firearms but not fully automatic weapons. Oh yes, you can also use deadfalls, cross bows and poisonous gas in hunting them.

It is illegal to posses any snake in Hawai. But a zoo can have two of each non-venomous snake — on one condition, both must be males.

In Alaska, the garter snake is classified as a game animal. No other animal has been listed as 'game animal'.

While on the subject, mention may also be made of an entry in the book *Curious Facts* by John May: "In 1972, a man was restrained from entering a movie theater in Belem, Brazil because he had a boa constrictor around his waist. Authorities said the snake was under-aged". In this case, however, the Law was not the ass, the usher was.

359. Does the cobra carry a precious stone inside its head?

Of course not. This is a superstition prevalent in many parts of India. The precious stone, usually thought to be emerald, is supposed to shed a greenish light that helps the snake to hunt at night especially when its vision is impaired by age.

In the West, the toad is similarly believed to carry in its head a precious stone, called the toadstone. The belief is more than 700 years old. In *As you like it,* Shakespeare says: "Sweet are the uses of adversity which, like the toad, ugly and venomous, wears yet a precious jewel in his head".

Another example of a fabled stone believed to be found in an animal relates to the hyena. The ancient Egyptians held the animal in veneration (a most unlikely candidate for the honour if there was one) because of the belief that a kind of stone called 'hyaenia' was found in its eye. Pliny (cA.D.23-79) in his *Natural History* (which should more appropriately be called 'Unnatural History' atleast in parts) asserts that when the stone is placed under the tongue, it imparts the gift of prophecy (*Brewer's Dictionary of Phrase & Fable*, 1870 / 2005).

360. Is 'pythoness' the feminine for 'python'?

Duke—duchess; emperor – empress; poet – poetess; actor – actress, priest – priestess. All yes, yes, yes, yes. But, python – pythoness? No! Pythoness means a 'woman soothsayer'. The original pythoness was a priestess of the temple at Delphi, the spot where Apollo killed the giant python (See Q & A 250).

There is a word, uncommonly found, to describe such an expression which appears to mean one thing but actually means quite another: "phantonym", coined on the analogy of synonym and antonym. (phantom+*anoma* or name). Anchors on Indian television shows often compliment someone's efforts as 'appreciable', when what is meant is 'to be appreciated'; 'appreciable' means 'large or important enough to be noticed', usually referring to quantities. When the newsreport refers to a crowd as 'noisome', the reporter may just mean 'noisy' and may have no intention of blaming the crowd for being offensively smelly or obnoxious which is what the word really means. But, pitiable are matrimonial advertisements in Indian newspapers which want the bride to be 'homely', little realizing that 'homely' does not mean 'home-loving', but simple and unsophisticated as in British usage or, worse still, 'unattractive' as in American usage. All tripped up by phantonyms!

361. What is the origin of the saying, "as deaf as an adder"?

This goes back to the belief that when a snake-charmer tried to catch an adder by incantations, it would escape the predicament by stopping one ear by twisting its tail into it and pressing the other ear to the ground, thus shutting out all sound. (The

snake, of course, cannot insert its tail into its ear since it has no ear-holes.) Psalm 58: 4-5 in the Bible says, "Like the deaf adder that stoppeth her ear, which will not hearken to the voice of charmers charming never so wisely".

Simpson and Roud say in *A Dictionary of English Folklore*, 2000: "On the principle that like cures like, adder's oil was prized as a remedy for deafness and earache; one snake-catcher used to sell it regularly to a chemist in Oakfield (Sussex) at a guinea an ounce in the late 19th century". For another possible explanation of the saying, see Q & A 268.

362. Which Indian snake occurring in different colour phases misled Charles Darwin?

Gunther's vine snake (*Ahaetulla dispar*) found in the southern Western Ghats (Tamil Nadu and Kerala), occurs in two very distinct colour phases: either bright green or brownish green. Dr.Albert Gunther who first described it in 1864 mistook this to be a case of sexual dimorphism i.e the male and the female being different forms (See Q & A 55). Charles Darwin (1809–1882) in his *The Descent of Man* (1871), the sequel to *The Origin of Species* (1859), while marshalling facts in support of his hypothesis that sexual selection exercises a major influence in the evolution of species, relied in part on this erroneous observation. Darwin says: "In the *Tragops dispar* [of India] the male is bright green and the female bronze –coloured". (Gunther had placed it in the genus *Tragops*)

363. Are worm snakes known to emerge from water taps?

Wall (*Snakes of Ceylon*, 1921) says about worm snakes (See Q & A 268): "This is almost certainly the species which some years ago invaded the water supply of Calcutta, many specimens finding their way into the pipes of distribution". It is not known whether there have been such occurrences elsewhere. (The tiny red worm-like creatures occasionally emerging from the municipal water taps are called 'bloodworms'. They are the larvae of some species of mosquito-like Chironomids or non-biting midges.)

364. What is the bis cobra?

EHA (Edward Hamilton Aitken, 1851-1909) describes it thus in his *The Tribes On my Frontier*: "…….. of all the things in this earth that bite or sting, the palm belongs to the bis cobra, a creature whose very name seems to indicate that it is

twice (*sic*) as bad as the cobra ….. The awful deadliness of the bite admits of no question, being supported by countless authentic instances… By inquiry among natives, I have learned a few remarkable facts about it, as, for instance, that it has eight legs and is a hybrid between a cobra and that gigantic lizard commonly miscalled an iguana… If it simply spits at a man, his fate is sealed…"

There was a lively discussion on this terrible animal at successive meetings of the Bombay Natural History Society in 1888 as chronicled in the Society's journal and also in submissions to the journal. The conclusion seems to have been that "there aint no such a person". And so it remains.

The word itself has been explained variously: 'bis' in Hindi denoting twenty implying that the animal is twenty times as deadly as the cobra, 'bis' being a corruption of 'bish' in Hindi meaning poison, the name meaning 'venomous cobra', 'bis' being derived from the Portugese 'bicho' meaning 'enemy' (i.e. enemy of cobra, the word 'cobra' also being of Portugese origin) and referring to the mongoose.

It is now generally accepted that the bis cobra, which seems to have gone out of favour these days, is nothing more than a fanciful version of the common Indian monitor (*Varanus bengalensis*), a 1 ½ m. long olive-grey or brownish lizard, with a snake-like flickering forked tongue, found all over India. It is not venomous as is the case with all lizards the world over with two exceptions from America (See Q & A 278).

Interestingly, a similar belief prevails in South Africa. The fictitious deadly animal is called the 'Das-Adder'. This has been described as having a hyrax-like head and the body of a viper. This is believed to be a fanciful description of the white-throated leguaan or mountain monitor (*Varanus albigularis*). John Visser (*Poisonous Snakes of Southern Africa*, 1966), however, feels that the high-altitude craig lizards are "stronger candidates for the name".

365. In Greek mythology, who were the 'terrible women' who had snakes for hair?

The three Gorgon sisters (from Greek *gorgos* meaning 'terrible'). (The similar-sounding English word ' gorgeous' which means exactly the opposite is from Old French *gorgias* meaning fine, stylish, elegant). The Gorgon sisters were Medusa, their chief, and Stheno and Euryale. Their heads were covered by writhing snakes instead of hair; they had boar-like tusks, hands of bronze and wings of gold. Their glance would turn their victims to stone. Medusa was beheaded by Perseus, son of

Zeus, the supreme god in Greek mythology. He had the divine help of Athena and Hermes in this task.

We are told that as Perseus was flying over Libya (he was wearing the winged sandals of Hermes), drops of blood from the severed head of Medusa which he was carrying fell on the desert sands and these turned into deadly snakes which are there to this day.

366. What is the basis for the belief that the snake is immortal?

The snake's 'mysterious' ability to shed its old skin and acquire a new one giving it a brand new appearance (see Q & A 41) gave rise to the misbelief that when the snake gets old, it renews itself and becomes young again and this process gets repeated indefinitely.

There are legends in different cultures on how the snake acquired the gift of 'immortality'.

367. What does the mythical snake Ouroboros have to do with the structure of the benzene molecule?

The ancient Greeks believed in a mythical serpent, named ouroboros, which could devour itself tail first and regenerate from inside. This, depicted as a circular symbol, was used by the alchemists and in agnosticism and hermeticism to represent the eternal cycle of destruction and re-construction in the world, of death and re-birth in perpetuity.

The motif of the ouroboros, though not named as such, occurs in many ancient cultures including that of Egypt and the Near East, India and China. Balaji Mundkur says in *The Cult of the Serpent: An Interdisciplinary Survey of its Manifestations and Origins*, 1983, that the motif could be found in India "in the Jaina religion and in some Hindu tantric cults" and that "the motif expresses the fundamental philosophical concept of the two contrasting attributes of time – ascending (*utsarpini*) and descending (*avasarpini*) – epochs of rising hope in the world order and increasingly imminent annihilation following each other in ceaseless cyclicity, time itself being envisioned as a serpent commencing to swallow its tail".

Though benzene was first isolated in 1825 by Michael Faraday, its structure could not be determined for 40 years. It was in 1865 that the German chemist, Friedrich August Kekulé, suggested that the structure contained a six-membered ring

of carbon atoms joined by alternating single and double bonds. This was a major discovery in organic chemistry. Later, Kekulé claimed that the ring-structure of the benzene molecule had occurred to him in a day-dream when he saw a snake seizing its own tail. This was the classic depiction of ouroboros.

There is a similar story of how Coleridge came to compose his famous poem 'Kubla Khan' (1826) beginning with the lines:

In Xanadu did Kubla Khan
A stately pleasure dome decree,
Where Alph, the sacred river, ran
Through caverns measureless to man
Down to a sunless sea.

Coleridge claimed that he was reading an account of Kubla Khan written by Purchas when he fell asleep and, in his dream, he composed some 200 or 300 lines of a poem on Kubla Khan. (His dream was reportedly induced by opium which he was known to consume). When he woke up, the lines were fresh in his memory and he began writing them down, but a visitor disturbed him and he could not, thereafter, continue with the poem: the rest of the lines had slipped out of his memory. The poem thus remains part-finished with 54 lines.

368. Do the *nāgās* of North East India get their name from snakes or snake worship?

Nāga in Sanskrit means snake. The tribal people of north-eastern India called *Nāgās*, who inhabit the present State of Nagaland and adjoining areas, are not known for snake worship.

It is not, however, as if snakes have no place in their culture. In his *The Cult of the Serpent*, 1983, Balaji Mundkur says, relying on J.P. Mills's *The Regma Nagas*, 1937, and J.H. Hutton's *The Sema Nagas*, 1968 and *The Angami Nagas*, 1969: "The … serpent also figure [s] very frequently in the myths of the Nāga tribes of northeastern India. The Sema Nāgās are said to venerate serpents… It is not clear whether Angami and Rengma nāgās venerate or deify [serpents] but field studies mention innumerable superstitions about the serpent's ferocity, roles in taboos, medicinal values, and involvement in love charms and human fertility".

The origin of the word *nāga* as applied to these people has, however, not been convincingly explained. The usage is of comparatively recent origin. There are different theories such as that it is derived from *noga* meaning 'folk' in certain hill

dialects, that it is a corruption of the word *nonga* meaning 'naked', that it is derived from the Sanskrit *nagah* (short 'a') meaning 'mountain' and so on – but snakes or snake worship does not figure anywhere in this

Quoting John Butler's paper *'Rough Notes on the Angami Nagas and their Language'* in the Journal of the Asiatic Society of Bengal, Part I No.IV, 1875, Prakash Singh says in his book *Nagaland*, 1972, that, until very recent times, " the hill tribes living in the areas now known as Nagaland had no generic name applicable to the whole race and "they merely used specific names for a particular group of villages" even though, admittedly, they all belonged to the same racial stock. Examples of such discrete names are Tengimas, Konyaks, Changs, Phoms and so on. Prakash Singh adds that "the appellation *Naga* was actually given to these hill tribes by the plains people". This perhaps, unintentionally, provided them with an inclusive identity and a rallying point which had its own political consequences in the 20th century leading to the creation of the separate State of Nagaland.

369. Do the *nāyars* (*nāirs*) of Kerala get their name from snakes or snake worship?

The *nāyars* (*nāirs*) constitute a wide-ranging community of Kerala. They are Hindu non-brahmins and have occupied a prominent position in the history and culture of Kerala. Historical evidence suggests that they were a force to contend with even before the 2nd century B.C. about which time the *namboothiri* brahmins are believed to have moved into Kerala.

There are some 18 sects or denominations among them. They are known by various specific names such as nayar, pilla, thamby, menon, nambiar, unnithan, valiyathan, kartha, kaimal, kurup, mannadiar, nayanar, panicker and so on.

The closeness of the word *nāyar* to *nāga* or snake in Sanskrit has given rise to much speculation. One theory about their origin is that they were serpent-worshippers and hence called *nāgar* which got corrupted to *nāyar*. Some believe that they were part of a widespread tribe of serpent worshippers who lived in North India in the distant past. (Nothing to do with the *nāgās* of northeast India) (See Q & A 368). In a paper entitled "Are Malayalis Tamilians?", 1931 (Kerala Society Papers II, 7), T. Lakshmana Pillai says: "The names Naganmar and Nagathar applied to [Nayars] in ancient Malayalam literature and folk songs evidently point to the fact that they were once Naga (serpent) worshipers. Nay, such worship is even now in vogue in some country parts in Kerala…".

But there are other theories as well. One such is that they are the descendents of a warrier-caste known as *naeri.* Another is that the name originated from *nāyakan* meaning 'he who leads' in Sanskrit and the credibility of this is strengthened by the occurrence of similar-sounding names in Kerala and the neighbouring regions such as *naick, naicker, nayanmar, nayanar, naidu etc.*

For more on the subject, see *Nāyar Samudāyathinte Ithihāsam* ('The Sāga of the Nair Community'), 2005 by Pattom G. Ramachandran Nayar. The book is in Malayalam.

370. What do these snake-words-expressions-sayings mean?

Adder's tongue: A fern of the genus *Ophioglossum.* Both the English and the Latin names are from the single pointed oval frond and unbranched spore-bearing stem. A different plant, of the lily family *Erythromium* spp., also has this name in N. America.

Glass snakes: Legless lizards of family Anguidae. Though snake-like in appearance, they can be readily distinguished from snakes by the presence of eyelids. They can 'drop' their tails like geckos when trying to escape predators.

About glass snakes found in America, there is a false belief that, when attacked, it will shatter like glass and get joined together again, when the danger has passed.

"Have you got a snake in your pocket"?

"An Australian catch-phrase addressed to one who is slow to 'shout' his friends to a round of drinks … the implication being that the snake will bite him if he puts his hand in his pocket to get at the money". (Eric Partridge: *A Dictionary of Slang and Unconventional English*, 8th edition, 1984*).

"Hold a serpent by the tail": Partridge (*Ibid.*) refers to this as a colloquialism for "to act foolishly". (For the literal meaning see Q & A 139).

***** This book is a good source for usages involving 'snake'. Interestingly, many of these have an Australian origin. May be because Australia has a large and unique population of snakes (See Q & A 273) and snakes are very much on the people's consciousness from the time of the ancient aborigines. That Partridge himself was of Australasian origin might also have helped.

Jerdon's Snake-eye. *Opisops jerdoni.* A lizard of the family Lacertidae found in peninsular India as elsewhere. The lizards of this family are legged and have notched tongues. Daniel (*The Book of Indian Reptiles & Amphibians*, 2003) says: "They are extremely fleet of foot and move so rapidly that at close quarters it is difficult for the eye to follow their movements".

Snake : A skein of silk (Partridge, *Ibid.*).

: A lively party. A Royal Air Force expression (Partridge, *Ibid.*).

: A very long rag-worm used as bait by fishermen (Partridge, *Ibid.*)
(rag- worm = a marine worm, *Nereis* spp.(OED))

: A senior NCO in Australian army (Partridge, *Ibid.*).

: A switchman in Canadian Railways (Partridge, *Ibid.*).

Snake (as verb) : to steal something.

Snake (as verb) : Royal Air Force slang for wriggling about in the sky by constant junking to evade enemy action (Partridge, *Ibid.*)

Snake off: to go quietly (Anglo-Irish expression).

Snake, the: Firemen's hose (a term used by the London Fire Brigade)

Snake charmer: British army slang for 'bugler'.

Snake eel: Any of the species of marine fish in the family Ophichthidae.

Snake fly: Any of the insects of the neuropteran order. Its long 'neck' gives it an unusual appearance for an insect since insects have no necks. This is, in fact, its prothorax.

Snake gourd: A vegetable of family cucurbitaceae, native to south-eastern Asia and Australia, but now grown world-wide.

Snake gully: A country race course.

Snake headed: Also snaky. Spitefully angry or vindictive (Australian slang) (Partridge, *Ibid.*).

Snake tart: Pigeon pie, a kind of baked dish. Contains no snakes, but pigeons.

Snake yarn: A tall story (Australian slang) (Partridge, *Ibid.*).

Snake's honeymoon: A tangled mass of rope etc. (Royal Navy expression).

Snake hips: A man with a middle-aged spread (used ironically).

Snake-necked turtle: Many species of turtle found in S. America, Australia and New Guinea. Some have very long necks.

Lower than a snake's belly: Despicable (Partridge, *Ibid*.)

Plumber's snake: A long flexible wire for clearing obstructions in pipes.

Serpentine verse: A verse that begins and ends with the same word. E.g. "Grows greater the love of money, as money itself grows". The origin is from the fanciful depiction of a snake with its tail in its mouth, thus having no beginning and no end. See Q & A 367).

Snake bird: The bird *Anhinga melanogaster.* Also called darter, seen in India and elsewhere. Called snake bird because of its very long and slender neck. The description given by Whistler (*Popular Handbook of Indian Birds*, 1928) is apt: "It swims very low in the water with, as a rule, only its head and neck uncovered; and as it moves along, the head turns from side to side and the long neck twists and bends with snake-like movements that at once suggest the name of snake-bird, so often applied to the species".

Snake board: A type of skate board with higher maneuverability than a standard skateboard.

Snake dance: A religious ceremony of the Hopi Indians of north eastern Arizona, U.S. involving large numbers of rattle snakes. (See Q & A 372).

Snake eyes: A throw of two at dice, the two dots suggesting the eyes of a snake. Considered unlucky.

Snake in the grass: A hidden or hypocritical enemy; a disguised danger. The phrase was first used by Virgil (1st century BC): *Latet anguis in herba* (A snake is lurking in the grass).

Snake head: Four species of fresh water fishes found in India and elsewhere belonging to Genus *Channa*. The Family name Ophiocephalidae also means snake head. The head has some resemblance to a snake's. A good fish to eat. Also called murrel.

Snake's head: *Fritillaria meleagris.* A plant of the lily family with red and purple flowers.

"Snake in the tunnel": An expression (now outdated) to describe an agreement that one nation's exchange rates will fluctuate within a narrower band than other nations' rates. William Safire (*Safire*'s *New Political Dictionary*, 1968) says: "This is as good a metaphor as the invisible hand of the 'dismal science' of economics has ever crafted… The word-picture combines the evil lurking in 'snake in the grass' with the hope implicit in 'light at the end of the tunnel'.

Snake juice: Australian slang for whiskey.

Snakes and ladders: A children's board game.

Snake mackerel: Another term for escolar. A large, elongated, predatory, marine fish. Family Genpylidae. Several species.

Snake oil: A substance with no medicinal value, sold as a cure-all. This has its origin in the practice of rattle snake oil once being sold in America by traveling salesmen and quacks.

Snake pit: An insane asylum. In olden times, in parts of Europe and China, condemned prisoners used to be executed by throwing them into pits teeming with venomous snakes.

Snake plant: Sansevieria, a plant commonly grown for its foliage. Many species. Its long, sword-shaped leaves have given it the name 'mother-in-law's tongue'.

Snake poison: American slang for strong liquor.

Snake river: A river of north-west U.S., rising in Yellowstone National Park in Wyoming. It flows through Idaho in the State of Washington where it joins the Columbia River which enters the Pacific ocean near Astoria, Oregon

Snake root: Various species of plants believed (no scientific basis) to be antidote for snake venom. See also Q & A 237.

Snake skink: A kind of lizard found in India and elsewhere. *Riopa punctata* (See Q & A 335)

Snake stone: Various substances used as antidote for snake venom. No scientific basis. Also, ammonites (See Q & A 238 and 339).

Stung by a serpent: Colloquialism for 'got with child' (Eric Partridge, *Ibid.*).

To carry a snake in one's bosom: A warning against encouraging someone without knowing his potential for danger to oneself. Based on Aesop's fable *The Farmer and the Snake* (c.570 BC).

To give (someone) a snake: To vex, annoy (Partridge, *Ibid.*).

371. In which Italian festival held every year is a religious leader honoured with huge offerings of live snakes?

Dominic de Guzman (1170-1221), a Spaniard, founded the Dominican Order. He traveled throughout central Italy preaching to the heretical Albigenses who had deviated from the Roman Catholic faith. The Albigenses were depicted as snakes to whose venom he was supposedly immune.

In the procession held in the month of May every year in the village of Cocullo, Italy, his effigy is draped with live snakes and paraded through the streets. The devotees offer huge numbers of snakes which are placed all over the statue. The species used is the four-lined snake, *Elaphe quatuorlineata*, a non-venomous species commonly found in this region.

372. What is the 'snake dance' performed by the Hopis?

The Hopi Amerindians of northern Arizona, U.S., perform this religious ceremony every alternate year and this dates back to antiquity, centuries before America was colonized. During this ceremony, the participants dance holding between their teeth live rattlesnakes, with fangs intact, and more than a hundred of them. The weird dance is a prayer to the gods, principally the 'Plumed Serpent', (See Q & A 384), to send rain to save the crops. The snakes, released unharmed after the ceremony, are believed to carry the prayers to the gods who dwell in the underworld. (See the author's *Snakes in the Bible*, 2006).

There is a fairly extensive discussion on the subject in Balaji Mundkur's *The Cult of the Serpent: An Interdisciplinary Survey of Its Manifestations and Origins*, 1983. But, much ambiguity still remains.

373. According to Hindu mythology, who was the mother of all snakes and who were the *ashta nāgās*?

Kadru and Vinatha were the daughters of Daksha, son of Brahma. They married Sage Kashyapa who asked both to choose a boon. Kadru wanted a thousand children; Vinatha wanted only two but they had to be more magnificent than the thousand children of Kadru. Thus Kadru had a thousand snakes as children. Vinatha had Aruna who became the charioteer of the Sun god and Garuda who became the king of birds.

Of the one thousand serpents born to Kadru, the most famous were eight: Vāsuki, Thakshaka, Kārkotaka, Samkha, Gulika, Padma, Mahāpadma and Ananda. They are known as the *ashta nāgās* or the 'Eight Serpents'.

374. Which snake, after killing a man, will not rest content till it sees his body burnt?

In South India, the common bronzeback tree snake (*Dendrelaphis tristis*), found throughout most of peninsular India and northeastern India, is thought to be highly venomous and so vengeful that when it kills a man, it will climb a tree and will

keep a vigil to make sure that the body is burnt and it will climb down only when it sees the smoke rising from the funeral pyre.

Anslem de Silva in his *Snakes of Sri Lanka*, 2009 attributes this belief in Sri Lanka to the common trinket snake (*Coelognathus helena helena*). This is probably an error since *komberi mookan* or *komberi moorkan*, the Tamil name in South India for the common bronzeback, has also been attributed by de Silva to the trinket snake. In *Snakes and other Reptiles of Sri Lanka*, 2005, jointly authored by Indraneil Das and de Silva himself, *komberi moorkan* has been given as the Tamil name in Sri Lanka for the common bronzeback.

In any case, both the snakes are non-venomous and incapable of such unseemly conduct.

375. Does a female snake swallow her young to protect them from predators?

This is a myth which, probably, owes its origin to the fact that when a live-bearing snake like a viper with the young ones inside is killed, and its body bursts open, one may see the small snakes inside. Since most people wrongly believe that all snakes lay eggs, they immediately attribute the appearance of the young snakes inside the dead snake to the snake having swallowed its young.

The ancient Druids (the pre-christian celtic people of the British Isles and Gaul) had a diametrically opposite belief. Curran and Kauffeld (*Snakes and their Ways*, 1937) record that the ancient Druids thought that the young vipers, on their birth, ate their mother. Because of this belief, any person guilty of patricide or matricide was drowned in a sack with a viper for company, being considered as two of a kind.

376. What is nāg panchami?

The nāg panchami is a festival of snakes celebrated every year in parts of India like Maharashtra, Uttar Pradesh, Bengal and Bihar. The festival usually falls in August. The rites and customs take somewhat different forms in different parts of the country but snake worship is a common feature. On these occasions, generally, snakes are caught in large numbers by snake charmers and displayed before devotees who 'feed' them or attempt to do so with milk and such other stuff which the snake doesn't really care for. The snakes are generally released after the worship, but there are heavy mortalities because of the force-feeding, starvation and rough handling and also

because of surreptitious slaughter for skins. After the Wildlife (Protection) Act, 1972, came into force, this practice has become illegal.

377. What are 'serpent groves'?

'Serpent groves' are a kind of sacred groves. Sacred groves are patches of land, small or big (sometimes, even twenty hectares or more), densely populated with many species of trees, lianas, creepers and herbs, native to the land, located in or near villages in different parts of India, particularly the hills of northeastern India, the Aravalli hills, parts of Central India and the Western Ghats. (They are found in other countries like Africa also). They represent the original forest growth of the area, preserved as such even as the surrounding forests were cleared for human habitation and cultivation. As pointed out by Madhav Gadgil and V.D. Vartak ('The Sacred Groves of India – A Plea for Continued Conservation' in the *Journal of the Bombay Natural History Society*, 72 (2), 1975), they correspond to the climax formation for the particular region which testifies to the immunity they enjoyed from human interference from very ancient times. These groves provide food and shelter to a large variety of animals, birds, reptiles and insects. They are veritable treasure troves of biodiversity and have been maintained as such by common consent long before the term biodiversity came into popular use and long before conservation of the environment, gene pools etc. became topics much discussed in seminars and workshops.

These groves are held by the local population not only as sacrosanct but also as sacred being associated with various primitive forms of worship.

While sacred groves in India generally are the abodes of folk deities, particularly the various manifestations of Mother Goddess, in Kerala many such groves are specially dedicated to snakes and are called *Sarpakkāvus* or *Pāmbin kāvus* or *Nāgathan kāvus* all of which mean 'serpent groves'. They are generally smaller in size than other sacred groves. In olden times, in Kerala, many of these serpent groves formed an integral part of the Hindu household. Located within the grove would be a large number of idols of snakes, in different configurations, usually in laterite. Snake idols would continue to get added from time to time by devotees for whom this is a form of worship in fulfillment of vows to become free of diseases (particularly skin diseases), to beget children, to get rid of misfortune believed to be caused by the curse of snakes (*sarpakopam* or *sarpadosham*) *etc.* Oil lamps are lighted in these groves

daily at dusk. On special days, atleast once a year, special 'poojas' are performed. (See Q & A 378).

Legend has it that when Parasurama, one of the incarnations of Lord Vishnu, reclaimed the land, which became Kerala, from the sea, it came to be occupied by hordes of serpents from the subterranean world where they had their domain. Parasurama who had reclaimed the land for settling the people he had brought with him from North India (the *namboothiri* brahmins), had to conclude a treaty with the serpents under which they agreed to confine themselves to portions of land exclusively reserved for their habitation and it was thus that the serpent groves came into existence.

With the increasing pressure on land for human occupation, fragmentation and decline of the traditional family units (the Namboothiri *illams* and Nair *tarawāds*) and a general slackening of religious beliefs, many of the serpent groves in private lands have, over a period of time, sadly, disappeared.

378. What is the *sarpam thullal* (snake dance) performed in Kerala?

The *sarpam thullal* or *pāmbu thullal* or *nāgathan thullal* or snake dance is a special form of snake worship performed in some households in Kerala. In the courtyard of the house, a *pandal* (a covered, temporary structure) is erected, about eight feet square. It is decorated with festoons of mango leaves, tender leaves of coconut and garlands of flowers. The ground is plastered with cowdung. Huge, stylized pictures of serpents in various configurations and of the *ńaga yakshi* (snake goddess) are drawn on the ground in bright colours using rice flour, turmeric powder, charcoal powder, and *kumkumam* (a red powder made by mixing turmeric powder and lime) and a green powder made from dry leaves of certain plants,. The painting is known as *Sarpakkalam*. On it are placed offerings of paddy, rice, *aval* (flattened rice), coconuts, jaggery, water, *vālkkannādi* (a type of mirror with handle, made of burnished metal), flowers, fruits and lighted oil lamps.

After various invocations, two young women of the family sit on the *sarpakkalam* in a posture of worship and intense meditation holding in their hands inflorescences of the araca palm (*Areca catechu*).

A community known as *pulluvars* is traditionally associated with the serpent worship on these occasions and also on other occasions when snakes are worshipped. Three or more of them – men and women – sit on the ground and sing a special genre

of songs (*pulluvan pāttu*) invoking various holy snakes mentioning them by name. The singing is accompanied by three types of traditional instruments, unique to this performance. These are the *pulluvar veena*, a single-stringed instrument played with a bow, the *pulluvar kutam* (a string-cum-percussion instrument) and the *thālam* (a pair of large cymbals).

As the songs of the pulluvans rise in crescendo, the women begin to sway and seem to go into a frenzy. They are in a trance and are believed to be 'possessed' by the snake goddess and seem to have no control over their movements as they violently swirl their heads round and round, their hair flying loose and wild in circles around them. As these frenetic gyrations rise in tempo, they speak in the language of oracles – the *nāgayakshi* is believed to speak through them. This performance goes on rising in its intensity until the women fall down in a faint. Sometimes, the performance is repeated after they are revived.

The songs of the pulluvars commemorate stories from the *Mahābhārata* or are in praise of the *Nāgayakshi*. In the songs occur phrases of r*āgā*s of carnatic music like *saurāshtra, srirāga, madhyamāvati, todi, sāveri, kalyāni, yadukulakhāmboji, chenchurutti* and *ghāntāram* of *Kathakali* music.

The music of the pulluvans has a significant place in the folk music of Kerala. L.S. Rajagopalan in a paper entitled 'The Pulluvans and their Music' in the *Journal of the Music Academy, Madras*, Vol.LI, 1980 laments: "The pernicious influence of film music has reared its ugly head in even some of the renderings of the *Pulluvars"*. S. Guptan Nair points out that this unhealthy trend has influenced Kerala's folk music in general much to the detriment of its pristine purity (*Keralavum sangeethavum* – 'Kerala and [its] Music', in Malayalam, 2004). As noted in Q & A 342, this has happened to the music of the snake charmers too.

379. What are the words for snake in the Sanskrit language and what do they mean?

In spite of man's predominant concern with snakes from the very beginning, most languages, ancient and modern, seem to have only a few words to mean 'snake' – not the different kinds of snakes but the snake as a creature. English, for instance, has only two words, snake and serpent. Sanskrit is, perhaps, unique in this respect with many words to mean the creature 'snake' some of which are as follows:-

Sarpah
Sarīsrpah } That which crawls about

Bhujagah		
Pannagah		
Bali	:	Strong
Vyālah	:	Vengeful (See Q & A 390)
Gokarnah	:	Whose eyes and ears are the same (See Q & A 29)
Chakshusravanah	:	Who hears with its eyes (See Q & A 29)
Akarnah	:	Who has no ears (See Q & A 29)
Goodapādah	:	Whose legs are hidden (See Q & A 380)
Ahi	:	Who moves about
Vayubukh *Vāthāsanah*	}	Who eats air, A wrong notion arising probably from its flickering tongue (See Q & A 31)
Vilāsah	:	Who lives in a burrow
Asīvishah	:	With venomous fang
Chakri	:	Who lies coiled up (like a wheel)

Kadrujah,
Kadruthanayah,
Kadru putrah,
Kadru Sutah,
Kadrunandanah:
} All meaning 'child of Kadru', the mother of all serpents. (See Q & A 373)

380. What is meant by the Tamil saying '*Pāmbinkāl pāmbariyum*'?

The ancient Indians thought that the snake does have limbs but they are hidden from human sight. That is why one of the names for the snake in Sanskrit is *goodapādah*-- one with hidden legs.

The saying in Tamil *Pämbinkäl pämbariyum* means that "a snake's legs only a snake can see". This proverb is often used in the metaphorical sense that only persons with similar traits can recognize these in one another.

But, the proverb is, perhaps, capable of a different interpretation also. Though the obvious meaning of *kāl* is 'leg', the word also means 'way, path'. See *The Tamil Lexicon*, University of Madras, 1982. The proverb could then mean that "a snake knows the way another snake has gone". That makes sense and conforms to a

common observation which is the basis for the superstition that if a snake is killed, its mate will soon appear to take revenge. A snake is wont to follow another by means of the scent trail left by the musk glands (See Q & A 390).

381. According to the story in the Bible, what was the cause for the 'eternal' enmity between the human race and snakes?

The Book of Genesis in the Old Testament tells us that the snake in the Garden of Eden tempted Eve to eat the fruit of the tree of the knowledge of good and evil which God had forbidden Adam and Eve from eating. For this act of disobedience, Adam and Eve were banished from the Garden of Eden. God cursed the serpent and condemned it and the humans to eternal enmity towards each other.

382. Was the snake in the Garden of Eden, Satan in disguise?

No. For an exposition of the theme, see the author's *Snakes in the Bible*, 2006.

383. What is 'snake handling' in churches?

In Mark 16:14-18 in the Bible, Jesus, after rising from his tomb, appears before his disciples and tells them of the signs that those who believe in him will show and one of these is that "they will take up serpents" (with impunity). There are a few small fundamentalist protestant church groups in the southeastern states of N America who interpret this passage literally. During the service in their churches, the congregants, in a frenzy of religious ecstasy, freely handle rattlesnakes, the timber rattler being a favourite. Sherman Minton Jr. and Madge Minton (*Venomous Reptiles*, 1969) give an account of these ceremonies: "Some of the faithful wind the snakes around their necks; others may wear a rattler or copperhead like a crown. Women permit snakes to crawl about their shoulders and breasts; sometimes they allow their babies and young children to touch the reptiles". It is said that the devotees are rarely bitten and, if bitten, they refuse treatment and either survive or succumb, trusting in Jesus. Various rational explanations have been advanced for the low incidence of fatal snakebites on these occasions but fatalities do occur.

The cult of snake handling in church began in 1909 in the state of Tennessee, USA, and the founder of the movement was one George Went Hensley. Sadly, he himself died of a rattlesnake bite in 1955 having refused any medical attention. The believers attributed it to his lack of adequate faith in what he was doing. His widow, who apparently still had faith enough in what her late husband was doing, continued

his ministry and moved to Tallahassee, Florida. Gordon Fee and Douglas Stuart (*How to Read the Bible for all its Worth, 1982*) point out that most Christians dismiss the snake-handling cult as the result of an improper interpretation of Mark 16: 14-18. 'Snake-handling' has now been banned by law in many states in America.

384. Who was the 'plumed serpent'?

A mythical creature, part snake, part bird. Also called 'the feathered serpent'.

Quetzalcoatl meaning 'plumed serpent' was a very important diety of the Toltecs and the Aztecs, the ancient Mexicans. He was the sun god, creator and master of life, the inventor of agriculture and metallurgy, the patron of every art, the god of civilization. According to contemporary accounts, when Cortez with his small band of Spaniards landed in Mexico in the year 1519, he was mistaken for the god 'plumed serpent' by Montezuma, the powerful Aztec ruler and his men, and this facilitated Cortez's conquest of Mexico.

D.H. Lawrence's novel *The Plumed Serpent* (1926) is set in Mexico.

385. Which profession has snakes as its emblem?

The medical profession has as its emblem the 'caduceus'. This shows two snakes entwined round the 'rod of harmony' and was originally the emblem of Mercury, the Roman god of trading and messenger of the gods. He was Hermes in Greek mythology. This later become the symbol of Asklepios, the Greek god of medicine, also known by his Latin name Aesculapius. The insignia dates back to about 2350 B.C. and was once the symbol of peace. The emblem is presumed to have its origin in the spectacle of entwined serpents that are occasionally seen (See Q & A 130). The word 'caduceus' itself has nothing to do with snake. It has its origin in the Greek word meaning 'herald' or official messenger, the allusion being to the messenger of the gods.

Incidentally, the snake identified with Aesculapius is the European colubrid *Elaphe longissima,* commonly known as the Aesculapian snake.

386. Which snake has had a statue erected in its honour?

The mussarana *(Clelia clelia)* found from Guatemala to Brazil. See Q & A 268. The Institute Butantan in São Paulo, Brazil, is noted for its pioneering work in the production of antivenin under the leadership of Vital Brazil. In the 1920s, Vital Brazil and his team studied with profit the mussarana's immunity to the venom of the

pit vipers of the genus *Bothrops*. As a tribute to the mussarana's contribution to the development of antivenin, the grateful scientists erected a statue in its honour at the Institute.

This reminds one of the monument erected by the citizens of Enterprise, Alabama (USA), to a disastrous agricultural pest though in somewhat different circumstances. In 1915, the Mexican boll weevil decimated the cotton crop, the mainstay of Alabama's economy. But this motivated the impoverished cotton farmers to diversify their crops next year with corn, potato, sugar cane and peanuts which yielded thrice the average income from cotton. The grateful farmers erected a monument dedicated to the boll weevil, the only monument in the world dedicated to a pest, and bearing the inscription:

"In profound appreciation of the boll weevil and what it has done as the herald of prosperity, this monument was erected by the citizens of Enterprise, Coffee County, Alabama".

387. What is the cockatrice and what could have been the origin of the cockatrice legend?

The cockatrice or the basilisk is a mythical creature born of the egg of a cock (yes, not a hen) hatched by a serpent or a toad. It has a cock's head, complete with a comb, and a serpent's body. It is the king of the serpents and can kill with a mere look or by its breath. This creature is mentioned in some passages in the Bible (See the author's *Snakes in the Bible,* 2006).

In *Snakes of Southern Africa*, 1962, Vivian Fitzsimons says about the black mamba (*Dendroaspis polylepis*) : "In old specimens, the skin is often incompletely shed, particularly over the top and back of the head, and a loosely attached plume or crest of old skin may remain for some time before being completely detached; this has given rise to the belief in the existence of a so-called 'crested mamba' as distinct from the normal form. So widely established has this belief become in Zululand that the Zulus have a special name for it viz. 'Indlondlo', meaning an old snake with a crest or protuberance at the back of the head". Referring to this, Sherman A. Minton Jr. and Madge R. Minton (*Venomous Reptiles*, 1969) say: "It is possible that stories of such snakes, carried by word of mouth from deep in Africa to the Mediterranean seaports, formed part of the basis for the cockatrice and basilisk legends".

388. What is special about the 'snake temple' of Penang?

Wagler's temple pit viper (*Tropidolaemus wagleri*) is a venomous Asian pit viper. It occurrs in variable colours and is stout-bodied and about 1 m long. Very large numbers of this snake roam about freely in the Buddhist snake temple (or the 'temple of the azure cloud') at Penang and are handled with impunity by pilgrims. Though this pit viper is docile by nature, unlike some other pit vipers, their extreme docility in this temple and the, presumably, total absence of any known cases of snakebite in the temple despite the numbers involved has sometimes been attributed to the huge quantities of incense burnt which fills the prayer hall with dense fumes and its 'soothing' (?) effect on the snake.

The temple was built in 1850 in honour of a Buddhist monk who was a celebrated healer.

389. Why is it believed in some parts of India that the common krait (*Bungarus caeruleus*) does not kill by biting but by sucking out the breath of the victim?

The venom of the common krait is the most potent among that of all Indian snakes. This snake is nocturnal and freely enters huts in search of rats and lizards when those sleeping on the floor are likely to become victims. The bite of this snake is painless and the person bitten may not wake up or have any occasion to suspect a snakebite. There may not also be much of local symptoms unlike in bites by cobras and vipers.. Hence the superstition that the snake had killed him by sucking out his breath.

390. Is it true that when a snake is killed, its mate will come in search of the killer to seek revenge?

No. There is no evidence that snakes are capable of such feelings as revenge. Nor have snakes any faculty to come in search of a particular person. It is, however, true that sometimes when a snake is killed, other snake(s) of the same species may later be found to visit the site of the kill. This is because of the attraction by the pheromones in the secretions from the cloacal glands exuded by the snake when it was killed (See also Q & A 177).

391. Can a dying snake be revived by mouth-to-mouth respiration?

A report in the *Hindu Business Line* of 13 Apr.2003 quotes a news item in *The Sun* on how Claire Farina of Lydney, Gloucestershire, a vet's nurse, saved the life of a

1.52 m. non-venomous pet snake, a Californian king snake, by blowing into the snake's mouth after it stopped breathing during an operation.

In the book *I Dreamed of Africa* (1991), by Kuki Gallmann, an Italian who had settled down in Africa with her family, there is an account of how her son, Emanuele, once revived an "apparently dead" spitting cobra by "mouth-to-mouth resuscitation" by blowing into its lungs through a silver straw.

[Warning: The surgeon-general does not recommend this procedure for general adoption].

392. What was the snake that was killed by Rikki-Tikki-Tavi?

Rudyard Kipling's short story *Rikki-Tikki-Tavi* has for long been a childhood favourite in India. What was the snake (other than the two cobras) that Rikki, the pet mongoose, killed, thus saving the life of his young master? Kipling, no stranger to India, calls it a 'karait' but what he says does not suit the krait very well. He describes it as a "dusty brown snakeling that lies for choice on the dusty earth … so small". If it was a krait, it must have been the common krait (*Bungarus caeruleus*). But this snake is not "so small", its average length being about 100 cm. Nor is it "dusty brown" – it is black or bluish black or bluish grey or brownish black. Nor has it any affinity to "dusty earth" -- it is found in piles of brick and rubble, termite mounds and rat holes.

In all probability, the snake was the saw-scaled viper (*Echis carinatus*). It is only less than 50 cm in length, brown or gray or sand-coloured. It can be seen moving about or basking on sandy soil.

The snake in the story tried to challenge Rikki during the morning hours and it "struck out" at Rikki. Now, the krait is usually a timid creature during day-time and will rarely be aggressive, unlike in the night (See Q & A 122). The saw-scaled viper, on the other hand, which is active during the day, is a short-tempered snake and can strike out "with lightning-like rapidity", to quote Wall (*Snakes of Ceylon*, 1921).

393. Which famous person in history is said to have committed suicide by snakebite?

Cleopatra (69-30 BC), queen of Egypt. On being defeated in war by Octavian, emperor of Rome, and her fears for her safety and her honour compounded by the (wrongly) presumed death of her ally and lover, Mark Antony, Cleopatra is said to have taken her life by causing an asp to bite her breast. Though the word 'asp' is

taken to mean both a viper – V*ipera aspis* – and a cobra, the snake in question was in all probability the Egyptian cobra (*Naja haje*). This snake was the symbol of Egyptian royalty and was incorporated in the headdress of the Pharaoh. What manner of death, if death it had to be, could have been more befitting for the proud queen of Egypt?

394. In which well-known short story is a snake used to commit murder?

The Speckled Band, a Sherlock Holmes adventure story, by Arthur Conan Doyle (1859-1930). The snake has not been identified for certain. In the story, it is described as yellow in colour with brownish speckles, with squat, diamond-shaped head and puffed neck. The site of its bite would show nothing more than two little dark punctures "which could be seen only by a sharp-eyed person". It caused a death in the story within ten seconds. Holmes claims it to be "a swamp adder **. . .** the deadliest snake in India". The enviable knowledge of Sherlock Holmes in many matters notwithstanding, there is no snake which answers to this description. Moreover, it had been trained by its master to respond to a whistle and to drink milk from a saucer! Pure fiction!

According to a news report, a 2004 publication *The New Annotated Sherlock Holmes* edited by Leslie S Klinger, a hefty tome of 1878 pages, has three pages of tables (no less!) listing the efforts of zoologists to identify the snake using the clues in the story. No consensus seems to have evolved.

395. Why did Dr. Johnson boast to Boswell that he could repeat from memory the complete chapter 72 of the *Natural History of Iceland (1758)* by Horrebow?

The said chapter titled 'Concerning Snakes' consists of exactly one sentence: "There are no snakes to be met with throughout the whole island". (See Q & A 269).

396. Are there rattle snakes in Chennai?

Of course, not ! But, Laurence Klauber, in his much-acclaimed work, *Rattle snakes, their Habits, Life Histories and Influence on Mankind*, 1982, writing on superstitions about rattle snakes, says: "It is reported that in Madras [now, Chennai] people postpone their journeys if they see a … rattlesnake". There is no such

superstition, really. In any case, Klauber adds, tongue in cheek: "I suppose that anyone seeing a rattle snake at large anywhere in Asia, Africa or Europe, would be justified in taking even stronger measures".

There is, probably, a mix-up here between rattle snake and rat snake. I do not know whether there is such a belief about the rate snake (*Ptyas mucosus*) in India, but Anslem de Silva says in his *Snakes of Sri Lanka*, 2009, that such a belief exists in Sri Lanka about the rat snake.

397. Which bird is the Garuda of Hindu mythology, the inveterate enemy of snakes?

In Hindu mythology, Garuda is the vehicle of Lord Vishnu. According to popular belief, this is the brahminy kite (*Haliastur indus*) and, for this reason, the bird is considered as sacred and a good omen. Garuda is the son of Vinatha and the snakes are the children of Kadru, both sisters and wives of sage Kashyapa (See Q & A 263 and 373) and Garuda was the enemy of snakes and so, as is popularly believed, is the brahminy kite. But, in fact, the brahminy kite is not known as a killer of snakes unlike some other raptors (see Q & A 333) even though, being of not very fastidious feeding habits, it may occasionally feed on a dead snake and so may be seen carrying a dead snake in its talons.

It makes better sense to identify the Garuda with the while-bellied sea eagle (*Haliaetus leucogaster*), larger and, arguably, more majestic-looking than the brahminy kite, ashy brown above with white head, neck, upper back and underparts. The colour pattern has a rough resemblance to the brahminy kite's which has deep chestnut upper parts and white head, neck, upper back and breast. In India, the white-bellied sea eagle occurs along the entire east coast and along the west coast south of Mumbai. It is a keen and accomplished hunter of sea snakes apart from fish. It can often be seen on a perch overlooking the sea or sailing in the sky along the shoreline keeping a sharp lookout for a sea snake or fish appearing on the surface of the waters. Once it spots its prey, it will swoop at tremendous speed and neatly and effortlessly grab the snake or fish in its talons, never pausing in its flight.

It is natural for the Garuda to be seen in the proximity of the sea just like the white-bellied sea eagle because Lord Vishnu is also somewhere there on the ocean of milk (*Pālāzhi*) reclining on the serpent Anantha.

There is one snag in identifying the white-bellied sea eagle as Garuda. While the belief about Garuda is widespread in India and the brahminy kite is also familiar

to people throughout India, the white-bellied sea-eagle is much less known and rarely seen inland.

Lending further credence to the belief that the brahminy kite is Garuda is the painting by Raja Ravi Varma (1848-1906) of Lord Vishnu, with his consorts, seated on a huge brahminy kite, copies of which painting regularly used to appear on wall calendars until recent times when gods had to give way to film stars and models.

C.F. Oldham (*The Sun and the Serpent: A contribution to the History of Serpent Worship,* 1905) observes that the legend of Garuda being the destroyer of snakes is a figurative account of the inter-tribal warfare between the Nāgās, also called Serpās, and Garudas, both being ancient tribes that claimed descent from the sun god. But, Oldham's theories, in general, do not seen to have found much favour among subsequent authors. (See Q & A 400).

398. Which aggregations of snakes are protected as 'national monuments' and as 'nature protection zones'?

The city of Iwakumi, Japan, has an aggregation of the albino rat snake, *Elaphe climacophora.* This is protected as a 'national monument'. Albinos usually occur as odd individuals in nature; it is very unusual for a whole population to consist of albinos (See Q & A 310). In fact, there is no other such case.

In China, the Snake Island, 40 km south of Lushun on the Liaoming peninsula, has been declared as a 'nature protection zone' because of the huge population, aggregating to some 13,000 on the small island, of Pollas pit vipers.

399. What is *Rāhu* in Indian mythology and *Reahou* in Cambodian mythology?

According to Indian mythology, eclipses of the moon and the sun are caused by their being swallowed by a demon, *Rāhu,* often depicted as a serpent. He had a score to settle with the moon and the sun dating back to the episode of the churning of the ocean of milk to extract nectar (*amrt*).

In Cambodia, *Reahou* is believed to be an evil cosmic serpent and a brother of the sun and the moon who swallows his siblings, thus causing the eclipses. On such occasions, the people make a racket beating on pots and pans, shouting and striking gongs in order to warn the heavenly body of the impending disaster and scare away the monster. Access to technology seems to have helped to stage more impressive demonstrations. Sherman Minton and Madge Minton say in *Giant Reptiles*, 1973 that

"on Jan.30, 1972, soldiers guarding the Cambodian Capital, Phnom Penh, lit the sky for a full hour with a fusillade of shells and tracer bullets. They unwittingly killed two of their comrades and wounded eightyfive others, all in an effort to drive away the malevolent serpent which was swallowing the moon. Commander-in-Chief Lon Nol called the incident "a serious blot on the honour of the Khmer Republic".

400. How and where did snake worship originate?

This is "that Serbonian bog betwixt Damiata and Mount Casius old where armies whole have sunk". (That's Milton in *Paradise Lost*,II, 592-4, albeit in a different context). I intend no more than to gingerly tip-toe on the bounds of the bog.

Some animals have been worshipped from ancient times in various cultures in different parts of the world but only in isolated pockets and with only half-hearted veneration. What is most remarkable about the worship of the snake is that it is universal and transcends geographical and cultural boundaries and it also takes on a fervour not seen in the worship of other animals.

Right from pre-historic times, man has attributed divine aspects to all forces of nature which he could not understand or comprehend or which he held in fear and awe. Hedged in by seemingly malevolent forces all round, man, in primitive times, found that worship of such forces gave him a level of comfort that made existence tolerable. The perceived omnipresence of snakes, more pronounced in times when wilderness was pervasive and untamed, their ability to appear out of nowhere almost at will and disappear equally suddenly, their many inexplicable features and habits and, more than anything else, their ability to deliver death with a single strike, much in the manner of a bolt shot by a god, the primitive man could do little else than propitiate them and pray for protection.

Some scholars hold the view that snake worship had a common source somewhere in the East or the Near East from where it spread to Asia, Africa, Europe and the Americas. Other scholars hold the view that snake cults in different parts of the world developed independently, the parallels that have been noticed being explained by the tremendous power that the snake as a basic image exerts over the human psyche everywhere. Joseph Campbell (1904 - 1987), the American mythologist, points out (*The Masks of God: Oriental Mythology*, 1962), though not about snake worship in particular, that while during the 19th and early 20th centuries, scholars held the view that analogous mythologies developed independently in

different parts of the world in accordance with common psychological laws, subsequent archaeological discoveries have promoted the view that it could have been more a case of diffusion, radiation and dispersal from a common source. Where the truth lies, we do not know for sure.

In many cultures such as India and other parts of Asia, the Aztecs and Mayas of South America, the Red Indian tribes of North America, and the aborigines of Australia, the snake is the symbol of fertility. The 'snake dance' of the Hopi Amerindians of northern Arizona, U.S. (See Q & A 372) is a particularly eloquent tribute to snakes as messengers sent to propitiate the rain god. The Australian aborigines associated snakes with rain and water sources. In ancient Japan, the god of thunder was a snake. The ancient Egyptians identified the snake with the River Nile and fertility.

Other people revered the snake in other manifestations. To the African tribals, python was the god of war. The early Greeks associated the snake with Askelepios or Aesculapius, the god of medicine, who they believed was originally a snake; later, when the god assumed a human form, he had snakes in his motif. Both the ancient Greeks and the ancient Romans encouraged snakes to be present near their temples and homesteads. This was so also in parts of India, especially Kerala and Bengal.

Snake worship also existed in Egypt, Indonesia, Southeast Asia and China.

As Ramona and Desmond Morris (*Men and Snakes*, 1965) point out, "snake worship reached its peak of development in India".

In Indian mythology, snakes are manifestations of divine forces. They keep guard over the fortunes of the home and the village. The spirits of long–departed ancestors indwell in them. They keep company with the most powerful of the gods of the Hindu pantheon. Lord Vishnu reclines on the coils of a gigantic snake, Anantha. Lord Siva has snakes for his adornments. Lord Ganesha has a snake for a girdle.

The serpent cult developed in India over a period of some three millennia. From the confines of religion, the cult permeated into folklore, literature and art and held such sway over people's imagination as little else has done. Serpent-lore found a significant place in the Brahminical and Buddhist literature of India from the Vedic times. Though there is no reference to serpent worship in Rig Veda, there are many references in Yajur Veda and Atharva Veda and in Vedic literature in general. The chief repositories of serpent lore are the *Mahabharata*, the *Jataka* tales in Buddhism and Kalhana's *Rajatarangini*.

Ancient literature in India refers to serpents as *Nāgās*. Who or what were *Nāgās*? Scholars have subscribed to different theories. One of the earliest expositions on this is found in James Ferguson's *Tree and Serpent Worship,* 1868. Even though the Sanskrit word *Nāgā* denotes serpent, he believed that the Nāgās were not originally serpents but serpent-worshippers, an aboriginal race of Turanian stock inhabiting northern India who were conquered by the Aryans. He was of the view that neither the Aryans nor the Dravidians worshipped the serpent and that references to serpent worship in the Vedas or similar early writings of Aryans must have been subsequent interpolations – a not-unusual feature attributed to many ancient texts.

C.F. Oldham (*The Sun and the Serpent: A Contribution to the History of Serpent Worship,* 1905) believed, just as Ferguson did, that the N*ā*g*ā*s were not serpents but serpent-worshippers but he differed from Ferguson on who these people were. His view was that Nāgās were people who claimed descent from the sun and had the hooded serpent for their totem. They were deified humans or demi-gods. They had Takshasila, now Taxila in the present Pakistan, as their capital and the serpent Takshaka as one of their chiefs. According to Oldham, the Asuras, and the Sarpas of the Rig Veda, the Asuras and Nagas of Manu and the Asuras or Demons of Brahminical literature, all represent hostile tribes who opposed the Aryan invasion of India.

Hendrik Kern (1833-1917), the Dutch orientalist, had a totally different take on the subject. He was of the view that Nāgās were essentially water spirits and personified forces of Nature. This was much in line with beliefs elsewhere in the world associating snakes with water sources.

Kern also believed that there was a possibility that serpents were worshipped by the aboriginal tribes of Southern India.

But Oldham, earlier, had held the view that the veneration of the serpent in India was not handed down by the aboriginal tribes but that "it was intimately connected with the worship of the sun, and is thus closely related to the orthodox Hindu religion".

J.Ph. Vogel in his *Indian Serpent-lore or the Nagas in Hindu Legend and Art,* 1926, discredited Oldham's thesis. Vogel incidentally believed that there was basis for the assumption that, in ancient India, deceased rulers were, sometimes, worshipped in the form of snakes.

In between, other theories had sprung up such as that of the German scholar and Indologist, Hermann Oldenberg (1854-1920), that N*ā*g*ā*s were demoniacal beings who were really snakes but could assume human form at will.

Even a cursory examination of the forms of snake worship in different cultures will show that various legends and beliefs had, over time, come to be woven together into a complex matrix. Adoration of the snake as a creature because of its many inscrutable features, so unlike all other animals, terror inspired by its very appearance because of its terrible potential to deliver death in a trice, belief that, with its perceived power over life and death, it could, in mysterious ways, exercise a certain judgement over man's conduct and dispense justice accordingly, worship of the deities of rivers and other water-sources for their life-sustaining power and the association of the snake with these, probably because of its wavy form, the many shapes that the snake assumes even as the ever-changing contours of rain-bearing clouds that herald the sprouting of life in the parched earth, worship of ancestors whose spirits indwelt in snakes or with whose spirits snakes living in some equally unknown subterranean realm held communion, its psycho-sexual body imagery, the fact that, for complex reasons, it is the most frequently occurring creature in dreams of men in all cultures – all these coalesced into a focussed worship of the snake as a divine force invoking awe, fear and veneration all at the same time as indeed is the case with most divinities.

But, as regards the exact origin of this body of beliefs and the related practices, the evidence available, be it in India or elsewhere, is so fragmentary and so fractured that ethnologists have not been able to convincingly reconstruct its history. Such history as has been pieced together is as fragile as the skeleton of the snake itself which has made the fossil evidence of the ancestry of snakes speculative to an extent.

CHAPTER - X

QUESTIONS AWAITING ANSWERS

Man has observed snakes ever since he appeared on planet Earth five-and-a-half million years ago. Scientific studies of snakes commenced some 300 years ago, in the 18th century. Though there was some literature on snakes even prior to this period in countries like India, China, Egypt and Greece, this was not, in most respects, scientific in the accepted sense of the term.

Even though much has been learnt about snakes during these 300 years, much remains to be known even on fundamental aspects like their evolution, their biology, habits, reproductive behaviour, distribution and so on. With the development of newer techniques in zoological research in the field, in captivity and in the laboratory, with more persons getting interested in herpetology, with more extensive and intensive studies and with the availability of sophisticated equipments to aid behavioural studies, it is hoped that, as time goes by, we will gain greater and greater insight into the complexities of the baffling creature called snake.

Questions that now await answers or complete answers are listed below. This is only a sample.

- Are we sure snakes evolved from lizards and not parallely along with lizards from a common ancestor?
- Can we ever be reasonably sure that all extant species of snakes have been or will be discovered?
- In spite of the lung surface in snakes being much reduced, one lung being practically lost during evolution, how is the gas exchange made possible?
- In a snake, particularly the tree-living species, when the head is at a higher elevation than the rest of the body for long periods, how does the blood supply reach the head?
- Does temperature have any effect on the sex ratio of snakes emerging from the eggs or in the individuals born live from eggs carried inside the body of the snakes (See Q & A 209)? The prevailing opinion is 'no', but this is based on our extremely limited observation of reproductive behaviour in a few captive species / specimens.
- While in almost all snake species, the males and females are about equal in numbers, why is it that in four species, so far as is known, males are predominant: the copperhead (*Agkistrodon contortrix*), the four-striped rat snake (*Elaphe quadrivirgata*), the Australian tiger snake (*Notechis sciatetus*) and the gopher snake

(*Pituophis melanoleucus*)? (In the copperhead, there are twice as many males at birth as there are females).

- How precisely does the 'pit' in pit vipers and pythons function? (See Q & A 21).
- Apart from the role of the 'pits' in a few (very few) of the snake species in the location and capture of prey, how do snakes in general sense the ambient temperature? Snakes are highly sensitive to the ambient temperature and have very narrow tolerance limits – high and low – and have to remain within this narrow range to maintain their physiological functions at optimum levels (See Q & A 144). What is the mechanism that enables them to precisely gauge the ambient temperature and decide on moving from one environment to another to regulate their body temperature?
- What are the ways in which snakes hear sound waves in the air? (See Q & A 29).
- Are we absolutely sure that there are no males in the brahminy worm snake (*Ramphotyphlops braminus*)? (See Q & A 178). Considering the very large worldwide population of this species, does the number of these snakes dissected so far by scientists and sex determined as exclusively female constitute anything approximating an adequate sample? Incidentally, no one has so far succeeded in breeding this snake in captivity which places a further constraint on our access to information on their reproductive behaviour.
- Does parthenogenesis occur in any species other than *Ramphotyphlops braminus*? (See Q & A 178).
- How is it that even in respect of the genus *Ramphotyphlops* and family Typhlopidae, parthenogenesis is presumed to occur only in the brahminy worm snake (*Ramphotyphlops braminus*) even though there are some 60 species in the very same genus and some 200 species in the same family*?*
- How is it that the brahminy worm snake does not seem to have suffered genetic degradation in spite of inbreeding for generations over 50 million years?(See Q & A 178).
- To what extent can sea snakes breathe through their skins? (See Q & A 36).
- How do the light-sensitive spots on the tail of the olive sea snake (*Aipysurus laevis*) function and what is the purpose? Does it have any evolutionary significance? (See Q & A 81).

- Why do many venomous snakes have quantities of venom far, far in excess of what is required for hunting and digesting their prey especially considering that snakes eat sparingly?
- Can snakes predict earthquakes? (See Q & A 293).
- Does the common vine snake (*Ahaetulla nasuta*) have a particular fascination for the eye of the person (or animal?) confronting it? (See Q & A 26).
- What are the variations in acuity of vision and perception of colour in different species of snakes and what factors influence these?
- Do snakes eat carrion in the wild? (See Q & A 171).
- Do we know enough about the reproductive behaviour of snakes considering that what we do know is limited to the more common species or zoo populations?
- Why are sea snakes found only in the Pacific and Indian oceans and not in the Atlantic waters? (Water temperature and ocean currents do not provide a complete answer) (See Q & A 276).
- Are there giant serpents in the sea or in fresh water lakes? (See Q & A 277).
- Why do sea snakes sometimes congregate in enormous numbers? This has often been noticed in the black and yellow sea snake (*Pelamis platurus*). Hundreds, if not thousands of them, come together to form huge 'slicks'. In 1932, an unbelievably huge mass of the large-headed sea snake (*Astrotia stokesii*), 3 m. wide and 100 km. long was observed near Indonesia by P.Love (quoted by Grzimek, *Animal Encyclopedia, Vol.6 Reptiles*, 1971) Surprisingly, this is otherwise a rare snake.
- What is the structure and function of the large pit in the posterior part of each nasal scale in the egg-eater snakes – both the African and the Indian species? (See Q & A 249).

  The three species of egg-eaters in Africa, belonging to the genus *Dasypeltis*, and *Elachistodon westermanni* of India have pits on their nasal shields. It is believed that their function is the same as that in the pythons and pit vipers, namely, as thermo-receptors for locating warm-blooded prey in the dark. Though the egg-eaters also are primarily nocturnal, it is not clear how thermo-receptors will be of help to them for locating eggs unlike in the case of pythons and pit vipers, which hunt warm-blooded prey. No doubt, this will help them locate a bird's nest with a brooding bird inside. But, in that case, the eggs will be under incubation and not fresh. Authors like Fitzsimons (*Snakes of Southern Africa*, 1962) and Scott Weidensaul (*Snakes of the*

World, 1991) are of the view that this snake does not care for other than fresh eggs. They seem to receive support from Groffmann and Starck who, in a paper entitled "Postprandial responses in the African rhomboid egg-eater (*Dasypeltis scabra*)" published in *Zoology*, vol.109, issue 4 (2006) say that egg eaters feed on 'liquid' food and that their gastric function is not geared "to break down solid meals in the stomach". However, a contrary view is expressed by Walter Rose (*Snakes – Mainly South African*, 1955): "It has been asserted by several writers that the egg-eater will ignore partly incubated or addled eggs, but our observations do not bear this out …. Partly incubated eggs they will take readily…". He cites Carl Gans in support. It is not known which view is correct. If the African egg-eater is not averse to partly incubated eggs, then only thermo-receptors will be of help to them, not otherwise.

While the role of the thermo receptor in the African egg-eaters is thus uncertain, not even a guess can be made in respect of the Indian egg-eater. This is because even in respect of the pit vipers and pythons, definite evidence of the function of the pits became available only in 1952 and subsequently. But, the Indian egg-eater was believed to have become extinct by then since it had not been seen from the early 1900s. It is only since 2003 that a few individuals have again been found. Therefore, no research has been done on this snake either in the field or in captivity and practically nothing is known of its feeding habits.

- Are there any musical notes or other sounds that have a soothing (or other) effect on snakes? (See Q & A 312).
- Are snakes intelligent? What is the extent of their learning ability? (See Q & A 111).
- To what extent is the intense fear of snakes that many of us have inborn or acquired or a mix of the two? (See Q & A 314).
- What is the function of the microscopic bristles on the skin of the file snake (*Acrochordus granulatus*)?

The wart snake or file snake is found in fresh waters, estuaries and sea water environments in India, Southeast Asia and northern part of Australia (See Q & A 47). They have many unique features one of which is the presence of microscopic bristles on their typical loose and shaggy skins. Such bristles are something quite strange for a snake. Some lizards (families Agamidae, Gekkonidae and Iguanidae) too have this feature and, about this, Kenneth R. Porter (*Herpetology*, 1972) says: "While physiological evidence is lacking as to the function of these hair-like organs (which is

specialized skin made of keratinized epithelium), Miller and Kasahara (1967) have postulated tentatively that "such areas night be sensitive to some type of radiant energy". "Some type of radiant energy"?. This is becoming 'curiouser and curiouser'!

- What is the function of the tubercles and pits (not the heat-sensitive pits in pythons and pit vipers - See Q & A 22) that are found on the scales of some snakes?

  There are certain scales on the skin of snakes where the cuticle is thinner. 'Tubercles' and 'pits' occur on these scales. Each tubercle is tiny, 1-2 mm. in diameter, and there is a rounded elevation surrounded by a circular depression. Pits are similar, seen in even fewer snakes, and are larger than tubercles being about 3 mm. in diameter. Both have a concentration of nerve endings immediately below. Pits are found in different parts of the scales and, when they occur on the tips of the scales, they are known as apical pits.

  The common trinket snake (*Coelognathus helena*), widely occurring in India and elsewhere, has its scales in front of the eye dotted with minute pits.

  In a paper titled "Sense-organ-like parietal pits, sporadically occurring, found in Psammophiinae" in Proceedings of the 13th Congress of the Societas Europaea Herpetologica (2006), Cornelius C. de Haan reports the presence of minute parietal pits, one to four in number, in several Psammophina snakes of both sexes, but only in some individuals. Similar observations have been made also about the lined olympic snake (*Dromophis lineatus*), *Malpolon monspessulanus,* and *Rhamphiophis rubropunctatus*.

  Are the tubercles and pits organs of touch? Or, atleast in the few species where only the males have pits, are these used in courtship and mating? Or, do the pits secrete an oily substance that 'waterproofs' the snake? Or, do they exude chemical substances that play a role in communication and marking of territory? Or, are the pits light-sensitive, and, if so, for what purpose? Or, are these pits temperature-sensitive and do they help the snake to choose its environment? Why is it that, in some species, this feature occurs only in some individuals?

- Among boas and pythons, only a few have thermo-receptor pits. Out of 43 species of boas in 13 genera, facial pits are found only in 19 species belonging to 3 genera. Similarly, out of 35 species of pythons in 7 genera, pits are found only in 19 species belonging to 7 genera. What are the reasons underlying this differentiation?

- Why are some snakes like the banded krait (*Bungarus fasciatus*) found in parts of India and in neighbouring countries triangular in cross-section? Why is the tentacled snake (*Erpeton tentaculum*) found in Thailand and Indochina almost rectangular in cross-section?(See Q & A 63).
- Does the brahminy worm snake or any other creature have a weakness for entering human ears? (See Q & A 353).
- What is the correlation between venom toxicity and venom quantity and the prey species of different snakes?
- What is the function of the unique 'tentacles', appendages on the snout of the fishing snake, *Erpeton tentaculatum* found in Thailand and Indo China? This was once supposed to be used as a lure for catching fish in the manner of the angler fishes of order *Lophiformes*. Hence its common name. But this theory is no longer in favour.
- What is the function of the 'horns' (which are modified scales) on the heads of some species of snakes like the desert horned viper (*Cerastes cerastes*) and horned adder (*Bitis caudalis*) found in Africa, eyelash boa (*Trachyboa boulengeri*) and the eyelash viper (*Bothreichis schlegetii)* both found in Central America, American side winder (*Crotalus cerastes*), *Pseudocerastes* spp. from the Middle East etc.?

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It is humbling to be reminded of what Thorstein Veblen said: "The outcome of any serious research can only be to make two questions grow where one question grew before". He might not have had the study of life forms in mind, but that's where it fits more than anywhere else.

Stephen Jay Gould observes in the epilogue to his book, *Ever Since Darwin* (1978): "Nature is so wonderfully complex and varied …… A person who wants clean, definitive, global answers to the problems of life must search elsewhere, not in nature … We can resolve small questions definitely; we do reasonably well with middle-sized questions; really big questions succumb to the richness of nature…".

Let the search for answers go on as it surely will. But, in the meantime, let us also rejoice with Gould "in the multifariousness of nature and leave the chimera of certainty to politicians and preachers".

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116. Do snakes yawn and, if so, why?

Yawning is noticed fairly often in other vertebrates but very rarely in snakes. Snakes do yawn. But, why? Well, we still do not know for sure why **we** yawn. Many explanations have been offered: fatigue, boredom, nervousness, stress, greater need for oxygen intake, to cool the brain, to regulate body temperature, contagious behaviour (seeing others – even animals – yawn either live or on the screen or on the printed page), thinking or reading about yawning, sending-out non-verbal messages, effect of neuro-transmitters in the brain and so on. The list seems to be endless. Is it any wonder then that we know nothing about why snakes yawn?

Amendment:

353. Can snakes predict earthquakes?

Reports have appeared in the press occasionally of the queer behaviour of many species of mammals, birds and snakes well ahead of earthquakes even as the humans had no idea of the impending doom. Similar reports had come also after the tsunami of Dec.2004. The earliest such account seems to be of the earthquake in 373 BC which wrecked the port city of Helice. According to the Roman scholar, Pliny the Elder (23-79 AD), one of the signs of a coming earthquake is "the excitation and terror of animals with no apparent reason".

There are accounts of such phenomena down to the present times. Most of the observations, understandably, relate to cats and dogs, farm animals and commonly seen birds. The historian Diodorus Siculus records animals leaving the city of Helice in droves days ahead of the earthquake of 373 BC much to the puzzlement of the human inhabitants. And, in this exodus, he includes snakes also.

On 4 February 1975, there was a major earthquake in the Liaoning province of China causing widespread damage and loss of lives. This had been preceded for some two months by the unusual behaviour of many species of animals and birds. It had

been reported in this context that “snakes came out of hibernation, crawled from their burrows and froze to death on the snow-covered surface”.

Various theories have been advanced to explain this phenomenon but none that will stand scrutiny. There has been no consistent research on this except some attempts by the Chinese State Seismological Bureau from the 1970s and some studies by Rupert Sheldrake and Daniel Jay Brown in California from the 1980s which have not led to any significant findings so far (For more on this subject, see *Dogs That Know When Their Owners Are Coming Home and Other Unexplained Powers of Animals* by Rupert Sheldrake, 1999, particularly the chapter captioned ‘Forebodings of earthquakes and other disasters’).

While attempting to answer a similar question about cats, Desmond Morris gives possible explanations in his *Catwatching*, 1986 : (i) sensitivity to very minute vibrations of the earth that precede an earthquake which are not apparent to us or capable of being registered on our instruments, (ii) responsiveness to the sudden increase in static electricity that apparently precedes earthquakes (iii) responsiveness to sudden shifts in the earth’s magnetic field that accompany earthquakes (iv) detection of all three phenomena at the same time.

A report from Reuters appeared in the Press in December 2006 on the observations made by the earthquake bureau in Nanning, capital of the Guangki autonomous region in Southern China, about the curious behaviour of snakes before an earthquake. “Of all the creatures on earth, snakes are perhaps the most sensitive to earthquakes”, bureau director Jiang Weisong was quoted as saying. Jiang said snakes could sense an earthquake 120 km away, three to five days before it happens. “Their erratic behaviour would be an indication of the quake to come”.

There is need for more study on this subject.

Amendment:

Question No. 293 **Can snakes predict earthquakes?**

Please insert the following as para 5 [that is, after the para ending with the words 'earthquakes and other disasters']

While attempting to answer a similar question about cats, Desmond Morris gives possible explanations in his *Catwatching*, 1986 : (i) sensitivity to very minute vibrations of the earth that precede an earthquake which are not apparent to us or .capable of being registered on our instruments, (ii) responsiveness to the sudden increase in static electricity that apparently precedes earthquakes (iii) responsiveness to sudden shifts in the earth's magnetic field that accompany earthquakes (iv) detection of all three phenomena at the same time.

CHAPTER - II

FORM, STRUCTURE & FUNCTION

Images from *Snakebit:* -

Page No.47

Head of cobra

Head of Rat snake

Head of Pit viper

Page No.49

Scales of common krait

Scales of wolf snake

Page No.50

Skull of python

Scales of cobra

Skull of Russell's viper