• Reminders:
  - No class next week
  - Final exam in two weeks

• SI Information

• Chapter 23: Vertebrate Animals

• Chapter 38: Animal Behavior
Key Chordate Traits

1 – Notochord: Rod-shaped, provides support
2 – Dorsal, Hollow Nerve Cord: Other groups have solid nerve cords, most others are ventral
3 – Pharyngeal Slits or Clefts: Grooves in pharynx developed into slits open to environment
4 – Muscular, Post-Anal Tail: Tail extends past end of digestive system
Primitive chordates: Tunicates (“Sea Squirts”)

- Most primitive, larval stage has all four chordate traits
Craniates: Chordates with a Head

- Most primitive craniate = hagfish
- Skull of cartilage, lack jaws & vertebrae
- Slime!
Vertebrates

- Craniates with a backbone (vertebrae)
- Most have mineralized endoskeleton of bone
Lampreys: Vertebrates without hinged jaws
Evolution of Jaws

- Hypothesis: jaws evolved from skeletal supports of gill slits

Fig 23.4, pg 480
Chondrichthyes

- Cartilaginous skeleton to reduce weight
- Thick, tough skin made of collagen for muscle attachment
- Paired nostrils, bony teeth, giant liver
• Swim or sink!
• If not swimming, must pump water over gills
• Sensory adaptations including electroreceptors & lateral line system
Osteichthyes – “Bony Fish”

- Bony, calcium carbonate endoskeleton
• Several unpaired fins, 2 sets of paired fins
• Gills made of filaments, protected by operculum, one gill slit
Osteichthyes have a swim bladder

- Used to regulate buoyancy through gas exchange with blood
Osteichthyes: Ray-finned fishes

- Includes majority of living species
- Fins are webs of skin supported by bony rays
Osteichthyes: Lobe-finned fishes

• Rounded fins with rod-shaped bones and thick muscle layer
• Gave rise to land vertebrates
Tetrapod characteristics

• 4 limbs that can support weight on land
• Feet with digits
Amphibians

- Salamanders, frogs, caecilians
- Generally tied to water (for reproduction)
• Frog larvae (tadpoles) have gills, develop in water
• Metamorphosis: Gills and tail absorbed, terrestrial adaptations developed
Amniotes: Reptiles

- Lizards, snakes, turtles, crocodiles, and BIRDS
- Scales (or feathers) that contain keratin provide protection against desiccation
• Most reptiles are ectothermic ("cold-blooded")
  huge energy benefit!
• Birds are endothermic
Birds: Reptiles Adapted for Flight

- Lack bladders, females have one ovary
- Gonads reduced in size
- Toothless
Wings, Feathers, and Bones

- Contour & downy feathers, air-filled bones
- Large pectoral muscle anchored to keel

Fig 23.15, pg 490
Amniotes: Mammals

- Mammary glands
- Hair
- Fat layer, high metabolic rate
- 4-chambered heart
• Differentiation of teeth

Carnivore

Herbivore

Omnivore

Non-differentiated
Monotremes: Egg-laying mammals

- Australia, New Guinea: platypus & spiny anteater
- No nipples!
Marsupials: Pouched mammals

- Live young, embryo nourished through placenta
- Nipples inside marsupium (pouch)
- Born very early in development and stay in pouch
Eutherians: Placental Mammals

- Long pregnancy – embryo completely develops inside mother
- Complex placenta to protect developing young
Ch. 38: Animal Behavior
Fixed Action Patterns (FAPs)

A FAP is an unchangeable series of actions triggered by a Sign Stimulus ("Releaser")
FAP – Yawning!
FAP – Baby Birds & Parent Birds
Exploiting FAPs: Brood Parasitism

Ex: A Common Cuckoo being raised by a Reed Warbler
Learning – modification of behavior as a result of specific experiences

1. **Habituation**: Loss of response to a repeated stimulus
2 - **Imprinting** – Learning that is limited to a specific time period in an animal’s life and that is generally irreversible.
Kinesis – A random movement in response to a stimulus (not learned)

Sow bugs exhibit kinesis in dry areas, becoming more active (greater chance of finding moisture).
Taxis – Automatic movement directed toward or away from some stimulus (not learned)

Brittle stars are *negatively phototaxic*
3 - **Spatial Learning**: Modification of behavior based on memories of landmarks in the environment.
4 - **Associative Learning**: Ability to associate one environmental feature with another

**Trial-and-Error Learning**
Mating Behaviors: Promiscuous, Monogamous, or Polygamous

Black macaque: Promiscuous

Waved albatrosses: Monogamous

Pheasants: Polygamous
Mating Behaviors: Courtship Rituals

Sage grouse in group courtship ritual