Lecture Highlights 2/1/02: Speciation and tree of life

Outline

• What is a species?
• Mechanisms of speciation
• Tempo of speciation
• Guide to tree of life (phylogeny)
  – AIDS as an example

What is a species?

• “species” – Latin for “kind” or “appearance”
• originally grouped by morphology (form)
  – the way they looked…
• BUT, many species look very similar…

• Biological species concept (Mayr 1927)
  – “groups of interbreeding natural populations that are reproductively isolated from other such groups”
  – KEY- reproductive isolation
• Genetic analysis

Reproductive barriers

• “pre-zygotic” (before egg)
  – temporal isolation (e.g., salmon runs)
  – habitat isolation (no contact)
  – behavioral isolation (e.g., courtship)
  – mechanical isolation (parts don’t fit)

• “post-zygotic”
  – hybrid inviability
  – hybrid sterility (e.g., mule)

Allopatric speciation – “other country”

• Process:
  1) Barrier blocks dispersal
     ✓ River, volcano, road, Isthmus of Panama
  2) Local environments different
  3) Through time –adapt to local environment (evolution)
  4) If reconnected, will not interbreed

Sympatric speciation

• “together”
• Not that common in animals, but plants
  – E.g., errors in cell division cause extra sets of chromosomes
• 2 examples (in process):
  – Coho salmon:
    • Reproductive isolation – spawning different times in same streams/ rivers
    • Different environments: seasons
  – Gall flies:
    • Reproductive isolation (“early” vs. “tall” galls)
    • Different environments (predators)

How fast is speciation?
  gradualist - slow, gradual change
  vs.
  punctuated equilibrium - Long periods of stasis followed by rapid speciation

• Darwin generally thought gradualist
• Fossil record shows:
  – Mass extinctions followed by rapid (in geological time) radiations
  – New species often appear more abruptly than predict under gradualist

Phylogeny – “tree of life”
  What does it show? (hint: relationship between morphology and time)

  Why is it useful? (Think about HIV phylogeny…..)

The five kingdoms
• Monera (Prokaryotes)

Eukaryotes
• Protista
  – mostly unicellular
• Plantae
• Fungi
• Animalia