Bio1B Evolution 10

Last lecture:

Species & speciation

- Hybridization - hybrid zones, reinforcement & hybrid-speciation
- Macroevolution:
  - The fossil record, extinctions and major transitions

Today

Fossil record (cont). [Text Pp. 521-524]

Mass extinctions - the Cretaceous/Paleogene ("K/T") boundary - cause & consequence

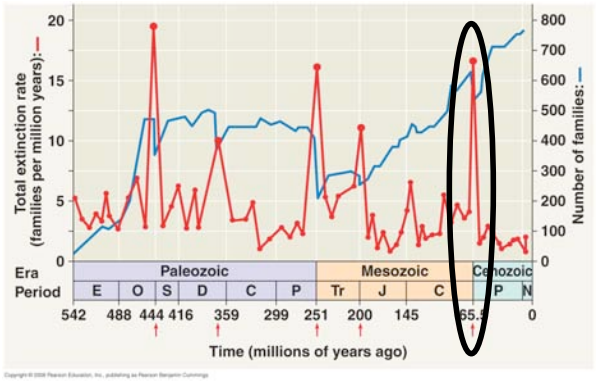
Transitional forms

- Terrestrial vertebrates (tetrapods)
- Birds & evolution of feathers

Evolution of development programs [Text Pp. 525-530]

- The eye, vertebrate limbs

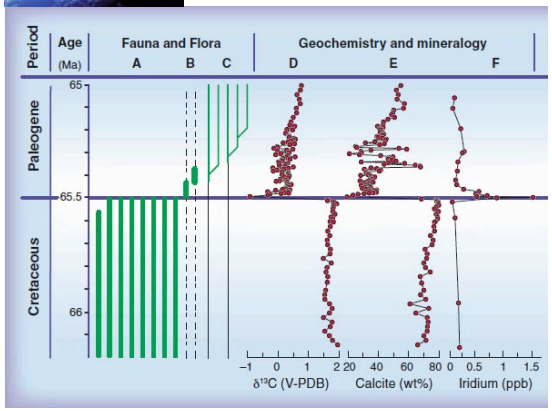
The big 5 mass extinctions



- Evidence from analyses of extinction (red) and blues (diversity) or families of marine invertebrates
- Permian-Triassic - 96% species extinction, 8/27 orders of insects; Volcanism in Siberia?
- Cretaceous-Paleogene ("K/T"), 65 Myr - demise of dinosaurs & large terrestrial animals => mammalian radiation

The asteroid impact hypothesis - Luiz & Walter Alvarez, UC Berkeley

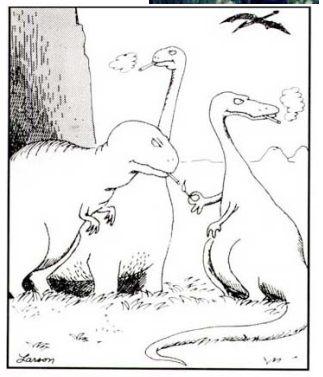
(see Science, 5th March, p1214)



Faunal turnover

Carbon cycle change

Iridium spike



Understanding the transition of tetrapod vertebrates from water to land

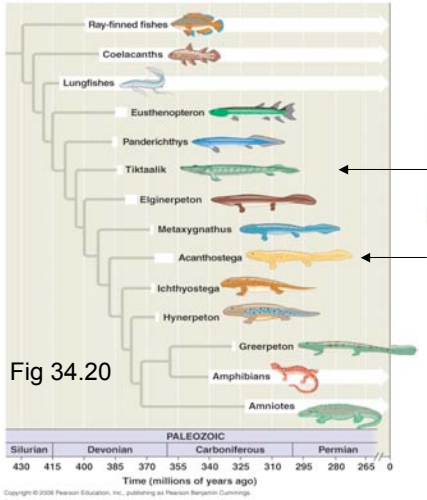
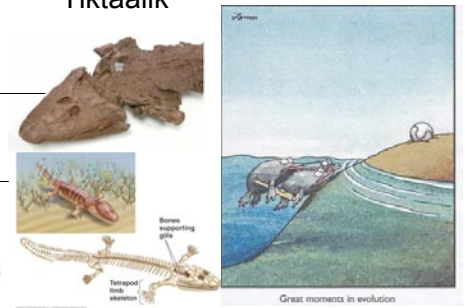


Fig 34.20

Tiktaalik



Acanthostega

Modification of existing structures for new purposes: ears and feathers

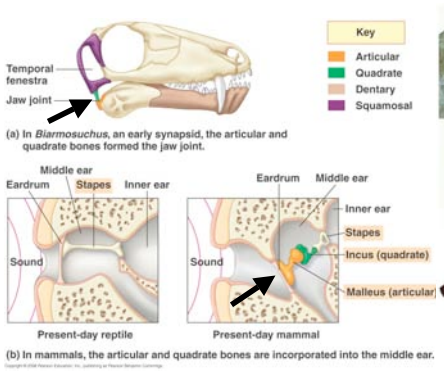


Fig. 34.31. Bones of inner ear of modern mammals are derived from jaw joint of ancestors (see also Fig. 25.6

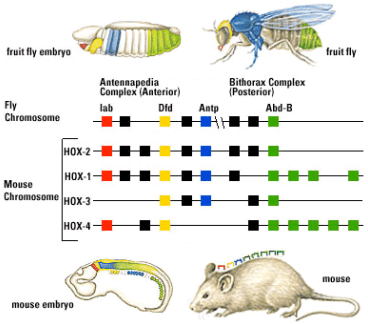
Feathers: for display or warmth before flight?

Late Jurassic feathered dinosaur

Recent discovery: dinosaur feathers were colored - display?

Evolution of developmental genes => phenotypic novelty

- Molecular homology: genes with common ancestry controlling development (top right)
- Changes in timing and spatial pattern of expression => change in phenotype
- E.g Ubx suppresses leg development in flies, but not shrimp



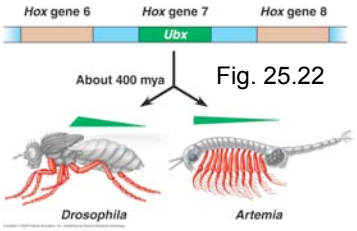
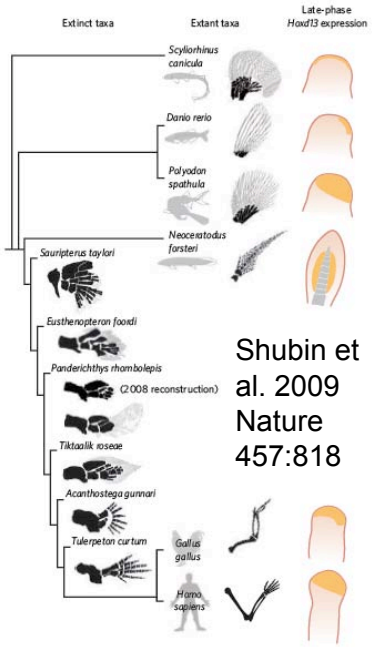


Fig. 25.22

Origin of novelties: The vertebrate limb

- Are the fish “fin” and vertebrate “limb” homologous?
- Very different anatomy, yet…
- Similar patterns of *Hox* gene expression
- Anatomic differences could be due to modification of timing/duration of expression?



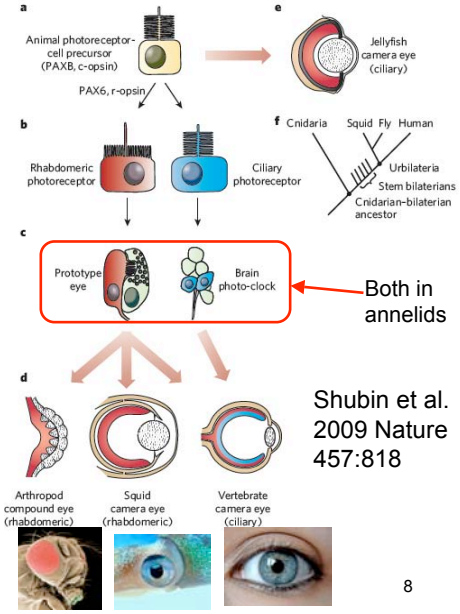
Shubin et al. 2009 Nature 457:818

Origin of novelty: The eye

Convergent evolution or descent with modification?

Molecular homology of key genes - Pax-6 & opsin pathway

Subsequent modification of pathways and structures



Shubin et al. 2009 Nature 457:818