

**November 18, 2013**

Characteristics of Chordates:

- Cephalization: development of a definite “head end”
- Segmented: serial metamerism
- Eucoelic: true coelom

Cephalochordata example: *Amphioxus* = *Branchiocephala*

Subphylum Urochordata → tunicate “Sea squirts” “Salps”

- Cellulose = beta1-4 linkage → can’t break down with spit
- Glucose = alpha1-4 linkage
- Tunicates can make cellulose

Tunicata

- marine
- sessile = non-motile
- lifestyle
  - o external fertilization → zygote → blastula → gastrula → larvae (free swimming)  
→ goes to bottom → becomes sessile

Subphylum Vertebrata

- vertebral column (back boned animals)

Superclass Pisces

- all fishes
- all diecious (almost all)
- most have external fertilization
- oviparous
- anadromous fish
  - o salmon
  - o spawning fresh water, developing salt water
- catadromous fish
  - o eels
  - o spawning salt water, develop in fresh water
- homing instinct → salmon are great example
  - o use fish ladder to get past dam
  - o nitrogen gas expansion is problem

Class Chondrichthyes – sharks, skates, rays

- 800 to 1000 species known
- mostly marine

**November 20, 2013**

### South America and Evolution of stingrays in fresh water



- marine rays and sharks got stuck in freshwater
  - o two freshwater lineages for sharks / rays
    - China and South America

Daniel R. Brooks

- worked on tapeworm host / parasite relationships
- worked with stingrays
- Amazon River used to drain to the pacific
- Cestode in *Pomatotrygon* → stingray in Amazon (fresh water)
  - o Tape worm in ray name: *Pomatotrygonocestus*

Richard Pyle at Bishop Museum

- coelacanth → hasn't changed in millions of years
- lobed fins

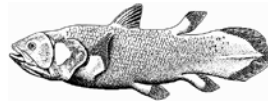
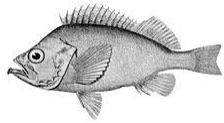
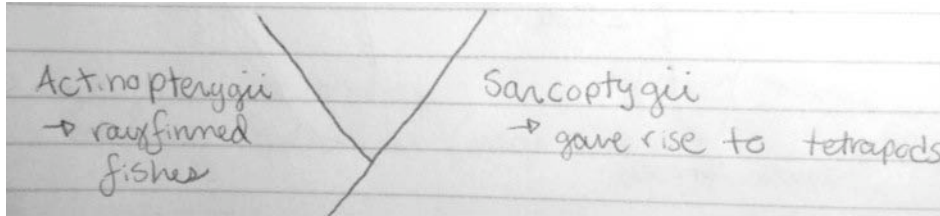
Two types of evolution:

- 1) Anagenetic evolution: non-diversifying, no new species, one species moving forward

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Biodiversity video

Ecotones can go higher as you get closer to the equator



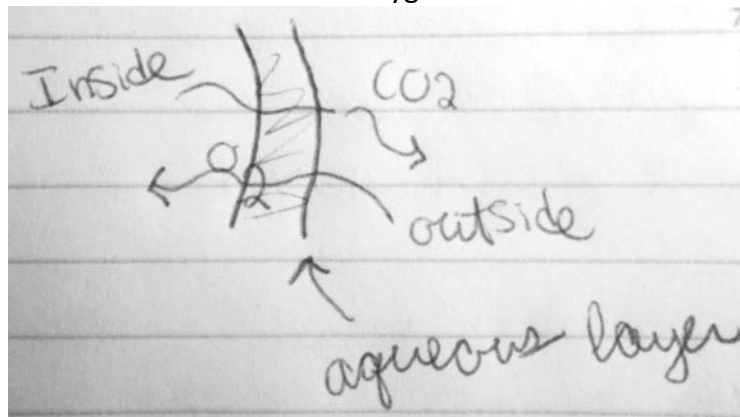
Actinopterygii  
 Family Salmonidae  
 → *Salmo gairdneri*

Sarcopterygii

Swim bladder for buoyancy

Transition from ocean to land

- movement → precursors to land tetrapods
- breath air → gills to lungs
  - o air has 20x more dissolved oxygen than water



- o
- air is not buffered from changes in temperature
- land environments are more diverse than marine → habitat heterogeneity
- 400 MYA – Devonian → Pangea → transition to land

Class Amphibia

- frogs
- salamanders
- Order Apoda
  - o *Caecilians* → no legs
- Order Caudata → tailed amphibians
  - o Salamanders
    - Family Plethodontidae → lungless salamanders
    - Family Ambystomatidae

- *Ambystoma tigrinum*
  - External fertilization → Eggs in fresh water → larvae with gills → paedomorphic → metamorphose → land → eggs