Phylum Chordata
Basic Chordate Characters

• notochord
• dorsal hollow nerve cord
• postanal tail
• segmental muscles
• pharyngeal slits and bars
  (ventral heart)
A Simple Chordate
(Amphioxus)
compare Hickman p. 273-274
From Lampreys to Sharks

mako
Lamprey Anatomy

gill slits

eye

tongue

teeth
Shark Advances over Lampreys

- jaws
  - from pharyngeal arches
- bony skin plates
  - evolved to fish scales and teeth
- pectoral and pelvic arches and fins
Evolution of Jaws
Campbell Fig. 18.17B

- gill slits
- cranium
- mouth
- pharyngeal bars

flex points

pharyngeal bars or arches
Chondrichthyes Examples

- black-tip reef shark
- manta ray
- blue-spotted sting ray
External Anatomy
Hickman Fig. 15-7

- lateral line
- spiracle
- nostril
- gill slits
- pelvic fin
- pectoral fin
- heterocercal tail
Bony Fishes

Introduction to Basic Features
Advanced Features

• swim bladder
  - enabling bony skeleton, variable body forms

• operculum
  - to force water over gills

• fin skeletal support
  - for increased maneuverability

• terminal, complex mouth
External Anatomy

- operculum
- lateral line
- terminal mouth
- pectoral fin
- pelvic fin
- homocercal tail
Amphibians

Evolution of Tetrapods
Amphibians

• “living a double life”
  Have aquatic and terrestrial adaptations
• Eggs
  - fertilized in water, no shell, covered with gelatin
• Aquatic larva
  - Tail, lateral line, gills, no legs
Adult Terrestrial features

- After "metamorphosis"
- Lungs replace gills
- Tail disappears
- Four limbs
- Eardrums
- Loses lateral line
- Eats insects
Amphibian groups

• Have tails
  - Salamanders, newts, etc.
• Lack tails
  Frogs and toads
Salamanders

Tail!
walking is awkward;
legs out on sides of body
Frogs and Toads

Tail lost!
ribs and neck reduced, hind legs enlarged
• communicate with sound
Reptiles
Turtles, Snakes, Lizards, and Crocodiles

- nostril
- pit organ
- poison gland
- hollow fang
- glottis
Reptilian adaptations

• Keratin covered scales “waterproofed”
• Eggs with shells that retain water
  - Amniotic egg
• Ectothermic - do not use metabolism to alter body temperature
Reptile groups

• Lizards
• Turtles
• Crocodiles and alligators
• Snakes
Lizards

• skin shed in patches, external ears, usually with legs
• well adapted for desert, but also in wet, warm habitats; one iguana is semi-marine
Examples of Lizards

Komodo dragon

iguana
Start here
Snakes

- body elongated, legs lost, jaws detach, anterior glottis
- move by scales and writhing
- all carnivorous, but many are not poisonous
- wet or dry terrestrial, freshwater, and fully marine habitats
Examples of Snakes
compare Campbell Fig. 18.20

coral snake
olive sea snake
garter snake
timber rattlesnake
Crocodiles

- alligator, crocodiles, caimans, gavials
- freshwater or marine
- occupy all temperate and tropical climates except Europe
Crocodile Characteristics

• carnivores, foraging partly on land
  - elevated eyes and nostrils
  - large, socketed teeth, powerful jaws
• tail compressed laterally for swimming
• scales not shed
Crocodilia

American crocodile

not an alligator:
narrow snout, large lower tooth exposed with mouth closed
Turtles

shell: dorsal carapace, ventral plastron

• very long lifespans
• freshwater, marine, & terrestrial
• omnivores or carnivores
Turtles

carapace

terrestrial

marine

freshwater

plastron
Birds

- Amniotic eggs, scales on legs, keratin
- Feathers
- Reduced skeleton and large muscles for flying
- Special lungs and circulatory system
- Endothermic - make their own heat
Feathers

- light weight, but strong
  - tubular, air-filled
- molted and replaced periodically
- insulation, waterproofing, signaling, camouflage, touch sensitivity
Flight Muscles

White meat
Air Sacs and Breathing
Mammals

Basic Features of the Class
Mammal Adaptations

- endothermy, hair, sweat and scent glands
- varying teeth (“heterodont”), epiglottis
- improved olfaction, larger nasal cavity
- 4-chambered heart, diaphragm
- more coordination, acute senses, and learning ability
Endothermy

maintaining constant body temperature by using extra energy

• insulation by fat, hair, large body size
• cooling by sweat, heat radiation, panting
• allows activity at low temperatures
Hair

- manufactured by epidermis
- for insulation
- for signaling and camouflage
- for sensing touch and air motion
  - especially whiskers
Mammalian Skin Glands

• sebaceous glands
  - condition, waterproof skin and fur
• sweat glands
  - cooling; communication by odor
• mammary glands
  - milk for offspring
Mammalian Teeth

Heterodont
- a standard four tooth types:
  - Incisors
  - Canines
  - Premolars
  - Molars
Oviparous Mammals

- 3 species in one order Monotremata
  - all live in Australia or New Guinea
- lay eggs, but have hair and nurse young

Campbell Fig. 18.22 (a)

duck-billed platypus mother, nursing
Marsupial Mammals

• fetuses do not fully implant in the simpler uterus
• adult females have a belly pouch (marsupium)
  - newborns stay inside, attached to nipple, for months
Marsupial Mammals
Campbell Fig. 18.22B

- Australian kangaroo
- South American tree opossum
- North American opossum
Placental Mammals

- true placenta formed by fetus and mother
- Joins the embryo to the mother within the mother’s uterus
- Embryo is nurtured by blood from the mother
- 95% of all mammals
Placental mammals
## Some Major Animal Phyla: A Review

<table>
<thead>
<tr>
<th>Phylum</th>
<th>Representative Animals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porifera</td>
<td>Sponges</td>
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<tr>
<td>Cnidaria</td>
<td>Hydras, jellies, sea anemones, corals</td>
</tr>
<tr>
<td>Platyhelminthes</td>
<td>Flatworms (planarians, flukes, tapeworms)</td>
</tr>
<tr>
<td>Nematoda</td>
<td>Roundworms</td>
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<tr>
<td>Mollusca</td>
<td>Snails, slugs, bivalves (such as clams), squids, octopuses</td>
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<tr>
<td>Annelida</td>
<td>Segmented worms (earthworms, polychaetes, leeches)</td>
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<tr>
<td>Arthropoda</td>
<td>Horseshoe crabs, arachnids (such as spiders), crustaceans (such as lobsters), insects, centipedes, millipedes</td>
</tr>
<tr>
<td>Echinodermata</td>
<td>Sea stars, sea urchins</td>
</tr>
<tr>
<td>Chordata</td>
<td>Lancelets, tunicates, lampreys, fishes, amphibians, reptiles, birds, mammals</td>
</tr>
</tbody>
</table>