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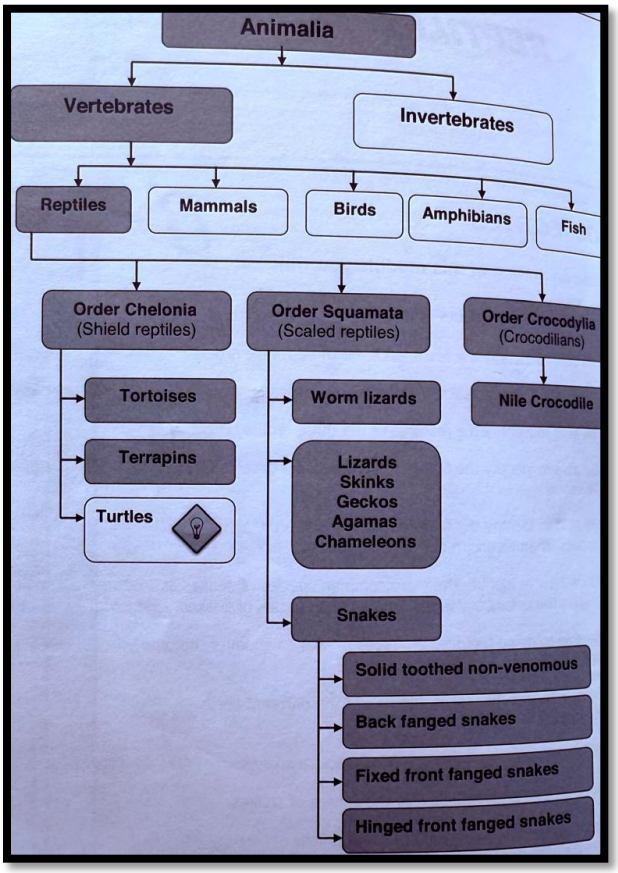
PSG PROGRAMME (NCQF LEVEL 5)
MODULE 11
REPTILES – CLASS: REPTALIA

OBJECTIVES (11.1)

- On completion of this module you will:
  - Know the characteristics of class of reptiles.
  - Be able to identify the features of the three reptiles Orders.
  - Be able to identify the features of the turtles, tortoises and terrapins.
  - Be able to identify the features of snakes, lizards, agamas, geckos, chameleons, monitors and snakes.
  - Be able to name the different types of snake venom, symptoms and effects.
  - Be able to classify snakes in terms of different teeth structures.
  - Know the different types of reproduction in snakes.
  - Know some interesting facts about reptiles.
  - Be able to provide some interesting facts about the Nile crocodile.

REPTILE CLASSIFICATION (11.1.1).

(See diagram below):



THE CHARACTERISTICS OF REPTILES (11.1.2).

- Reptiles evolved from amphibians and have been around for over 300 million years; they are very specialized and successful animals, and they out number mammals in Southern Africa. Reptiles are also **amniotes** (like birds and mammals). They all have the following characteristics:
  - The most obvious characteristics of reptiles is their **dry**, **horny skin** that is usually modified into **scales** or **plates.** This development prevents them from losing water at a fast rate. This characteristic has allowed them to move onto dry land and they need not return to water to breed; as most of frogs do. This means that reptiles are not restricted to moist habitats. The skull has one **occipital condyle** as opposed to two in mammals and birds; no external ears with only 1 internal bone (as opposed to 3 in mammals).
  - Reptiles are **ectothermic** or **cold-blooded** meaning; 'outer warmth' – relying on external sources (sun) to regulate body temperature. Many reptiles will simply sit in the sun until their body reaches the correct temperature (which is usually higher than mammals), and then move in & out between the sun and the shade to maintain a constant body temperature. The advantage of being ectothermic is **fuel** efficiency; unlike mammals that need constant intake of food for metabolic heat, reptiles can become

temporarily dormant in cold weather and provided they have protection from any danger they need not waste any energy.

- All reptiles rely on internal fertilization.

❖ **Comparing Cold-blooded and Warm-blooded Systems:**

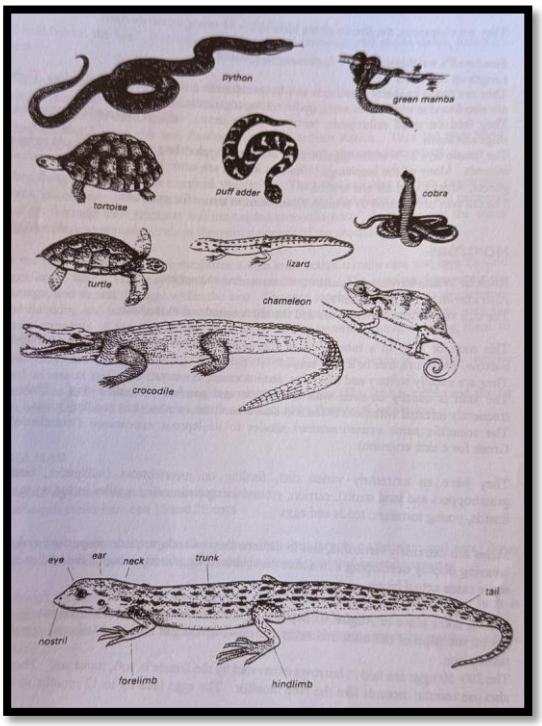
- **Cold-blooded** or **ectothermic** animals, rely on outside sources for maintaining body temperature and have the disadvantage that they cannot live in cold climates (where there is no heat) or remain active during cold times or seasons. They therefore stop moving around and hide in a safe place. Saving energy is therefore the major advantage of this system, and energy from food is not wasted on making heat, but used simply for growing and health – a bonus when there is not always a lot of food. **Warm-blooded** or **endothermic** animals on the other hand use up most of their food intake to generate heat, allowing them to colonize colder climates and remain active during extreme cold. The disadvantage being that a large, constant intake of food is necessary for survival.

❖ **Reproduction:**

- Many reptiles **lay eggs** that undergo development without water and without their parents being present. They lay either soft or hard-shelled eggs usually in places that are warm and moist in order to help with the incubation. Only crocodiles and some tortoises, terrapins and turtles that temperature in the nest determines whether the eggs become male or female babies.
- All reptiles use internal fertilization by either a single penis in crocodiles and tortoises/terrapins or paired penises (called **hemipenes**) in snakes and lizards. Most species lay eggs that are a whitish color and vary from round to oblong in a variety of sizes. They are generally laid in moist, warm areas (either hidden or out in the open) and are not incubated. The incubation temperature determines the sex of the embryo in some tortoises/terrapins and all crocodiles. In tortoises/terrapins, (26 -30 degrees Celsius) produces males and (31- 34 degrees Celsius) produces females; while in crocodiles (26 – 30 degrees) produces females and (31 – 34 degrees Celsius) produces males.
- In cooler climates, some snakes and lizards have developed a system where they give birth to live young (called **viviparous**). Semi-viviparity (called **ovoviviparous**) is where the eggs are retained within the body until hatching, or hatch within minutes or days of being laid and has also evolved in snakes and lizards.
- They have a **Jacobson`s organ** in the roof of their mouth which is used for smelling (this is however not found in crocodiles).

THE THREE ORDERS OF REPTILES FOUND IN SOUTHERN AFRICA (11.1.2).

- The living reptiles are divided into four Orders, of which three occur in Southern Africa. There are over 600 described species of reptiles in Southern Africa. The three Orders are:
  - **Chelonia** – Tortoises, Terrapins and Turtles.
  - **Squamata** – Snakes and Lizards.
  - **Crocodylia** –Crocodiles. (Reptiles pictures below):



- **Introduction To Chelonians (Shield Reptiles):**

  - The terminology used in the English language to describe these animals is somewhat confusing. In the United States, all species of chelonians, be they aquatic or terrestrial, are known as turtles. The word terrapin however, comes from a North American Indian word for 'small tortoise'. In Southern Africa, they are divided more clearly than this. They are:
    - All terrestrial species are known as tortoises.
    - All marine species are known as turtles.
    - All species that frequent fresh water habitats are known as terrapins.
    - In Southern Africa there are 5 species of turtles, 14 species of tortoises and 6 species of terrapins.
  - The fossil record of the order Chelonia has been well preserved. In the past eras, gigantic species used to roam the earth and swim the oceans. The fossil species Geochelone gigas was a land living tortoise that measured 2.4m and weighed more than 850kg. Another species Stupendemys geographicus a side necked turtle, must have weighed over 2000kg.
  - The size of modern chelonian varies widely, the smallest and the largest chelonians in the world being found in Southern Africa. These are the

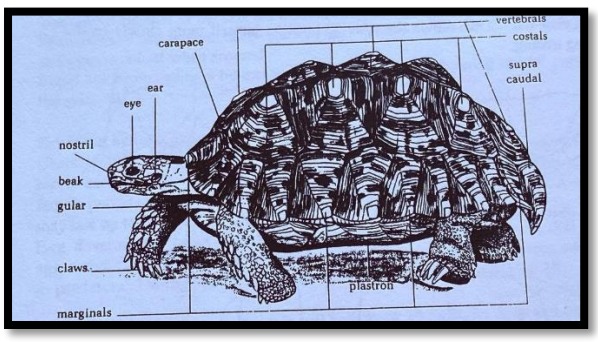
Speckled Padloper (Homopus signatus) which seldom measures more than 9 cm, and the Leatherback Turtle (Dermochelys coriacea) which weighs up to 650kg or more. The largest tortoise species in Southern Africa is the Leopard tortoise (Geochelone pardalis), which reaches a maximum mass of 40kg and is the only tortoise that can swim.

❖ **The basic differences between the three chelonians are:**

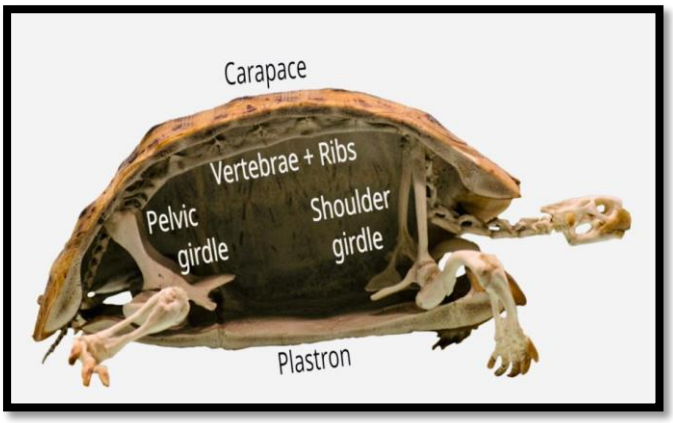
Turtles	**Tortoises**	Terrapins
Live in the oceans and have flippers.	Live on land.	Live in fresh water and have clawed webbed feet.
Head cannot be retracted.	Head drawn back straight back into the shell.	Head drawn back into the shell sideways.

- Chelonians are distinguished from other reptiles by the following combination of characteristics:
  - All have limbs, the majority with claws at the ends of the digits.
  - All have moveable eyelids.
  - All have external ear openings.
  - Their bodies are covered by a hard shell giving them the name of **shield reptiles**.
  - None have teeth, but have a parrot-like beak instead.
  - All species are oviparous (producing young by means of eggs which are hatched).
  - The sex of hatchlings is determined by the temperature during incubation. Keep in mind that egg temperature and gender is the opposite in crocodiles compared to tortoises.
  - Generally they are active at temperatures of 25 – 30 degrees Celsius, going into hibernation when the temperature remains below 19 degrees Celsius. This takes place in a sheltered spot where they burrow under rocks, logs etc. in order to get sheltered. The leopard tortoise often bulldozes its way into thick vegetation and hibernates there.
  - Direct sun can quickly kill them since their shell acts like an oven.

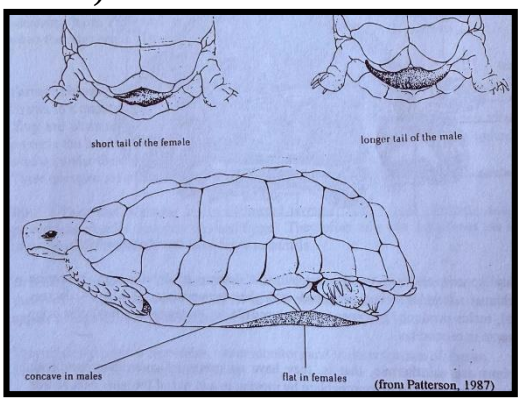
❖ **Basic Anatomy** (See picture below):



- These animals are so familiar to most people that they do not really require description. What follows is a discussion of some of the anatomical peculiarities shown by chelonians. The shell of chelonians comprises a layer of horny **keratin** scales or **scutes** that overlie a hard bony case. This box-like case is made up of lateral expansions to the ribs, vertebrae, sternum and clavicles (collar bones) and is in turn fused to the ribcage.
- The upper level of the shell is known as the **carapace**, and the lower portion as the **plastron.** The peculiar anatomy of chelonian demands that the **pelvic** and **pectoral girdles** be situated inside the ribcage; a unique anatomical structure in the animal kingdom. The shell is made of bony plates which are the ribs and other bones fused together. In hatchlings the fusion is not yet complete and the shell of young tortoise is soft when squeezed. (See picture below):



- The central portion of each scale is known as the **areola**. As the animal grows, so more horny material is deposited on the edges of the areola and this enlarges the scute gradually. The differing speeds with which this material is deposited during the winter and the summer seasons leaves growth rings on the scutes. These are said to be useful for age determination, but young tortoises have been known to add up to 8 growth rings in a single season. It is better to describe the age of chelonians by their age category viz; **hatchling**, **juvenile** and **adult**.
- Male tortoises have a depression (concave) in the plastron which is designed to fit the curve of the female`s shell during mating. (See picture below):



❖ Coloration and Markings:

- The coloration of chelonians is primarily designed for concealment purposes, and none are known to show specific breeding coloration. Some species of padloper tortoises have been noticed to develop brighter colors on the head and neck region during the breeding season. Whether or not this is related to breeding has however not yet been demonstrated.

❖ Senses:

- The sense of smell of chelonians is said to be good, but is limited to rather short ranges and seems to be used to detect the nature of food, mates etc. The marine turtles have probably got an undeveloped sense of smell for obvious reasons.
- Terrapins have got very good vision, and are able to detect movement from quite long distances. All other chelonian appear to have fairly good eyesight over short distances. Most species are able to distinguish certain colors in the red and yellow area of the spectrum. The sense of hearing is said to be good in terrapins and is probably equally good in other types, but this is difficult to test. Chelonians have good homing instincts, and experiments have shown that individuals have returned to their home ranges from distances of up to 10km.

❖ Families of Chelonians in Southern Africa.

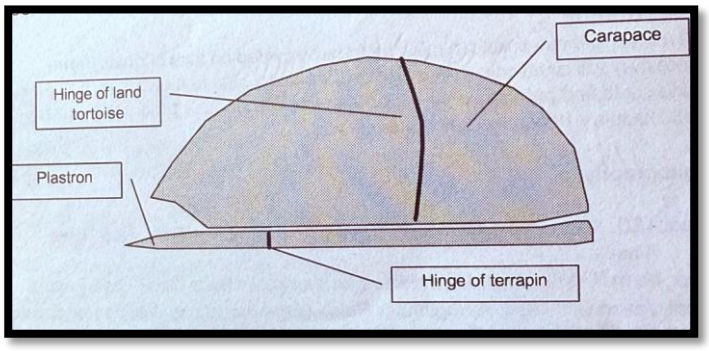
- The following families of chelonian have been recognised in this region:
- Land Tortoises – (Testudinidae) – in Southern Africa there are 14 species of tortoises of which 12 are endemic to South Africa.
  - The neck and head are withdrawn straight back into the shell by an S-shaped kinking of the 8 neck vertebrae in a vertical plane. **Cryptodirans** (meaning hidden neck); all tortoises, turtles and many terrapins belong to this group.
  - The shell is usually quite highly domed, and some species have developed hinged carapaces for protection of the rear limbs (**Hinged tortoises**).
  - Feet are unwebbed and are strongly clawed and armored with enlarged scales.
  - All species are terrestrial.
  - 14 species are found in the region.
  - Water is stored in anal sac called the **bursa.** This water is used when needed to soften the soli for egg laying or reabsorbed for bodily functions.

    NB// Tortoises are often stressed when picked up and react by urinating. It is not advisable to pick them up in dry periods or in

the winter months as this may lead them to urinate and then dehydrate, as there is not much water available to them!!!

- Side-necked Terrapins – (Pelomedusidae):
  - The head and neck of these species are withdrawn into the shell in a horizontal plane. This leaves a portion of the neck and head exposed. This is considered a primitive feature and is used by some terrapins. **Pleurodirans** (meaning side neck) the head is turned sideways and pulled into the shell, one side remaining visible and exposed to predators.
  - Some species have developed hinges on their plastron which allows the head region to be totally concealed (**Hinged terrapin**).
  - The shell is usually quite flattened, lacking the high dome of the typical tortoises.
  - Their feet are webbed for swimming, and are armed with strong claws.
  - There are at least two species of side-necked terrapins found in Southern Africa: the **South African Helmeted Terrapin** (Pelomedusa galeata) and the **Common Helmeted Terrapin** (Pelomedusa sabrufa). Both are members of the Pelomedusa genus.

- Soft-shelled Terrapins - (Trionychidae):
  - All have only three claws on the feet.
  - The shell is flat and has a flexible edge.
  - The shell is completely lacking in horny scutes or shields.
  - The neck is long and can be extended.
  - There are 2 species found in Southern Africa: the **Zambezi flap-shell turtle/terrapin** (Cycloderma frenatum) and the **African soft-shell turtle/terrapin** (Trionyx triunguis). Other soft-shell species present bin the region are **invasive**, such as the **Spiny soft-hell turtle** (Apalone spinifera) and the **Chinese soft-shell terrapin** (Pelodiscus sinensis).
- Details of carapace, plastron and hinges. (See picture below):



- Modern Sea Turtle – (Cheloniidae):
  - None are capable of retracting the head or the limbs.
  - The limbs of all species are modified into flippers, and have at most, two claws per limb.

- Salt is secreted from the tear duct, allowing removal of excess salt ingested in their marine environment.
- All are land breeders, and return to beaches in warm areas to lay eggs.
- There are 4 species found in Southern Africa: the Hawksbill, Kemp`s ridley, Loggerhead and Chelonia mydas.

- Leatherback Turtles – (Dermochelyidae):

  - A very ancient form of marine turtle and the largest turtle in the world.
  - All have a rubbery skin overlying their shell of polygonal bones.
  - The body has a series of prominent longitudinal ridges on the plastron, carapace and sides.
  - The flippers lack claws.
  - Feed exclusively on jelly fish.
  - Only one species is found in Southern Africa: the **Leatherback turtle** (Dermochelys coriacea).

❖ **Lizards – Order Squamata:** Snakes and Lizards (Scaled reptiles).

- Lizards date back to about 190 million years ago. There are about 230 species of lizards found in Southern Africa.

- The skin is shed periodically in a process called **sloughing**, whereby the animal becomes sluggish as the upper horny layer starts to separate from the underlying areas. A lubricant is secreted by the skin, helping to separate the new and old layers. This causes the skin to take on a dull appearance with the eye becoming milky as the covering (fused eyelids) that protects the eye is covered in the substance and starts to separate. The outer covering of the eye is therefore also shed (absent in some lizards species). This process allows the individual to grow.

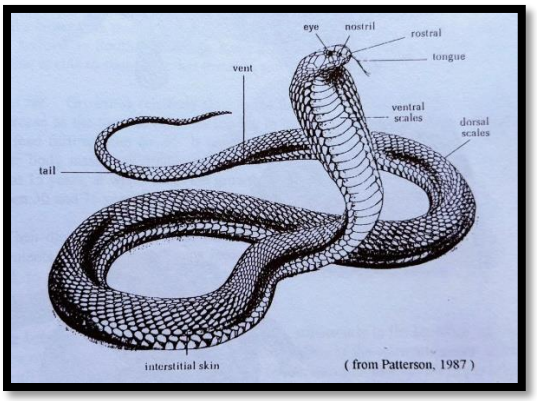
- **Characteristics are as follows:**
  - The bones in the roof of the mouth have gaps.
  - The genital opening is at right angles to the body.
  - The paired hemipenes (pennies) are stored in the tail base.
  - The body is covered by scales either with small bony inserts called **osteoderms**.

❖ **Three Sub-orders are present in Southern Africa:**

- Serpents – Snakes (date back to at least 80 million years ago).
- Amphisbaenia – Worm lizards (date back to at least 65 million years ago).
- Sauria – Lizards.

❖ **Snakes:**

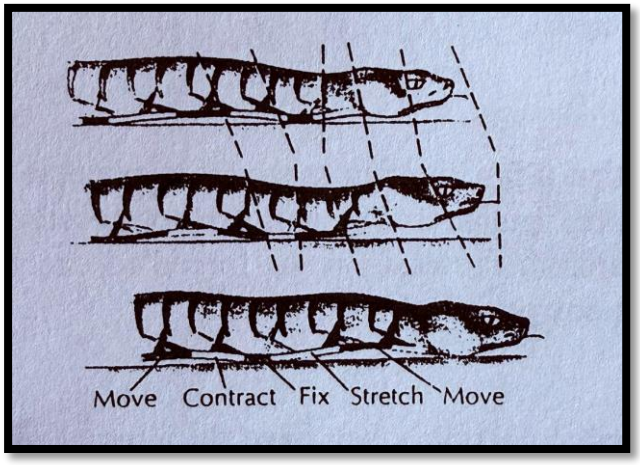
- There are 143 species of snakes in Southern Africa, of which 37 have fangs and venom that have caused clinical symptoms. (See snake parts below):



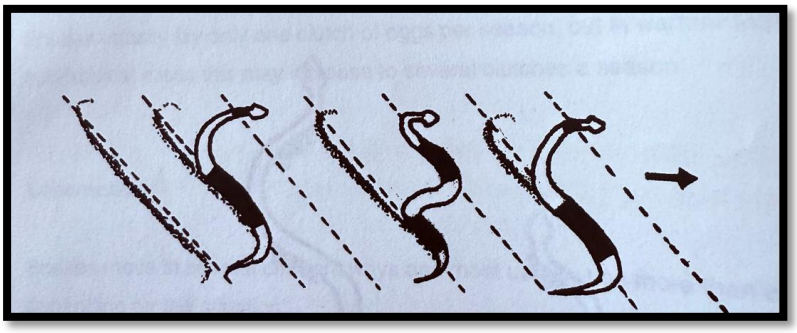
- Snakes have the following:
  - Lack external ears and eye lids.
  - Usually only have one lung (the right one).
  - Scales do not contain osteoderms.
  - The tongue is retractile and sheathed.
  - Have long back bones with moveable ribs to allow for various types of motion achieved by pressing different parts of the body against the ground.
  - Total absence of limbs.
  - All are carnivorous, with fangs able to inject venom to subdue or kill prey; occurring in many species.

❖ **There are basic types of locomotion:**

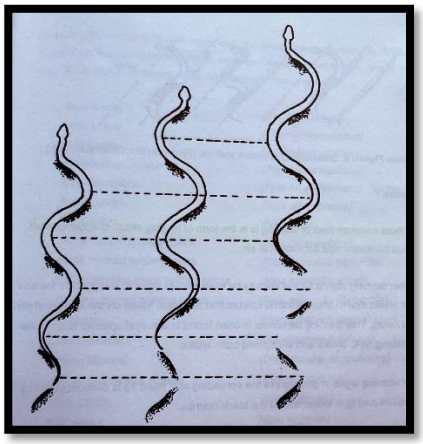
- <u>Caterpillar-like movement</u> (Rectilinear motion) – e.g., Boomslang. This is when a snake moves in a rectilinear or straight line motion by muscular waves moving from tail to tip very much like the motion of a caterpillar. Typical of snakes moving along branches or heavy bodied snakes like pythons. See picture below):



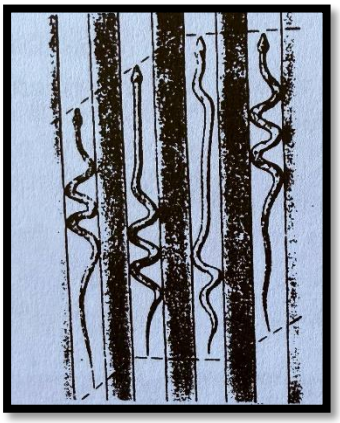
- Side-winding movement – e.g. Peringueys adder. The body is moved in smooth, sideways curves (s-shapes), lifting most of the body from the sand in rapid motion. Only two sections of the body touch the sand at any one time. This an adaptation to areas with hot loose sandy areas. (See picture below):



- Normal Serpentine movement e.g. Black mamba. This is a graceful, sweeping s-shaped movement of the body to propel it through grass and other uneven terrain. This is typical of most snakes when disturbed or chasing their prey, hence the name serpentine. (See picture below):

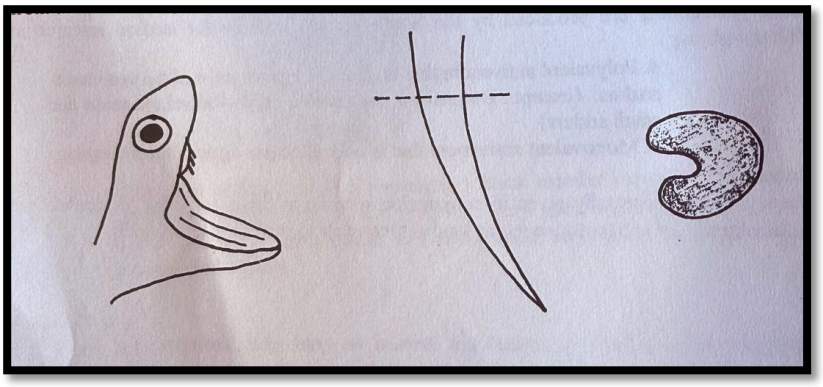


- Concertina-type movement – e.g. Puff adder. This type of motion is very similar to caterpillar-like motion, but instead of the muscle moving in waves from tail to head, they stop about midway causing the rear half to become compressed. Tis then becomes the point from which the next movement originates, the compressed section straightening out again and effectively pushing the body forward. This is typical of straight-line motion on the ground. (See picture below):

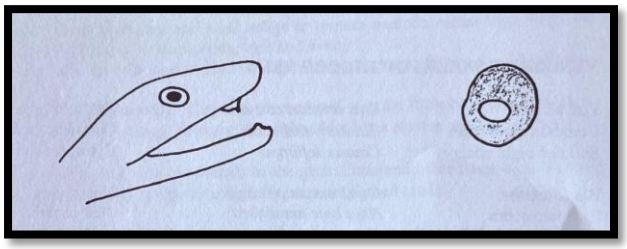


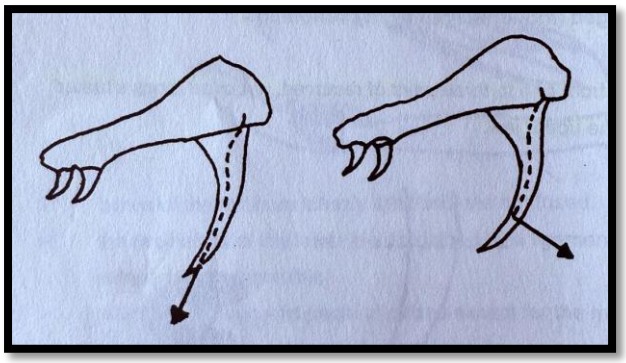
❖ **Teeth Classification of Snakes.**

- The teeth and fangs of all snakes' species are replaced throughout their life. Venomous snakes are never without a functional set of fangs unless severely damaged, say by a predator.
- Snakes can roughly be classified into four groups according to their teeth:
  - Solid-toothed non-venomous – e.g. African rock python. There are no fangs and therefore no venom. The teeth are usually numerous although vary in size, as prey is usually killed by chewing or holding with the mouth and constricting. Teeth often break off causing infection.
  - Back-fanged – e.g. Boomslang. Hollow, venom injecting teeth are situated at the back of the mouth in the upper jaw only. These snakes would generally be able to open the widely in order to use these small to medium-sized fangs effectively. (See picture below):



  - Fixed front-fanged – e.g. snouted cobra. Hollow fangs situated in the front of the mouth in the upper jaw only. They are usually not too long, allowing the mouth to close easily. The shallow injection of venom is enough because these species often have powerful **neurotoxins** (nerve-destroying). (See picture below):





- Hinged front-fanged – e.g. Puff adder. Usually large, long fangs situated in the upper top of the mouth which 'hinge' to fold flat along the side of the mouth, allowing it to close properly. Deep injection of venom is necessary for the slower acting **cyto-toxic** venom (tissue-destroying) to be most effective. (see picture below):



❖ **Feeding Habits:**

- Snakes are incapable of chewing or swallowing prey in the normal way associated with other animals. To enable them to swallow such large prey;
  - Snakes have developed a wide gape (up to 130 degrees Celsius).
  - The bones of the skull are loosely articulated in the middle which allows them to expand independently around very large prey items. The lower jaw of many species can be dislocated to cater for large prey.
  - The throat and body walls are highly distendable (stretched) to allow for passage of prey.
  - The trachea can be extended out of the mouth to prevent suffocation whilst the snake is swallowing.
- Most snake's species are able to swallow prey up to 25% of their weight, but others as the pythons may swallow prey weighing as much as they do. All snakes are carnivorous, and prey on a variety of animals; amphibians, mammals, birds, fish (water snakes), insects, bird's eggs, other snakes and reptiles etc. Some species are highly specialized and will only prey on a single type of prey such as bird's eggs, slugs, centipedes etc.
- Digestive juices of snakes are very strong and most matter is digestible, including bones and teeth. Hair, feathers and horn are not digested, and these are egested with the faeces. Because venom is modified saliva, it aids in the digestion of prey.
- The tail cannot be shed under stress (called **autotomy**) like in lizards.

❖ **Senses:**

- The most developed sense in most snakes is that of the sense of smell. Nostrils play no part in this. The forked tongue of snakes is able to protrude through the lips without the mouth to be opened. This is accomplished by

a muscle that extends and retracts the tongue at will. The tongue is kept stored in the hyoid sheath below the trachea when not in use.

- The tips of the tongue pick up the scent particles from the air and surrounding substrate and transfer these to the organ of Jacobson. This organ is situated on the roof of the mouth and has pockets that are lined with sensory epithelial cells. These cells absorb the scent particles and translate the message to the snake.
- Sight is used by most diurnal species as the prime means of locating prey. The sight of even these species is not very good, and most are only able to discern movement. Only the vine snake and the boomslang are thought to be capable of identifying stationary prey. All snakes see in **monochrome** (black and white shades).
- Another sensory adaptation of some snakes is that of **heat sensory organs**. The pythons, pit vipers and boas all have these organs. These usually take the form of pits or depressions on the anterior edge of the lips. The sensitivity of these pits to heat is remarkable, and a temperature of less than 1 degrees Celsius can be determined. These organs aid the snake in locating and capturing warm-blooded prey; even on totally dark nights. All snakes lack external ears and eardrums, but are sensitive to vibrations which are transmitted to the brain via the ribs and ultimately the quadrate bone (skull bone).

❖ **Reproduction:**

- Snakes locate partners using the organ of Jacobson to follow scent trails of glandular secretions from the skin and cloaca of females. Male snakes have paired copulatory organs known as hemipenes. This lie on either side of the tail just behind the cloaca and are retracted into the body when not in use. Before copulation, the hemipenes are projected forwards and are turned inside out by a muscle attached to the end of each organ. Copulation takes place with only one pair of hemipenes actually penetrating the cloaca of the female. Mating may last from a few minutes to a couple of hours.
- All snakes are essentially hatched from eggs. In the majority of species eggs are laid and left to incubate under natural conditions. These species are **oviparou**s. Other species however, retain the eggs within the body cavity until incubation is complete and thereafter give birth to live young. This is known as **ovo-viviparous** reproduction. Ovo-viviparous species (Puff adder, Mole snake & Rinkhals), normally give birth to their young after a gestation of anything from 15 – 24 weeks. Young are encased in a thin membrane that is quickly broken by the efforts of the newborn snake.
- Snake eggs have a shell unlike that of birds in that it is formed from a parchment-like substance that is deposited in 9 or 10 layers; each at right angles to the next. The shell is therefore soft and pliable (flexible). Eggs are normally laid from 4 – 6 weeks after mating takes place and may take anything from 2 to 7 months to incubate. Before hatching, juveniles

develop an egg tooth that allows them to slit the eggshell and escape. The tooth is shed shortly after hatching.

❖ **Snake Venom:**

- Snake venom is produced and stored in salivary glands that are situated roughly on either side of the head, behind the eyes. The venom not only enables the snake to kill its prey, but also assists with the digestive processes.
- Snake venom is broadly divided into three categories:
  - Haemotoxic – the symptom of haemotoxic poisoning is severe headache several hours after the bite. Bleeding will start from small cuts and the mucous membranes and will eventually degrade into severe internal bleeding. Bites from the following snakes will cause haemotoxic poisoning:
    - Boomslang and Vine snake.
  - Neurotoxic – the symptoms are dizziness, with progressive difficulty in swallowing and breathing. Symptoms develop some time after the bite and victims of black mamba bites reported that they experienced a metal taste in the mouth shortly after a bite. Neurotoxic poisoning is caused by bites:
    - Egyptian, Cape and Forest cobras.
    - Black and Green mamba.
    - Yellow-bellied sea snake.
    - Garter and Cape coral snake.
  - Cytotoxic – in this case symptoms are an immediate burning pain followed by severe swelling of the bite. The symptoms are caused by the bites of:
    - Gabon adder and Puff adder.
    - Spitting cobra.

❖ **Snakebite Treatment:**

- Venom in the eyes – rinse the eyes immediately with large quantities of liquid. If water is not available, use any suitable liquid. It is of crucial importance that the eyes must be rinsed; even if you have to resort to urine. Wipe venom on the face away from the eyes. The victim must be treated by a medical doctor as soon as possible, as partial blindness may result. After proper treatment full recovery takes only a few days.
- Snakebite – the treatment of snake bite has undergone drastic changes in the last number of years. Leave the use of **anti-venom** to a qualified doctor and do not cut, suck or squeeze a bite. The **pressure bandage** is prescribed for field treatment. Make sure you understand the difference between a pressure bandage and a tourniquet. The aim of a pressure bandage is to apply firm pressure on the skin, without interrupting the flow of blood. Important facts:

- Work with competence and speed, demonstrating that you are in command of the situation; thereby instilling confidence. This will assist in keeping the victim calm. **Reassure** the person from the start by words and deeds; no snake bite needs to be fatal if treated correctly.
- Immediately apply a pressure bandage to the site of the bite. Start by applying a small pad to the bite, then start bandaging from below the bite towards the heart, as far as you can go.
- Movement will accelerate the spread of poison through the body; keep the affected limb **immobile** by applying a normal splint.
- Make the victim as comfortable as possible and prevent the onset of shock. If you need to wait for medical assistance, keep the victim in the shade.
- Monitor the vital signs of the victim, and be prepared to administer CPR to assist breathing.
- In case of a bite by a snake with cytotoxic venom, do not apply a pressure bandage. Excessive swelling could cause the blood circulation to be cut off.
- If you are in a position to move the victim by vehicle, do so immediately and get to medical help as soon as possible.
- Even if a person recovers, do not allow him/her to continue a trail without the benefit of full medical examination and treatment.
- Try to identify the snake if possible and don't try to kill or catch it. Nobody needs a second victim.

  - Some snakes (especially the rinkhals) fake death when they feel threatened; a process called **thanatosis**. Be very wary of this and never handle a seemingly dead snake.

❖ **Anti-venom** – two anti-venoms are produced by the South African institute for medical research:
  - A **Polyvalent** anti-venom that is effective against most of the venomous snakes (except, boomslang, twig snake, yellow-bellied sea snake and small adders.
  - A **Monovalent** anti-venom that is only effective against the boomslang.

ORDER: SQUAMATA – SUB-ORDER: SAURIA (11.1.3) – Lizards.

❖ **Origin**:

  - The earliest fossil remains of lizards date back to about 190 million years ago. There are about 230 species of lizards in southern Africa.

❖ **General Characteristics of Lizards:**

- The majority have limbs (except legless forms) with at the end of the digits and many genera have developed highly specialized digits, depending on their habitat.
- Small external ears (**pinnae**) are sometimes present.
- May or may not have movable eyelids, in some species they are fused to form a spectacle.
- The lower jaw halves are fused.
- The tongue can be withdrawn in some species but is never sheathed.
- Autotomy exists and usually involves the tail.
- Both herbivorous and carnivorous species occur. Prey is ambushed and overwhelmed by a sudden dash.
- Osteoderms present in many species.

❖ **Lizard Families in Southern Africa:** Southern African lizards and worm lizards are divided into the following families:

- **Worm Lizards** – (Sub-order Amphisbaenia).
  - They have a large medial tooth on the head bone.
  - They the most specialized burrowing reptiles, and are capable of driving tunnels through hard soils and are very seldom seen.
  - All the species of worm lizards are legless.
  - They do not have external ears and their nostrils are backward facing to prevent sand from going into their nose when they burrow.
  - Because their scales are arranged in rings they look like earthworms.
  - They feed mainly on termites and soft-bodied invertebrates.
  - There are 12 species of worm lizards in Southern Africa.
  - Most of them are egg-laying.
  - The tail is usually short and when they are threatened they waive the tail in the air. This resembles the head any predator would then go for the head and instead get the tail. In this way the worm lizard would be able to escape.
  - The name **Amphisbaenia** means '**two-headed'**.
- **Lizards, Skinks, Geckos, Agamas & Chameleons** (Sub-order Sauria).
- **Skinks** – (Family Scinicidae).
  - Their scales are smooth and overlapping and are often iridescent and brightly colored.
  - Most species live on or below the ground.
  - Some may have limbs that are reduced for burrowing.
  - There are 59 species of skinks found in Southern Africa.
  - Feed mainly on small insects.
- The African legless skinks are specialized burrowing skinks. The Blind legless skinks display adaptations for living underground and have almost lost their eyes. Old world skinks are burrowing or very secretive. The advanced skinks are a diverse group consisting of typical skinks, writhing skinks and snake eyed skinks. All these skinks have legs. The important species to know are the **Rainbow skinks** and the **Striped skinks**.

- **Girdled Lizards –** (Family Cordylidae)
  - Their body scales are usually overlapping, rectangular plates that may or may not be heavily armored and arranged in regular rows (girdles).
  - Their eyes and ears are well developed.
  - They have well developed legs and longish tails.
  - The tongue is round and stout.
  - They have a flat head with symmetrical head shields.
  - Most species give birth to live young.
- **Plated Lizards** – (Family Gerrhosauridae)
  - Most species have stout bodies.
  - They have rounded tails and well developed legs.
  - The body has rectangular scales.
  - They are active during the day.
  - They lay eggs.
- **Monitor Lizards –** (Family Varanidae)
  - All the monitors have well developed legs and strong claws.
  - They have long tails that cannot be shed.
  - They are predatory, and they swallow their food whole and may sometimes tear their food into smaller pieces using their claws.
  - Most monitors are semi-aquatic, particularly water monitors.
  - They are active during the day.
  - They lay eggs, most often in termite mounds.
- There are two species found in Southern Africa. The **Rock** or **White-throated monitor** and the **Water** or **Nile monitor**. In South Africa they are also called **Leguaans**.

- **Agamas –**(Family Agamidae)
  - These lizards have stout triangular heads with small granular body scales.
  - Their tails are short, thin and they cannot shed their tails.
  - Their pupils are round and they have moveable eyelids.
  - They are active during the day.
  - They feed mainly on ants and termites.
  - The mails are territorial and develop distinct bright breeding colors.
  - These lizards often live in social groupings.
  - Most species lay eggs.
  - There are nine species of agamas found in Southern Africa.

❖ **Old World Lizards –** (Family Lacertidae)
- All these species have slender bodies with long tails.
- They have well developed legs and claws.
- Their bodies are covered with granular scales with larger granular scales.
- These lizards can shed their tails.

- Most of these lizards are active during the day and are known to live underground.
- All these lizards lay eggs.
- There are 30 species found in Southern Africa.

❖ **Geckos –** (Family Gekkonidae)

- All species have fixed eyelids and they clean their eyes with their tongue.
- They are able to make a noise; no other reptiles are vocal except for the crocodile.
- Their toes are highly adapted and are webbed, sticky or are full of scales that have very fine hairs to grab onto small cracks on the surface which they move across. These pads are called **scanners**.
- Many species have claws, some of which they are able to retract.
- Most geckos are nocturnal, except for species like the Dwarf geckos.
- Geckos can shed their tails.
- Geckos are able to live in much colder climates than other reptiles.
- They all lay two hard-shelled eggs.
- Geckos can store calcium inside glands in the neck.

❖ **Chameleons –** (Family Chamaeleonidae)

- All species have protruding and independently moving eyes.
- They have laterally compressed bodies.
- They have small granular scales that do not overlap.
- The digits on their feet are opposite and are able to grip well while climbing.
- They cannot shed their tails.
- They have a telescopic tongue that can shot out at a distance that is longer than the length of their own body.
- Most chameleons are tree welling (arboreal).
- All chameleons are able to change their skin color according to their surroundings.
- Both males and females are exclusively territorial and not very social lizards.
- During any form of combat and when threatened they will head butt, inflate their throat pouch and change their color usually going darker.
- Most chameleons lay eggs.
- There are 16 species of chameleons found in Southern Africa.

INTRODUCTION TO CROCODILES (11.1.4)

❖ **Order: Crocodylia –** (The Nile crocodile).

- Crocodiles originated about 135 to 65 million years ago. The order crocodylia has one family, the crocodylia, which includes 21 living species distributed throughout the tropical and subtropical areas of the world. The Nile crocodile is the only species found in Southern. They can weigh up to 1000 kg and can reach a length of nearly 6 meters. They have five toes on

the front feet and four toes on the back feet that are partially webbed. The tail is 40% of the total body length.

❖ **Characteristics are as follows:**

- Have a four-chambered heart.
- Have a nictitating membrane that moves sideways to clean the eye.
- Has a single penis.
- Longitudinal genital opening (in line with the body).
- Single, hard palate in mouth.
- Valved nostrils and gular flap allow feeding under water.
- Eggs are laid in pit above high water mark. Mother looks after young.
- They are all carnivorous; taking a variety of prey up to the size of large ungulates depending on the species. Prey is either caught and consumed in water or drowned.
- On hot days they will often lie on banks with their mouths open. This is a form of thermo-regulation to cool the body as air passing over the moist inner mouth, which is richly supplied with capillaries; allows for evaporative cooling of the blood.
- Crocodiles have very powerful muscles to close the jaws, obviously effective in crushing prey, but the muscles to open the jaws are relatively weak.

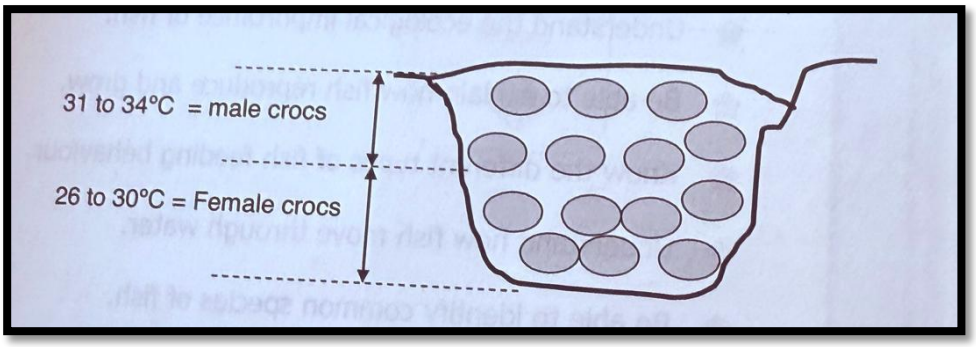
- When a crocodile catches its prey (example; fish) under the water it can open its mouth to catch the fish without drowning. The reason for this is that the valves in the nostrils close and the **throat valve** (**gular flap**) closes. This means that the crocodile cannot swallow its prey under water and has to come to the surface for the throat flap to open allowing it to swallow. If it remains inactive a large crocodile can stay underwater for up to **an hour**. The eyes are protected by well-developed lids and behind them lay the ears, visible as two slits which flap close when under water.
- The upper jaw is an extension of the skull and only the **bottom jaw** can be moved. This means, on hot days when the crocodile is **basking** on the sand banks with its mouth open to lose heat by **evaporation**, it has to hold its head upwards, allowing the bottom jaw to fall open and rest on the ground. During cold mornings and late afternoons crocodiles let the sun directly into their mouths. The heat is taken up by the soft membrane in the mouth and is dispersed throughout the body through blood circulation to raise the body temperature.
- The teeth (more than 60) are designed for **gripping** rather than chewing and interlock when the jaws are closed exposing the fourth mandibular tooth. If the prey is too large to be swallowed whole, the crocodile flicks it back and forth with sideways movements of the head or seizing a mouthful **spins** on its long axis until a piece small enough to be swallowed is torn off.

❖ **Diet and Feeding:**

- Crocodiles progresses through a series of preferred prey species during the course of their lives and diet varies according to their age and size. Hatchlings or young crocodiles feed mainly on small invertebrates, amphibians, other reptiles and small mammals. Once they have grown to more than a meter in length, fish form the major portion of their diet, particularly catfish and they spend more time in quiet sections of rivers, lakes and dams where they avoid competition of the larger individuals.
- Crocodiles over three meters in length include in their diet as well as fish, birds (cormorants), terrapins, snakes, other crocodiles, otters, warthogs and various mammalian species. They are opportunistic feeders, taking either live prey or carrion (dead meat), ensuring that rotting material is removed from the aquatic environment.

❖ **Reproduction:**

- Sexual maturity is reached at 12 to 15 years (2 – 3 meters). At start of the breeding season around May, the males develop a dominance hierarchy and the courtship is elaborate. The non-sexual physical contact during this period stimulates the egg development. Mating takes place in the water in July and August.
- The female selects a suitable sunny sand bank above the flood water having good drainage and nearby cover. Unless disturbed she will use the same nest sight for the rest of her life. In October/November, usually at night she digs a hole (30 – 40cm deep) with her hind legs and will lay 16 – 80 white-shelled eggs. The nest site is defended against predators; the greatest threat being the water monitor lizard, and other crocodiles. During this period the female **does not eat,** but she may go to the water to drink. The male remains in the vicinity but is kept away from the nest mound by the female.
- About 84 to 90 days later the hatchlings while still in the eggs, give a high **pitched cheeping noise** that can be heard 20 meters away. The female carefully opens the nest and takes **all the young into her mouth**. They remain close together in a **crèche** area for six to eight weeks. The sex of the hatchlings is dependent on the **egg incubation temperature** in the nest hole. Female crocodiles develop at temperature of 26 to 30 degrees Celsius and males at higher temperatures of 31 degrees to 34 degrees Celsius. (See picture below):



❖ **Defense and Enemies:**

- Young crocodiles rely on camouflage and agility to avoid predation, but adults have no natural predators apart from man. Baby crocodiles have many enemies, for example monitor lizards (leguaans), birds of prey, storks, southern ground hornbills, genets, water mongoose, otters and many more. On average only one crocodile out of a nest of 50 eggs will reach maturity. The **greatest threat** to this order of reptiles is that of habitat destruction and commercial hunting for the leather industry.

❖ **Thermoregulation and Hibernation:**

- Crocodiles are **ectothermic** i.e. they have no means of controlling their body temperature, and thus have to thermoregulate by moving into and out of heat sources. Crocodiles spend a considerable time basking in order to build their body temperature up to a satisfactory level. The colder the day, the more time they spend basking. In very hot condition, crocodiles leave their mouths open in order to lose body heat through evaporation. Crocodiles **do not hibernate**!

❖ **Differences Between Crocodiles And Alligators:**

Crocodiles	**Alligators**
Have a narrow snout	Have a broad, rounded snout
Upper and lower jaws are same width	Upper jaw wider and overlaps lower jaw
4^{th} mandibular tooth visible when mouth closed	4^{th} tooth hidden when mouth closed
Upper jaw constricted behind nose	No constriction behind nose
Lower and upper jaw teeth interlock	Lower jaw teeth fit into holes in upper jaw
Functional salt glands on tongue; tolerate saline water	Non-functional salt glands; avoids saline water
Sensory receptors in scales of entire body	Sensory receptors in scales of jaws only