

# Reptiles

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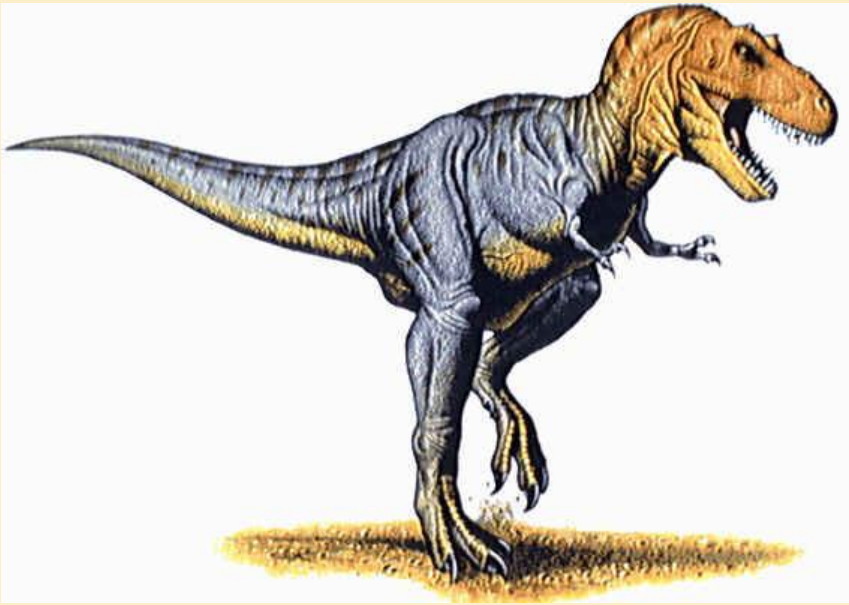
- First truly terrestrial vertebrates
- ~7000 species worldwide
- ~300 species in U.S. and Canada

# Reptiles



- Probably best remembered for what they once were, rather than what they are now
- Mesozoic era - age of reptiles
- Dominant group for >150 millions years

# Reptiles



- 12 or so principal groups of reptiles evolved
- Only 4 groups remain today

# Characteristics

- Reptiles are cold-blooded, vertebrates with scales covering their skin.
- They are considered as tetrapod's (with four legs or leg-like appendages) even though legs are absent in some animals, like snakes.
- The scales are made of keratin and form from the epidermis for protection.
- The skin has few cutaneous glands and high levels of keratin, which prevents water loss through the skin.

# Evolutionary Prospective

- The earliest members of the class Reptilian were the first vertebrates to possess amniotic eggs.
- Amniotic eggs have extra embryonic membranes that protect the embryo from desiccation, cushion the embryo, promote gas transfer and store waste materials.
- The amniotic egg is the major synapomorphy that distinguishes the reptiles, birds and mammals from other vertebrates.
- This adaptation has allowed reptiles to flourish on land.
- Living representatives of this class include: turtles, snakes, crocodiles, and the tuaturans

# Classification of Living Reptiles

- **Class Reptilian-dry** skin with epidermal scales; skull with one point of articulation with the vertebral column; respiration via lungs; metanephric kidneys; internal fertilization; amniotic eggs.



- Order **Testudines or Chelonia**- teeth absent in adults and replaced by a horny beak; short broad body; shell consisting of a dorsal carapace and ventral plastron. Turtles.



Blanding's Turtle

photo by Jim Harding

- Order **Crocodylia**- elongate, muscular, and laterally compressed; tongue not protrusible; complete ventricular septum. Crocodiles, alligators, gavials.



- Order Sphenodontida or **Rhynchocephalia**- contains very primitive, lizardlike reptiles; well-developed parietal eye. Tuataras.

## Continued ...

- Order Squamata- recognized by specific characteristics of the skull and jaw (temporal arch reduced or absent and quadrate moveable or secondarily fixed); the most successful and diverse group of living reptiles. Snakes, lizards, worm lizards.





# Reptilian External Structure and Locomotion

- The typical reptilian posture, limbs project nearly perpendicular from the body and bend downward toward the ground at the elbows and knees.
- The only living reptiles that use a vertical limb posture in walking are crocodiles.
- When walking the body flexes up and down rather than side to side.

# Nutrition and Digestion

- Most reptiles are carnivores, although turtles may be herbivores, omnivores, or carnivores depending on the species. The tongues of turtles and crocodiles are non-protrusible and aid in swallowing.
- Like some anurans, some lizards and the tuatara have sticky tongues for capturing prey.
- The tongue extension of chameleons exceeds their body length.
- In snakes, the skull has been adapted for feeding; the bones of the skull and jaws loosely join and spread apart and ingest prey much larger than a snake's normal head size.
- Posteriorly pointing teeth prevent prey escape and help force the food into the esophagus. The glottis, the respiratory opening, is far forward so that the snake can breathe while slowly swallowing its prey.

# Snake Feeding

- Venom - toxic concentrations in saliva
- Neurotoxic - blindness, paralysis
- Hemolytic - ruptures blood vessels, cells



# Snake Feeding

- Sea snakes have most deadly venom
- King cobra most dangerous, largest (5.5 m) - kill 9,000 people per year



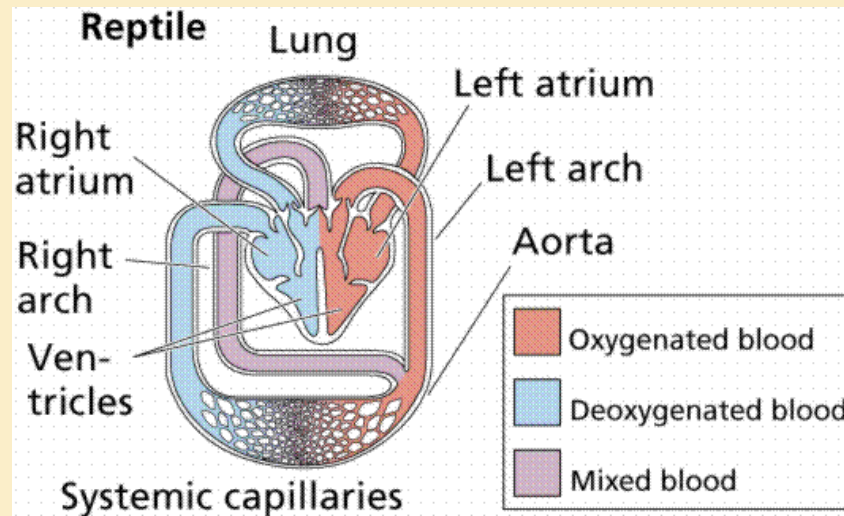
# Reptile Jaws



- Reptile jaws designed for crushing prey
- Fish, amphibian jaws designed for quick closure, but little force after
- Reptile jaw muscles larger, longer, arranged for better mechanical advantage

# Circulation

- The circulatory system of reptiles is based on that of amphibians; because reptiles are, on average, larger than amphibians, their blood must travel under higher pressures to reach distant body parts.
- Reptiles possess two atria that are completely separated in the adult and have veins from the body and lungs emptying into them.



# Gas Exchange

- Reptiles exchange respiratory gases across internal respiratory surfaces to avoid losing large quantities of water.
- A larynx is present, however, vocal cords are usually absent. Cartilages support the respiratory passages of reptiles, and lungs are partitioned into sponge-like, interconnected chambers. Lung chambers provide a large surface area for gas exchange.

# Temperature Regulation

- Most reptiles use external heat sources for thermoregulation and are, therefore, ectotherms.
- Some reptiles can survive wide temperature fluctuations; to sustain activity however body temperatures are regulated in a narrow range, between 25 and 37 degrees.
- If that is not possible, the reptile usually seeks a retreat why body temperatures are likely to remain within the range compatible with life.

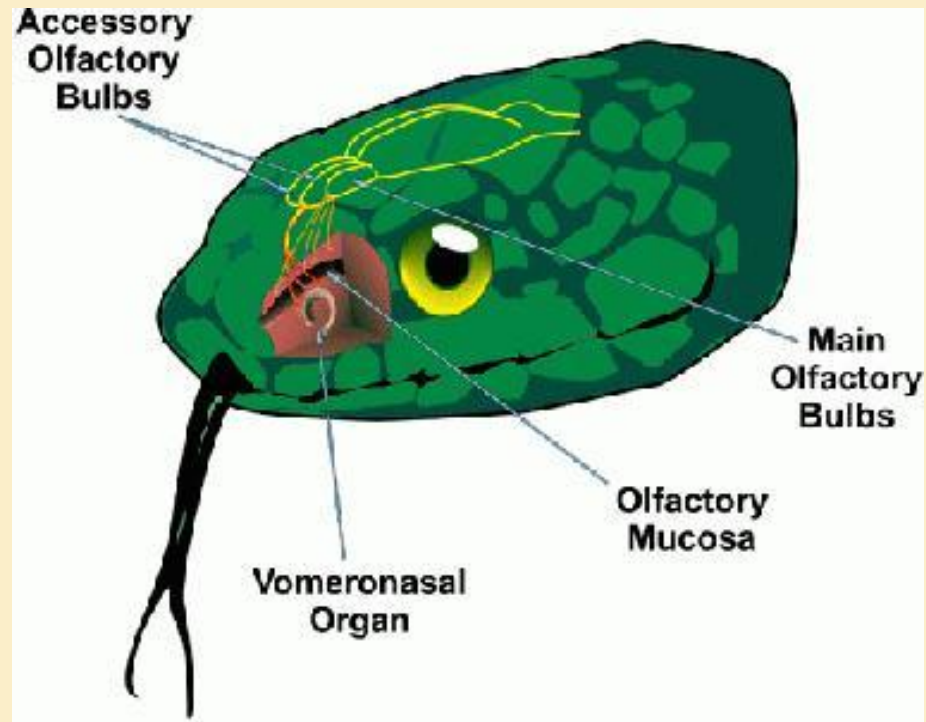


# Nervous and Sensory Functions

- The cerebral hemispheres of reptiles are somewhat larger than those of amphibians. This increased size is associated with an improved sense of smell. The optic lobes and cerebellum are also enlarged, which reflects increased reliance on vision and more refined coordination of muscle functions.
- Vision is a dominant sense in most reptiles; snakes focus on nearby by moving the lens forward. Contraction of the iris places pressure on the gel-like vitreous body in the posterior region of the eye and displacement of this gel pushes the lens forward.
- All other reptiles focus on nearby objects when the normally elliptical lens is made more spherical, as a result of ciliary muscles pressing the ciliary body against the lens.

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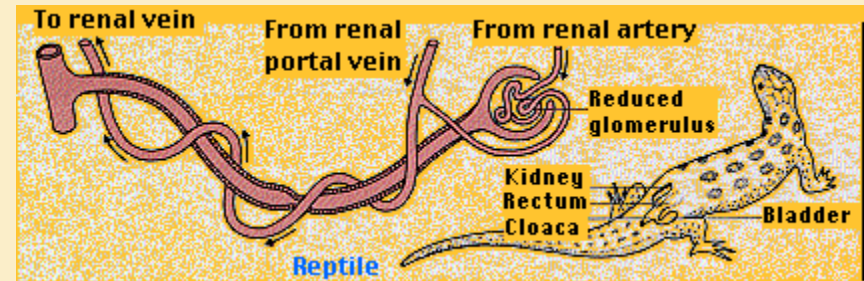
- Olfactory senses are better developed in reptiles than amphibians. In addition to the partial secondary palate providing more surface for olfactory epithelium, many reptiles possess blind-ending pouches that open through the secondary palate into the mouth cavity.



- Sense organs generally well-developed
- Hearing generally poorly developed in most

# Reptile Kidney

- Kidneys more advanced (metanephric)
- Very efficient at conserving water
- Excretes **uric acid** (rather than urea, ammonia)
- A semisolid paste



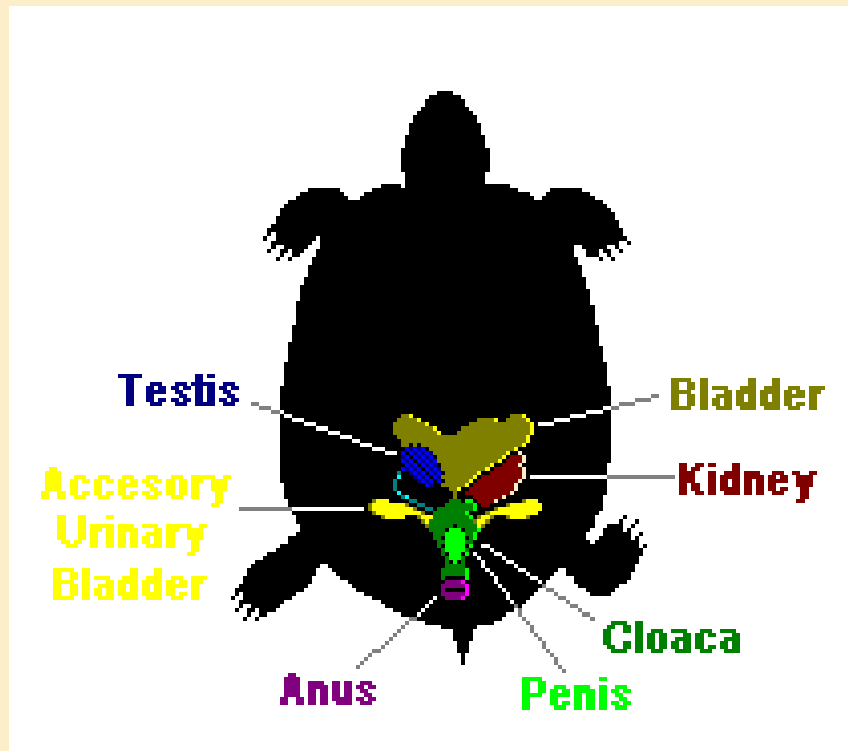
# Excretion and Osmoregulation

- A kidney with many blood filtering units, called nephrons, replaces the reptilian embryonic kidney during development.
- Their function depends on a circulatory system that delivers more blood at greater pressures to filter large quantities of blood.
- Most reptiles excrete **uric acid**; it's nontoxic, and being relatively insoluble in water, it precipitates in the excretory system. The urinary bladder or cloacal walls reabsorb water, and the uric acid can be stored in a paste like form.
- Utilization of uric acid as an excretory product also made possible the development of embryos in terrestrial environments, because nontoxic uric acid can be concentrated in egg membranes.

## Continued ...

- Reabsorption of water, internal respiratory surfaces and relatively impermeable exposed surfaces reduce evaporative water loss.
- The behaviors that help regulate temperature also help conserve water loss.

# Reptile Copulatory Organ



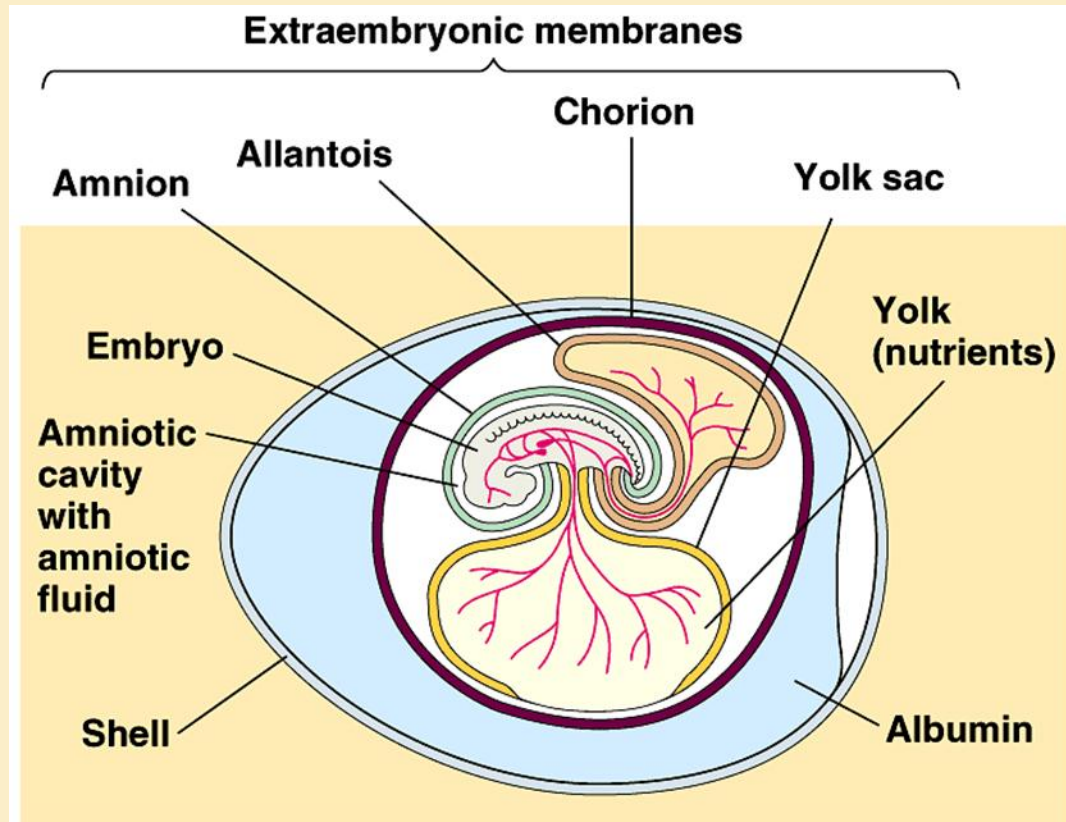
- Copulatory organ permitting internal fertilization
- Internal fertilization required for a shelled egg
- Copulatory organ formed from an evagination of cloaca

# Reproduction and Development

- For vertebrates, internal fertilization and the amniotic egg made complete movement to land possible.
- The amniotic egg, however, is not completely independent of water; pores in the egg shell permit gas exchange but also allow water to evaporate. They require significant energy expenditures by parents.
- They have internal fertilization, but eggs develop outside of the body.



# Amniotic Egg



# Lizards

- Range of reproductive modes from oviparity to viviparity
- Skinks - eggs retained in oviducts, receive nutrients across a “placenta”



# Lizards

- Parental care
- Many lizards remain with eggs or nest site
- Little if any care given after young hatch or are born



# Snake Reproduction

- Most oviparous - lay eggs in protected areas
- Most of remainder are ovoviviparous (including rattlesnakes)
- Very few viviparous
- Females store sperm from single mating, can lay several clutches over long interval



# Order Crocodylia

- Oviparous - lay eggs in mass of vegetation
- Guarded by mother
- Incubation temperature determines sex of alligator hatchlings
- Low - females
- High - males
- 5:1 (M:F) in some areas



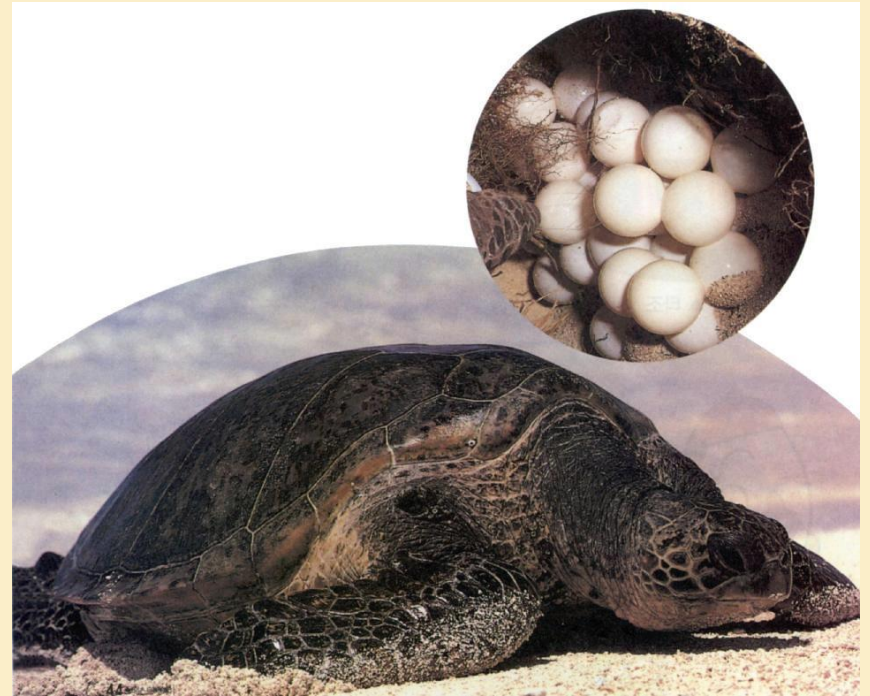
# Order Crocodylia

- Vocalizations by hatchlings cause mother to open next, allow hatchlings to escape
- Some adults carry young to water



# Turtle Conservation

- Problem severe for large tortoises, sea turtles
- Largest, slowest-growing
- Human and animal invasion of beaches, isolated island habitats



# Turtle Conservation

- Herbivores compete with tortoises for limited vegetation
- Eggs, young fall prey to dogs, cats, rats





# Turtle Conservation

- Ocean plastics pollution - bags look like natural jellyfish prey
- Not enough known about biology do devise protective management program
- Tag a turtle? 2000 X



# Order Crocodylia

- Mothers may guard young in pools for period of time to protect them from predators (fish, mammals)



# Some basic terminology

- Amniotic egg-the egg of reptiles, birds, and mammals; it has extra embryonic membranes that help prevent desiccation, store wastes, and promote gas exchange.
- Autotomy-the self-amputation of an appendage. The automized appendage of the reptile is usually regenerated (a tail of a lizard).
- Carapace-the dorsal portion of the shell of a turtle; formed from fusion of vertebrae, ribs, and dermal bone.
- Keratin- a tough, water-resistant protein found in the epidermal layers of the skin of reptiles, birds, and mammals. Found in hair, feathers, hooves, nails, claws, bills, etc.
- Pit Organs-receptor of infrared radiation (heat) on the heads of some snakes (pit vipers).

## References

- [www.smackslide.com](http://www.smackslide.com)