

Phylum Chordata (sec 28.3)

Class Amphibia Amphibians

- animals all started out living in the water. Eventually they made the move to land
- Animals faced several physical challenges in the move from water to land
 - these include buoyancy, oxygen concentration, and temperature

Conditions in Water	Conditions on Land	Adaptations
Water exerts a buoyant force that counters the force of gravity	Air is 1000 x less buoyant than water animals must move against gravity	Limbs develop and the skeletal and muscular systems become stronger
Oxygen is dissolved in water and must be removed by gills through countercurrent circulation	Oxygen is at least 20 times more available in air than in water	With lungs, terrestrial animals can get oxygen from air more efficiently than from water
Water retains heat, so the temperature of water does not change quickly	Air Temperature changes more easily than water temperature daily temperatures may change by 10 oC between day and night	Terrestrial animals develop behavioral and physical adaptations to protect themselves from extreme temperatures

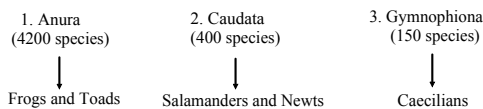
General Amphibian Info.

- most begin life as aquatic organisms until they go through metamorphosis. Then they can live on land
- bilateral symmetry
- most have 4 legs
- moist skin with no scales
- gas exchange through skin
- lungs
- a double loop circulatory system
- aquatic larva

↳ TADPOLES

Amphibian Diversity

- Amphibians are divided into 3 orders



Order Anura → Frogs and Toads

- lack tails and have long legs enabling them to jump
- frogs have longer and more powerful legs than toads
- frogs have moist smooth skin and toads have a rougher dry skin
- they both need water to carry out reproduction
- toads have a kidney shaped gland near the back of their head that releases a bad tasting poison

Order Caudata → Salamanders and Newts

- have long slim bodies with necks and tails
- most salamanders have 4 legs, thin moist skin, and cannot live far from water
- newts are aquatic through their lives
- most lay eggs in water

Order Gymnophiona → Caecilians

- legless and worm-like
- they burrow in soil and feed on worms and other invertebrates
- skin covers the eyes of caecilians
- all have internal fertilization
- found in tropical forests of South America, Africa and Asia

Feeding and Digestion

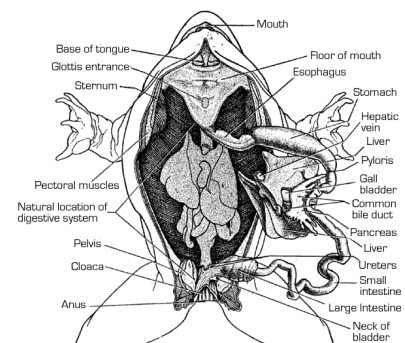
- most frog larva are herbivores and salamander larva are carnivores
- Adult frogs and salamanders feed on small vertebrates and invertebrates
- Frogs capture their food by flicking out their long sticky tongues with great speed and accuracy to capture prey

- Path of digestion in the frog

1. mouth
2. esophagus
3. stomach
4. small intestine - receives enzymes from the pancreas to digest food
 - food is absorbed into the bloodstream and delivered to body cells
5. large intestine
6. cloaca - a chamber that receives the digestive wastes, urinary waste, and eggs or sperm before they leave the body

other organs that help in digestion are the liver and gall bladder

produces bile stores bile



Anuran Digestive System

The natural location of the digestive system is shown by the shaded organs in the middle of the trunk. The anus is cut open to show the walls of the cloaca.

Excretion

- Amphibians filter waste from their blood through their kidneys and excrete either ammonia or urea as the waste product of cellular metabolism
- Ammonia is the waste product of protein metabolism and is excreted by amphibians that live in water
- Amphibians that live on land excrete urea that is made from ammonia in the liver
- Urea is stored in the urinary bladder until it is removed by the cloaca

Respiration

- As larvae most amphibians exchange gas through their skin and gills
- As adults, most breathe through lungs, their thin moist skin, and the lining of their mouth cavities
- Frogs can breathe through their skin either in or out of water
 - live in mud during winter

Circulatory System

- Amphibians have a circulatory system that consists of a double loop

1. The first loop moves oxygen-poor blood from the heart to pick up oxygen in the lungs and skin and then moves oxygen-filled blood back to the heart
2. The second loop blood filled with oxygen moves from the heart through vessels to the body where oxygen diffuses into cells. Then oxygen-poor blood then travels back to the heart and the process begins again

- Amphibians have a closed circulatory system with veins and arteries

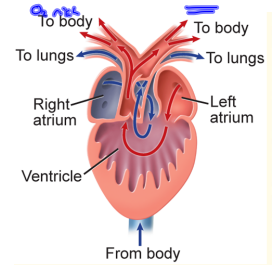
- Amphibians have 3 chambered hearts

1. the atrium is separated into 2 atria by tissue

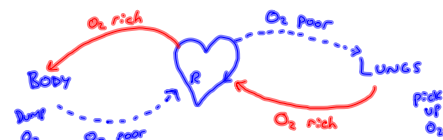
- the right atrium receives deoxygenated blood from the body

- the left atrium receives oxygenated blood from the lungs

2. the ventricle is undivided



O_2 = oxygen



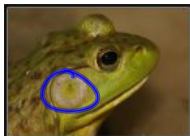
The Brain and Senses

- the nervous system of amphibians are well developed
- the forebrain of frogs contains an area that is involved with the detection of odors in the air
- the cerebellum which helps fish balance is not as developed in frogs because the frogs stay close to the ground
- Vision is the most important sense for amphibians
 - the use their eyes to locate and capture prey
 - the use their eyes to locate and escape predators

** Frogs eyes have structures called nictitating membranes

transparent eyelid that can move across the eye to protect it under water and keep it from drying out on land

- Frogs also have an adaptation of the ear called the tympanic membrane



- a thin internal membrane on the side of the frogs head that acts as an eardrum

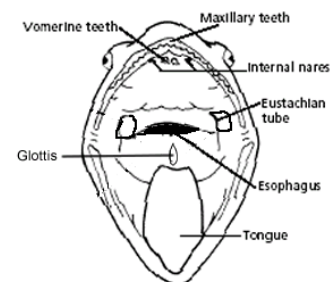
- they can detect high pitched sounds and amplify sounds from the vocal cords

- Other senses include chemical receptors on the skin (touch), taste buds on the tongue and a sense of smell in the nasal cavity

- Amphibians need to sense the temperature of their environment because they are ectotherms

animals that obtain their body heat from an external environment

Frog Mouth



Vomerine and Maxillary Teeth: Used for holding prey

Internal Nares (nostrils) breathing

Eustachian Tubes: equalize pressure in inner ear

Glottis: Tube leading to the lungs

Esophagus: Tube leading to the stomach

Tongue: Front attached, aids in grabbing prey

Tympanic Membrane: eardrum, located behind eyes

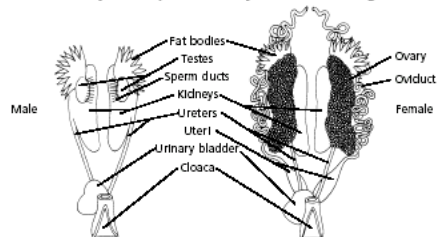
Nictitating Membrane: clear eyelid, protects the eye

Reproduction and Development

- Female frogs lay eggs to be fertilized by males in the water
- the eggs do not have a shell or covering to prevent them from drying out
- after fertilization the embryo uses yolk as nourishment until it hatches into a tadpole
- Tadpoles use gills to breathe
have no legs
are herbivores
2 chambered heart
- Tadpoles undergo metamorphosis and many changes occur including...
 - Adults lungs to breathe
 - 4 legs
 - carnivores / omnivores
 - 3 chambered heart

Frog Urogenital System

Urinary and Reproductive Systems of the Frog



Kidneys: Filter Blood

Ureters: Carry urine from kidneys to bladder

Testes: Make sperm

Oviducts: eggs travel through these

Ovary: makes egg (usually not visible on frog)

Urinary Bladder: Stores Urine

Cloaca: Where sperm, eggs, urine, and feces exit. The "Sewer"