Chapter 9. Origin of Tetrapods

- Late Devonian – 360 mya
- Sarcopterygian fishes
  - Dipnoi are sister taxon among extant
  - Extinct sister taxon – Elpistostegidae
    - Dorsoventrally flattened fishes
    - Eyes on top of heads, elongated snout
    - Share paired frontal bones and ventrally projecting ribs with tetrapods
- *Acanthostega* – earliest tetrapod
  - Fishlike, retained gills (groove on ceratobranchial)
  - 8 fingers on forelegs (pentadactyl limb not ancestral)

Hypotheses for Tetrapod origin

- Drought – hypothesis
  - Limbs allowed movement over land to other water bodies
- New hypothesis – selective advantage in water
  - Juveniles in shallows – crawl or lift to breathe
  - Move to land to escape predation, exploit food source (insects)
  - Dispersal stage

Tetrapod Radiation

- Devonian Tetrapods – diverse
  - Some closely related to amniotes, thus amphibians reserved for modern forms
  - Missing portion of fossil record from late D to early Carboniferous
- Carboniferous forms – 3 groups
  - Temnospondyls – generally more aquatic, immobile skulls, 4 fingers on hands
    - May be related to Lissamphibia
  - “anthracosaurs” – generally more terrestrial, kinetic skulls, five fingers
    - Closely related to amniotes
  - Lepospondyls – small, lizard-sized, with simple vertebrae and teeth
    - Relationship to others unknown
- Most extinct by end of Permian

Amniotes

- Originated in late D or early Carbo.
  - First – *Casineria* (85 mm long)
  - Radiated in late C or early Permian, and replaced nonamniotes
- Derived Features
  - Amniotic egg (chorion, amnion, allantois)
    - Allows larger eggs gas exchange, and support on land
    - May have allowed evolution of larger adults
  - Skin changes – waterproofing, keratinous derivatives (scales, feathers, hair)
  - Costal lung ventilation
Temporal Fenestration (amniotes)

- Holes in skull – allow places for muscle attachment and bulging
  - Stronger forces – prey capture and manipulation
  - Anapsid – primitive condition – no holes
    - Retained in turtles
  - Synapsid – single hole – mammals and ancestors
    - Branched off early
  - Diapsid – two holes – other reptiles and birds