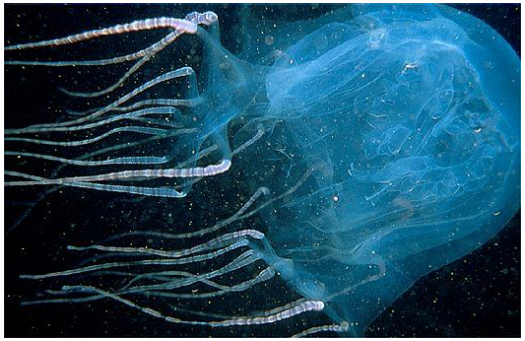
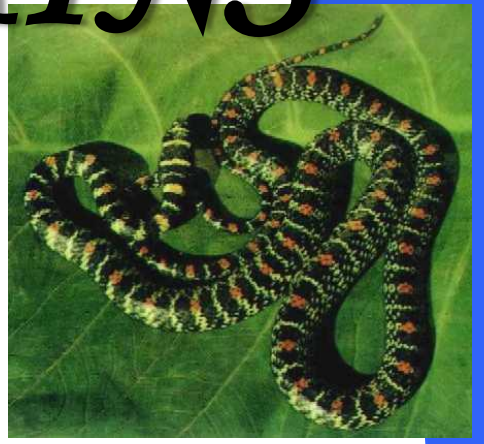





ANIMAL TOXINS





What are animal toxins?

Evolutionary strategy to

Feeding

Defense by molecular means

Mixtures of 20 to 25 different kinds of molecules dissolved in water.

.

Two important components of venom

1. Proteins / polypeptides

   Ranging from 30 to 80 amino acid residues.

2. Enzymes

   They are mostly

   - Proteinases
   - Nucleases
   - Phospholipases

Targets of animal toxins

All animal venoms are targeted against key elements of locomotion

to immobilize the predator or prey animal in order to be an evolutionary success

Site of action

1. Acetylcholine receptors
   eg. corals, cone shells, sea snakes and cobras

   Many animal toxins are targeted against the acetylcholine receptor.

2. Neuromuscular junction
   eg. dendrotoxins and some bungarotoxins

3. Potassium channel
   eg. scorpions, bees

4. Sodium channel
   eg. scorpion toxins, anemone toxins and amphibian toxins

Poisonous Animals

- Snakes
- Honeybees, wasps, hornets, ants etc.
- Spiders
- Scorpions
- Lizards
- Frogs
- Marine animals

VENOMOUS SNAKES OF SRI LANKA

- 96 species belonging to 9 families
- > 50% are endemic .
- 70% of species – **non-venomous**
- Approximately annual **37,000** instances of snake bite reported causing around 200 deaths
- 98% deaths are due to cobra, Russell's viper and kraits.

Highly venomous snakes

1. Cobra – *Naja naja naja* නයා

2. Common krait – *Bungarus caeruleus*
තෙල් කරවලා

3. Ceylon krait – *Bungarus ceylonicus*
මුදු කරවලා

4. Russell's viper – *Vipera russelli*
තිත් පොළඟා

5. Saw-scaled viper – *Echis carinatus*
වැලි පොළඟා

Moderately venomous snakes

1.Hump-nosed viper – *Hypnale hypnale*

*2.*Green pit viper – *Trimeresurus Trigonocephalus*

Mildly venomous snakes

1.Cat snakes – *Boiga* spp.

2.Whip snakes – *Ahaetulla* spp.

Classification of venomous snakes

Belong to four(4) families

1. Elapidae – Highly venomous
2. Viperidae – Highly and moderately venomous
3. Hydrophiidae – Highly venomous
4. Colubridae – Mildly or non venomous

Elapidae

Cobras

Kraits

Coral snakes

Some sea snakes

Viperidae

Viperinae (true vipers)

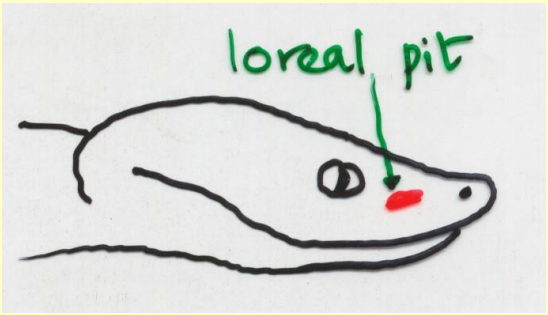
Russell’s viper

Saw-scaled viper

Crotalinae (Pit vipers)

Hump-nosed viper

Green pit viper



Snake venom

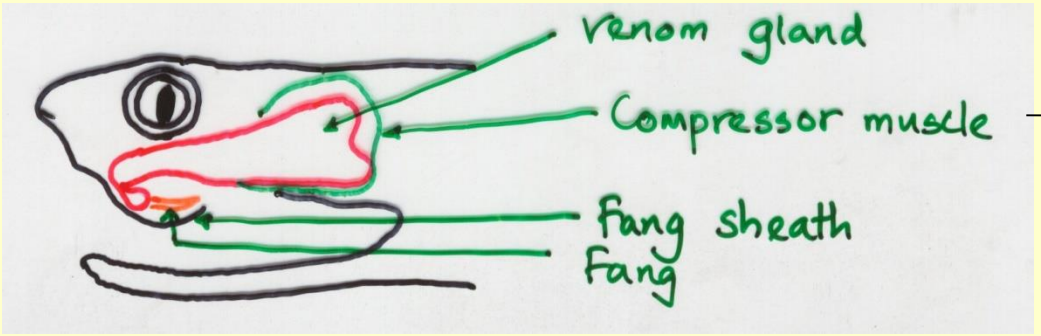
- Active components are **proteins** and **enzymes.**
- Vary according to the species of snake.
- Effects depend on
  - Type of venom
  - Amount injected

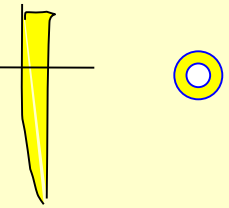
Where is venom produced and stored & how does it injected?

- The venoms of snakes are produced and stored in the main venom gland.
- It works like a modified salivary gland, located in both sides of the head.
- Fangs are responsible for injecting venom into the victim.
- When the snake bites, the venom travels through duct system to the base of the functional fang, which has a long tunnel starting at the base of the fang and ending at the tip of the fang.

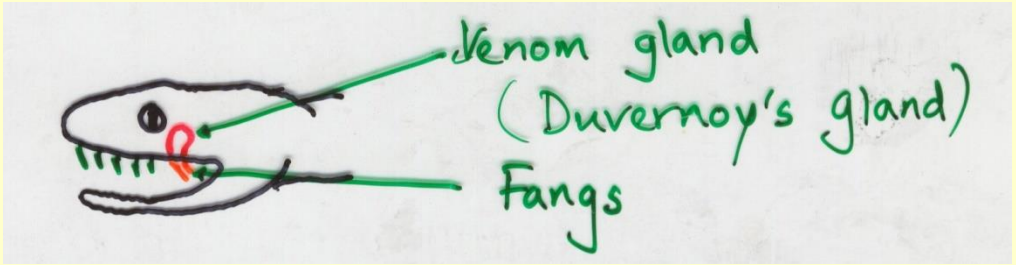
View of a snake skull

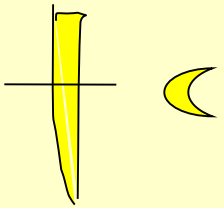
Buccal cavity of a highly venomous snake (Elapidae, Viperidae, Hydrophiidae)





Buccal cavity of a mildly venomous snake (Colubridae)





Types of snake venom

Neurotoxins

Hemotoxins

Myotoxins

Neurological effects

Elapids

Haematological effects

Vipers

Myotoxic effectes

Sea snakes

Size *of toxic molecules affects the appearance of effects*

Small in Elapids (including sea snake venom)

rapid absorption into blood stream

Large in Vipers

slower absorption into lymphatics

Clinical effects of snake bite

1. Fear and shock

2. Local effects – pain and swelling,
blistering, necrosis of skin

***** may be absent in krait bites***

Oedema of more than half of the bitten limb is considered as significant envenomation

late presentations

ecchymoses, haemorrhagic bullae

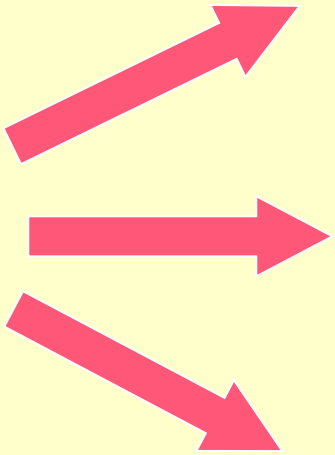
early gangrene, foul-smelling discharge

**** tetanus***

3. Systemic effects

Non-specific – vomiting, hypotension, collapse and shock

Specific



- neurological
- haematological
- muscular

Specific effects

Elapid venom is mainly neurotoxic

Eg : krait venom has

1. Beta bungarotoxin – pre-synaptic blocker
2. Alpha bungarotoxin – post synaptic blocker

Earliest symptoms → **ptosis** → death from respiratory failure

Viper venom mainly causes **disorders of haemostasis.**

Bleeding (from gums etc.) → renal failure

****Russell's viper venom is also neurotoxic**

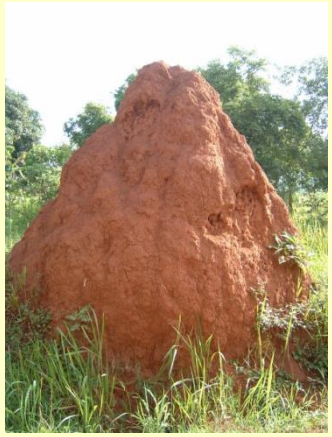
Sea snake venom is mainly **myotoxic**

destruction of myoglobin → Myalgia →

myoglobinuria → renal failure

Prevention of snake bite

- Wear protective clothing – boots/sarong/long trousers
- Take a heavy stick/heavy tread
- Be cautious in exploring termite holes etc. Stepping over logs, stones etc.



- Cover outlets of drains, destroy anthills near house
- Keep buildings free of rats, mice & frogs
- Be careful in handling/killing snakes.

TOXINS

OF

OTHER ANIMALS

Arthropods

(Honeybees, wasps, hornets, ants etc.)

- Contains neurotoxins – **APAMIN (honeybees) & PHILANTHOTOXIN (wasps)**
- Causes anaphylactic reactions → Death
- Effects are based on age and physique.
- Even one sting can cause a fatal anaphylactic reaction in a hypersensitive person.
- Toxic effects progress faster - deaths can result <1 hr

Honey bee

Wasp

Hornet

NATIONAL GEOGRAPHIC

Find more wallpapers at **www.nationalgeographic.com**

Photograph by George Grall

Clinical manifestations include

- Severe pains, fever, muscular weakness lasting for weeks, sensory dissociation
- Renal failure
- Aplastic anaemia
- Death (Toxic effects are slow – majority of deaths >12 hrs after the bite)

Scorpions

- There are over 1050 different species of scorpions world-wide - relatively few of them are poisonous to man.
- One such highly poisonous scorpion is the *Leiurus quinquestriatus* (Death Stalker / Yellow scorpion) found predominantly on the Israeli deserts.
- Possess neurotoxins (eg. Chlorotoxin, charbydotoxin etc.)

Clinical manifestations

pain and some numbness or tingling over the involved part

In children – tense feeling
restlessness
abnormal eye, neck and head movements

In adults – tachycardia
hypertension
respiratory difficulty
weakness and motor disturbances

Frogs

- About 7 genera of frogs (>165 different types) are known to have lethal toxins on their skin. Eg. Dart-poison frog

- Batrachotoxin, the most powerful animal venom known [250 times more powerful than strychnine], is produced by the dart-frog *Phyllobates terriblis.*

- The highly toxic alkaloids produce muscle paralysis and cardio-respiratory depression, eventually leading to death

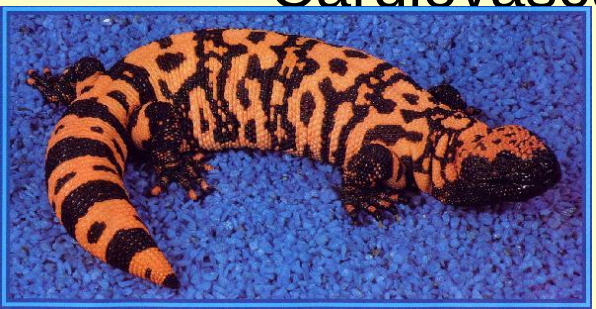
Lizards

- The best known venomous lizards are the Gila monster and the beaded lizard.

- Their venom is similar to that of some pit vipers.

- Most common manifestations are

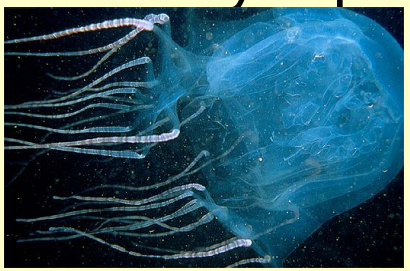
  - weakness, sweating, thirst, headache, tinnitus.
  - Cardiovascular collapse sometimes occurs.



Marine animals

- Cone snails and Coelenterates (*corals, sea anemones, jellyfishes, and hydroids*) possess neurotoxins

- These venoms are highly venomous and have very rapid action.



  - 70% of some cone snails are fatal
  - The Box Jellyfish (sea wasp/sea stinger) is highly lethal to humans: <u>death within 5 minutes</u> is possible.

Systemic manifestations include

- weakness, nausea, headache
- muscle pain and spasms
- lacrimation and nasal discharge
- changes in pulse rate
- pleuritic chest pain