Bio1B EVOLUTION

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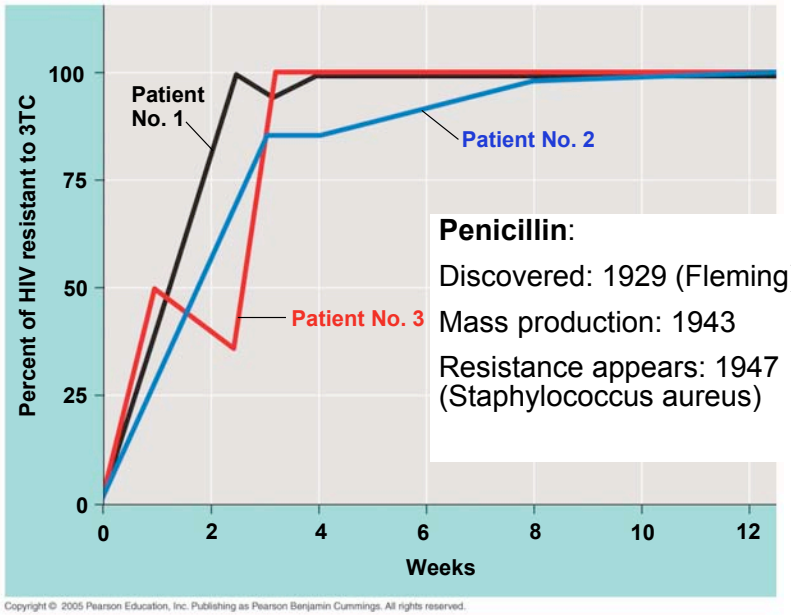
- Relevance & History (L1)
- Tree of life & phylogeny (L2)
- Mechanisms of evolution (L3-6)
- Sex & its evolutionary implications (L6-7)
- Species and how they arise (L8-9)
- Evidence from fossils - macroevolution (L10)
- The evolution of novelties (L11)
- Human evolution and medicine (L12)

Why does evolution matter?

- Understanding our own species
  - Origins, variation, health => evolutionary medicine
- The arms race with pathogens
  - Antibiotic resistance; HIV control etc.
- …. and insect pests of agriculture
  - Insecticide resistance
- Saving biodiversity on a rapidly changing planet
  - Invasive species
  - Overharvesting
  - Habitat loss & climate change

LE 22-13



Development of the theory of evolution

Aristotle (384-322 BC)
- Species fixed, scala naturae

Linnaeus (1707-78)
- Hierarchical classification - binomial system

Mutability of species
- Lamarck, E. Darwin

Geological change
- Hutton, Lyell (uniformitarianism

Fossil record, extinction
- Cuvier

Biogeography
- Humboldt, de Candolle

Population pressure
- Malthus

Linnaean hierarchy

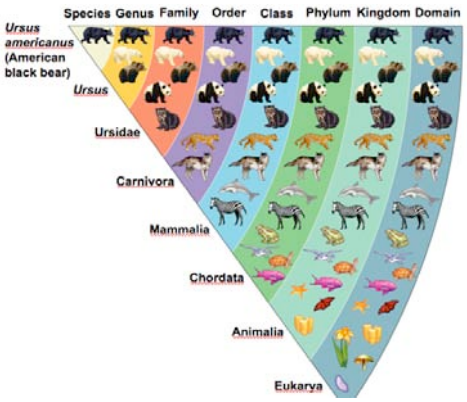
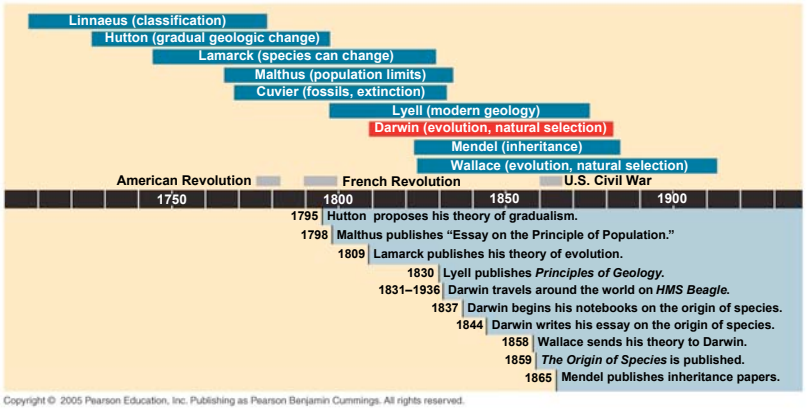


Fig 1.14



Early influences

Henslow - nat hist

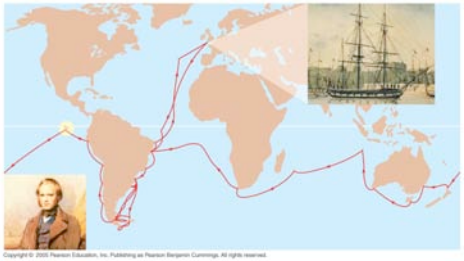
Sedgwick - Geology

Humboldt - explorer, biogeography

Charles Lyell - geology, uniformitarianism

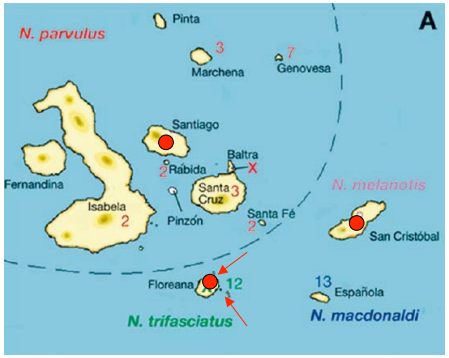
The Voyage of the Beagle

- Mapping coastlines
- Capt. Robert Fitzroy
- Darwin as 22 yr old companion naturalist
- Dec 17 1831 - Oct 1836
- 28m x 7m - 74 people
- Darwin's cabin: 11ft wide, with 6.5 ft chart table; shared.
  - compare to your dorm?



Replica @ Down House with Darwin hologram!

Darwin's mockingbirds



The amazing variety of Darwin's finches - 14 "species" descended from a common ancestor

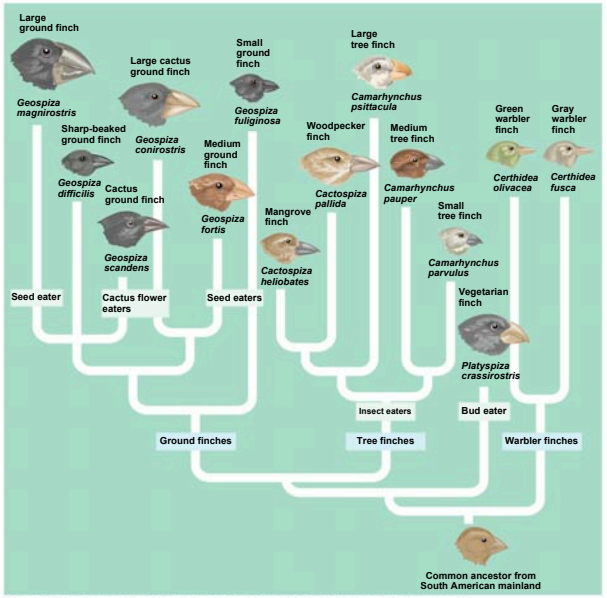
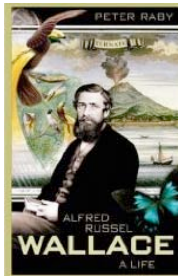


Fig. 1-23

And then there was Alfred R. Wallace… (1823 - 1913)



Professional collector - trained in nat hist, geology, surveying

Amazon: 1848-52 (most collection lost)
SE Asian islands: 1954-62 ("Wallace's line")

Sarawak law (1855) ***"Every species has come to existence coincident both in time and space with a pre-existing, closely related allied species"***
(1858) "*On the Tendency of Varieties to Depart Indefinitely From the Original Type"* - evolution by natural selection

The Darwin-Wallace principle of Natural selection

- Individuals within a population vary for one or more characteristics (traits)
- Traits are (to some extent) inherited by offspring from their parents
- More offspring are produced than can survive

=> those with traits that improve survival/reproduction leave more offspring

=> these favorable traits will accumulate in the population over generations

Lines of evidence in the "Origin of the species by means of natural selection" (Darwin, 1859)

- Artificial selection as analogy to natural selection
- Biogeography: Nested geographic distributions
- Homology of traits modified for different purposes
- Population pressure

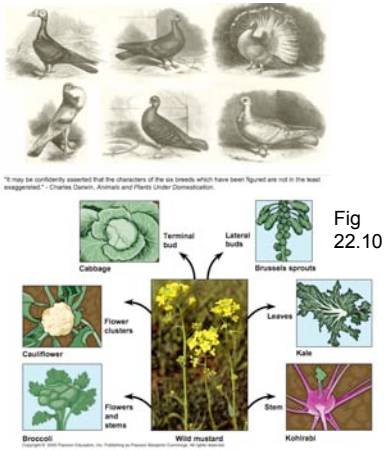


Fig 22.10

Homologous structures: variations on a structure present in a common ancestor

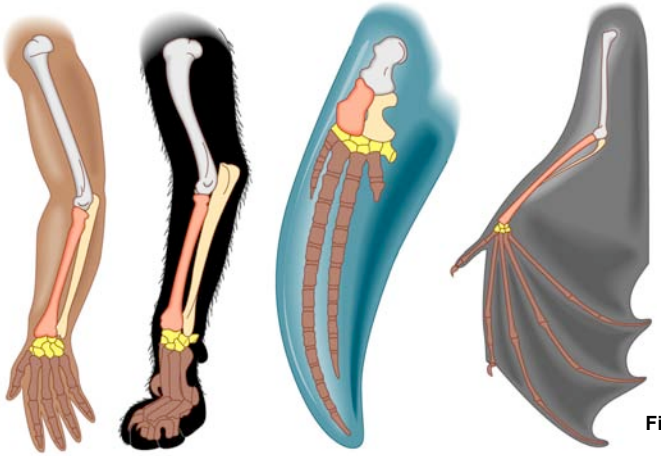
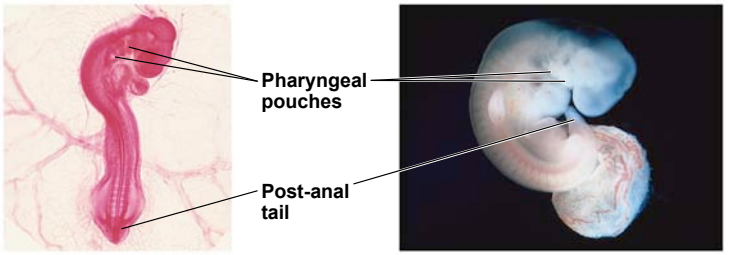


Fig. 22-17

Fig. 22-18

Anatomical homologies of embryos



Pharangeal pouches → Fish - gills; Mammals - ears, throat

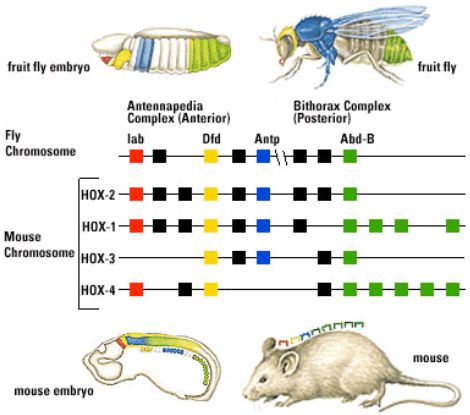
Molecular homologies

Genetic code, tRNA, rRNA

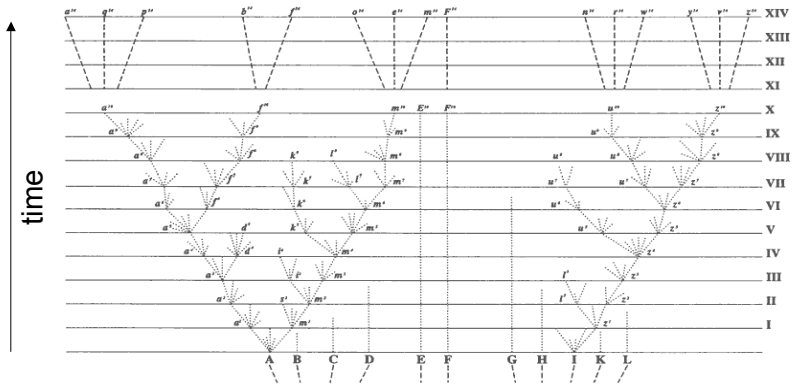
Colinear segmentation (Hox genes)

Molecular homologies

- Genetic code
- Transcription & translation machinery
- Colinear segmentation (Hox) genes
- etc etc.



Descent with modification



The only figure in “Origin of the species”