HOW ARE THEY DIFFERENT THAN FISH?

- Stronger skeleton - more rigid vertebrae
- Pelvis
- Mobile neck
- No operculum
- Limbs with digits
WHAT ARE THE CHALLENGES OF LIVING IN TWO PLACES?

- Gas exchange
  - Amphibians use skin and lungs
- Water supports the body, air does not
- Freshwater amphibians gain water
  - Osmoregulation
- Evaporation
KEY CHARACTERISTICS OF AMPHIBIANS:

1. Move back and forth between water and land or live one stage of life in water and the other on land
2. Tetrapods- 4 muscular limbs and feet with toes or fingers
3. Skin that secretes mucus
4. Lacking scales, feathers or hair
5. Larvae are aquatic and go through metamorphosis- gills as juvenile and lungs as adult
6. 3 chambered heart
THERE ARE ALWAYS EXCEPTIONS!
TYPES OF AMPHIBIANS

- Anura – frogs and toads
- Caudata- salamanders and newts
- Gymnophiona – caecilians
WHERE DID AMPHIBIANS COME FROM?

- Sarcoptyerygians
- *Ictheostega*
About 3000 living species
Live on every continent but Antarctica
What do you think is cool about amphibians?
JUST SO YOU KNOW

- You only need to write the main bullets
CHARACTERISTICS OF AMPHIBIANS

- The Importance of Skin
- Protection
  - Microorganisms, UV light, desiccation, injury
- Gas exchange
CHARACTERISTICS OF AMPHIBIANS

- The Importance of Skin
- Temperature regulation
- Absorption and storage of water
CHARACTERISTICS OF AMPHIBIANS

- The Importance of Skin
- Chemicals
  - Prevent drying, produce toxic chemicals
- Coloration
FEEDING AND DIGESTION

- Larvae are herbivores
- Adults are carnivores
  - Eat invertebrates
  - Frogs can eat birds, mammals and other frogs
FEEDING AND DIGESTION

- Most catch prey by sight
  - Aquatic salamanders and caecilians use smell
- Frogs have modified tongue
  - Anterior and flick
  - Sticky
RESPIRATION AND GAS EXCHANGE

- External gills in larvae
  - Some adults retain them
Gills are replaced by lungs
  - Mouth forces air into the lungs
  - Moist skin allows oxygen to diffuse

Amphibian lungs are ventral outpocketings of the gut, though they lie dorsal to it
3 chambered heart with circuit to lungs and skin
- Efficient for getting oxygen to cells
- Some mixing of blood

(a) Fish
(b) Amphibian
(c) Mammal

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ADAPTATIONS FOR A DUAL LIFE

- Heart can change amount of blood pumped to the lungs
  - Why could this be helpful?
CIRCULATION AND GAS EXCHANGE

- When in water or mud, gas exchange happens only through the skin
  - Hibernation
SKELETON AND MOVEMENT

- Modified to counteract gravity - thicker
  - Attach powerful muscles
  - Flat skull - lighter
  - Jaw- for chewing and crushing
SKELETON AND MOVEMENT

- Spine – supports anterior and posterior ends
  - Specialized vertebrae prevent twisting
    - Cervical, Sacral
Bones have joints
- Shoulder, hip, elbow, knee, wrist, ankle,
- Bone patterns similar to lobed fin fish
SKELETON AND MOVEMENT

- Reduced muscles in body wall; appendage muscles enhanced
- Modified movements
  - salamander, frog, caecilians
What are their senses?
NERVOUS SYSTEM AND SENSES

- Vision - large eyes
  - Binocular vision with depth perception
  - Cells for color vision
- Nictitating membrane and eyelid
Hearing and vibrations

- What is sound?
- Hearing is an adaptation to land life
NERVOUS SYSTEM AND SENSES

- Air vibrations - tympanic membrane
  - Middle and inner ear; bones transfer vibration
  - Inner ear: rotation and balance
    - Acceleration/deceleration (like fish)
Ground vibrations - appendages pass vibrations to inner ear bones

- Some anurans use muscles to lock bones in place
  - Shuts their hearing off
- Salamanders have no membrane or middle ear
  - What could this tell us about them?
NERVOUS SYSTEM AND SENSES

- Lateral line – in larvae and adult aquatic salamanders
  - Sense vibrations in the water and water movement
Smell and taste: nose, mouth and tongue
- Recognize food, mate, danger

Sensory receptors in skin
- Heat, cold, pain

Temperature regulation by behavior – cold blooded
- Examples of behavior: Being nocturnal, burrowing
Maintaining water balance (osmoregulation) is the biggest challenge

- Extra water is gained in freshwater
- Water is easily lost on land

Amphibians don’t drink or have kidneys that recapture water

- Warts reduce water loss
- Water is conserved by behavior

What is a behavior that conserves water?
REPRODUCTION AND DEVELOPMENT

- Dioecious - many have external fertilization
- Eggs with no covering – must be in water
REPRODUCTION AND DEVELOPMENT

- Amphibians show courtship behavior
  - Anurans use vocalization
  - Why is vocalization a great adaptation?
REPRODUCTION AND DEVELOPMENT

- Frogs and toads: amplexus
  - Male grasps female; both release gametes
Salamanders: males make sperm packets and leave them on the ground
- Female decides whether or not to accept it
Caecilians have internal fertilization and development.
Amphibians have many adaptations for parental care of their offspring:
- Internal fertilization
- Watching eggs - protection
- Aerating, cleaning and moistening eggs
- Removal of dead or infected eggs

What are the positive benefits of parental care?
- Negatives?
Amphibians have many adaptations for parental care of their offspring:
- Eggs on the back
- Brood in stomach
Metamorphosis
What is it?
What are the changes?
What life processes are affected?

Sketch what happens
■ **Metamorphosis**
■ **Tadpole is the larvae**
■ **Major changes in respiration, movement, body shape and diet**
  ▪ Tail fin lost; frogs lose tail
  ▪ Gills reabsorbed
  ▪ Limbs and lungs develop
  ▪ Some salamanders keep tadpole characteristics into adulthood

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UNIQUE AMPHIBIANS

Purple frog

Turtle Frog

Hellbender