Evolution and Natural Selection

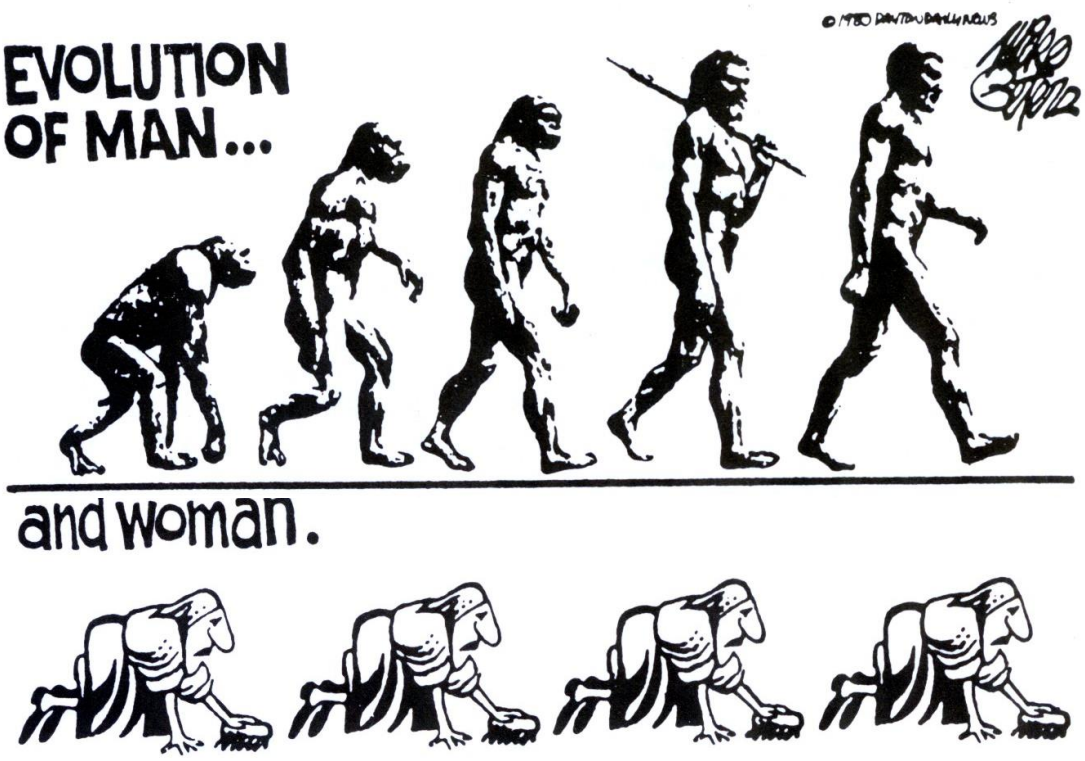
BI 201 Natural History of Guam

Class Presentation 24

Evolution and Natural Selection

- The theory of evolution was first articulated by
  a) Charles Darwin—*The Origin of Species by Means of Natural Selection or The Preservation of Favored Races in the Struggle for Life*, 1859
     - Darwin's theory arose from his observations of the natural world during his voyage around the world on *H.M.S. Beagle* 1831–1836
  b) Alfred Russell Wallace—*On the Tendency of Varieties to Depart Indefinitely from the Original Type, 1859*
     - Wallace reached the same conclusions based on his observations in Indonesia in the mid1850s

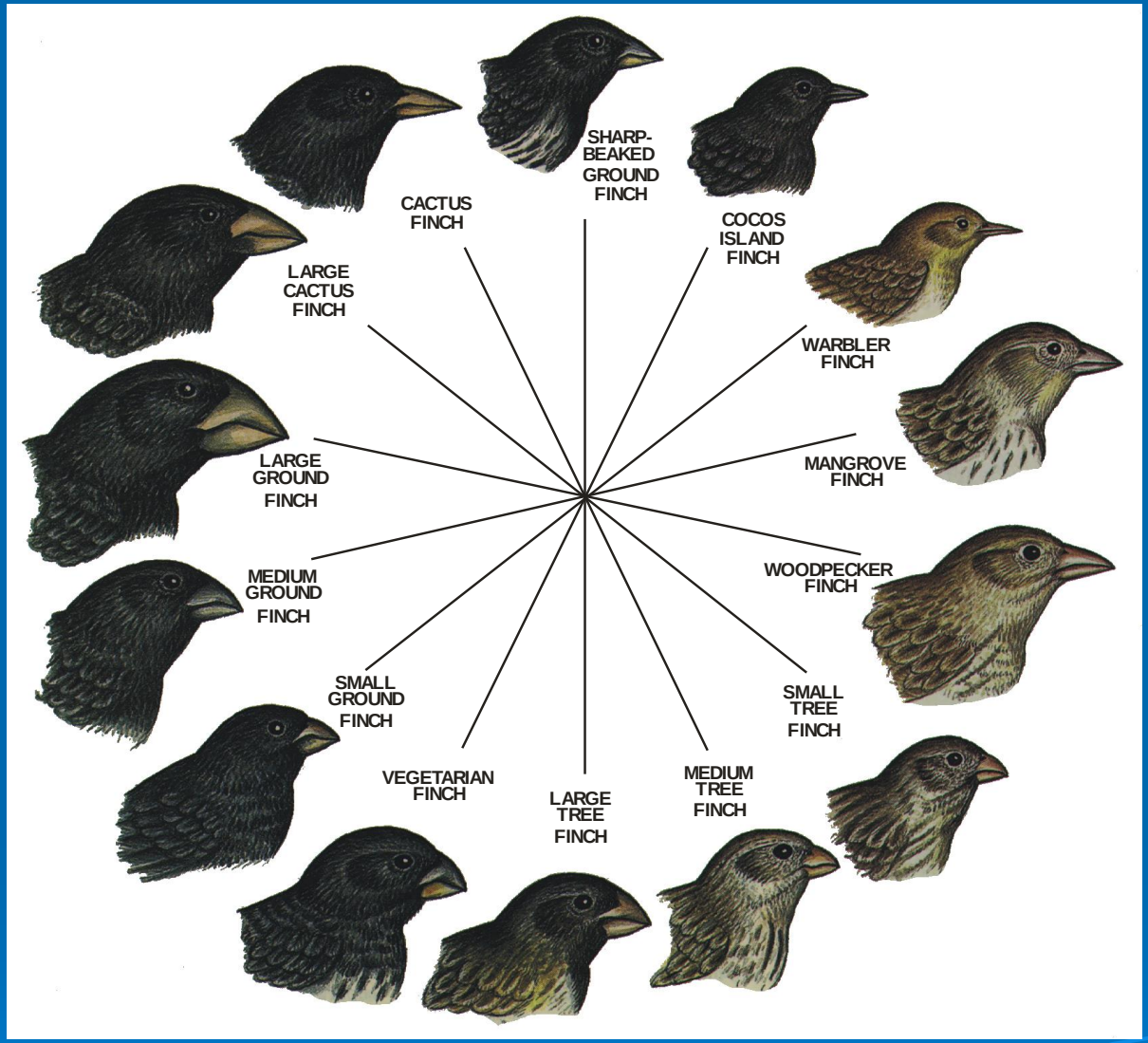
- What is evolution?
  - The standard textbook definition of evolution is “the progressive change in organisms through time”
  - But what is “progressive”?
    - Evolution is “progressive” in the sense of being better adapted to prevailing environmental conditions; NOT progress toward a superior being in the form of humans



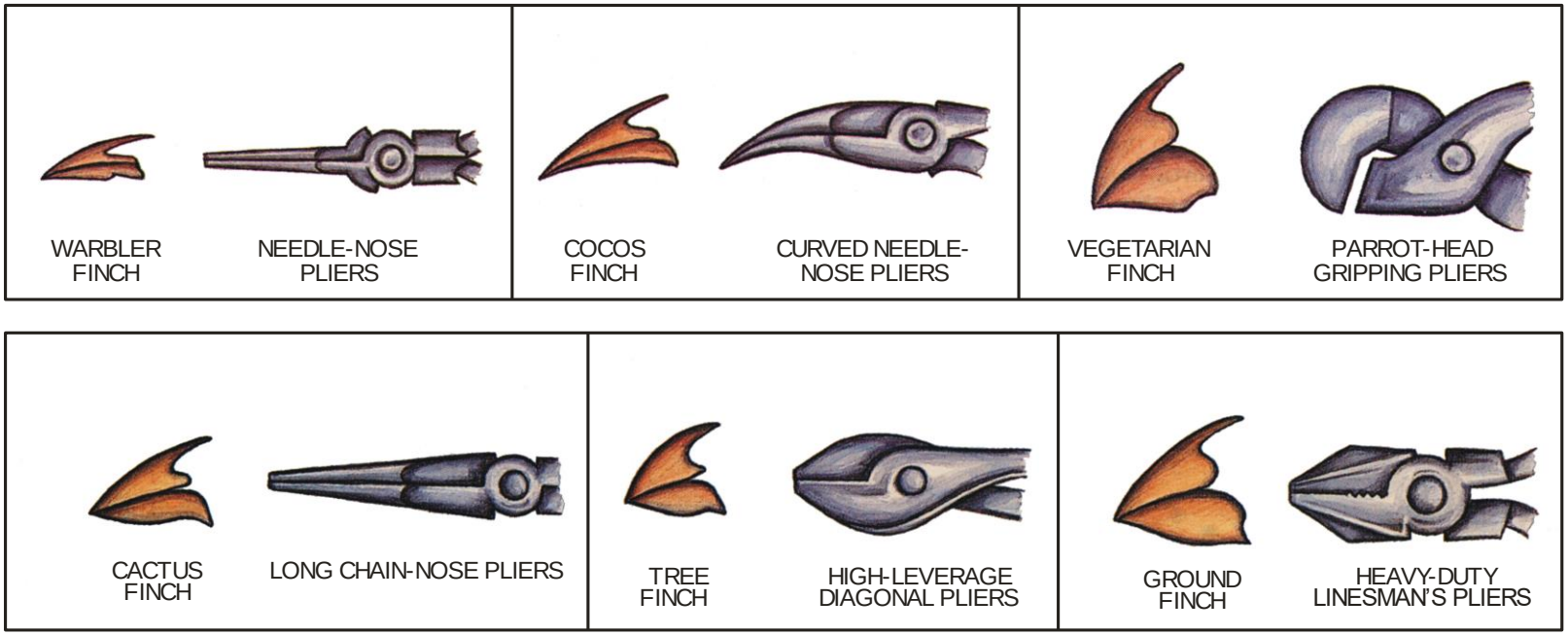
1.10. More mileage from the iconography of the ladder. By Mike Peters, in the *Dayton Daily News.* (Reprinted by permission of UFS, Inc.)

Frank and Ernest

- What then is it that changes in organisms through time?
  - The change is actually a change in the frequency of particular genes within the gene pool of a population, making them better adapted to their environment
  - Darwin described the change as “descent with modification”



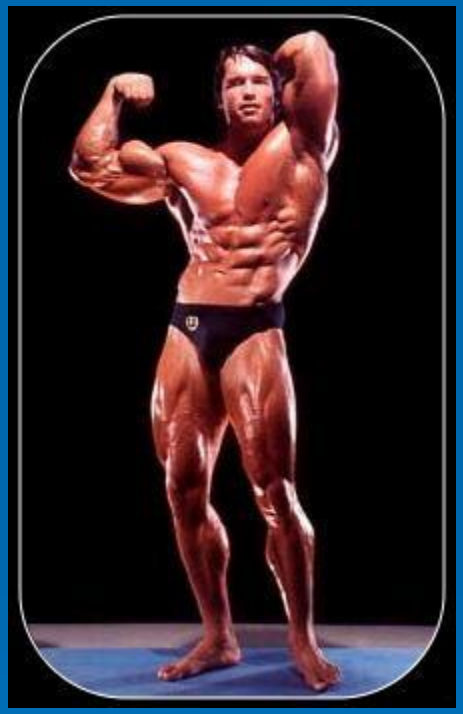
Adaptive radiation, in which a population differentiates after dispersing from one habitat to the next, is believed to have produced the 14 species of Darwin's finches in the past 1–5 My. Thirteen of the species live in the Galápagos Archipelago. [Adapted from Grant, 1991].



Beaks as tools. The beaks of Darwin's finches can be compared to pliers. Just as each type of pliers is designed to perform a specific type of job, finch beacks are adapted for specific diets. [Adapted from Grant, 1991].

- What about “survival of the fittest”?
  - Darwin never used the phrase in his treatise
  - You should not either unless you can adequately explain “**fittest,**” because the term has been misused and abused so frequently by opponents of evolutionary theory

- Who is “fitter”?
- It depends on the definition of fitness
  a) Who has more muscle cells?
  b) Who is physically more fit?
  c) Who is financially more fit?
  d) Who is evolutionarily more fit?

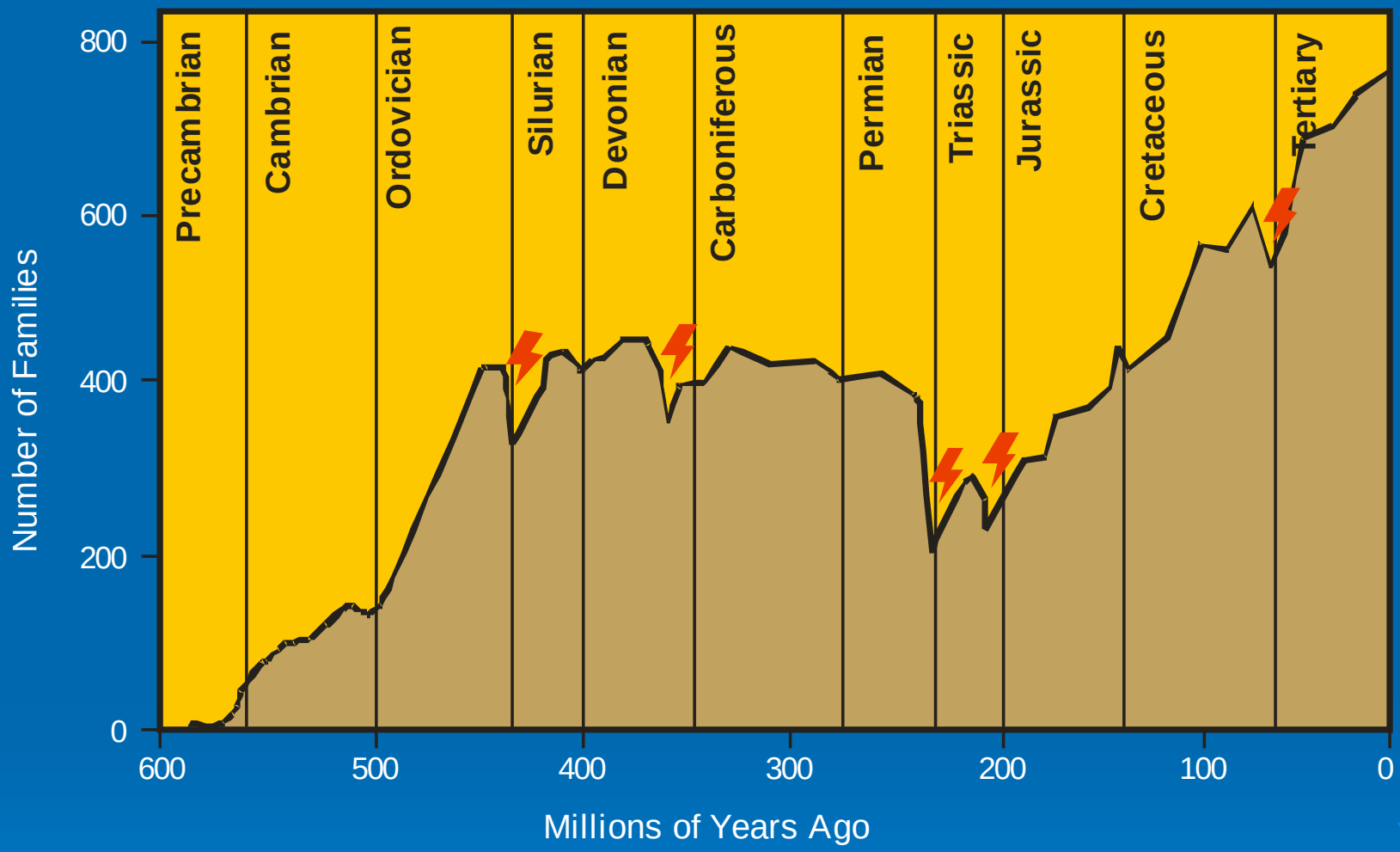


a) Draw!
b) Arnold
c) Arnold
d) Barry!

- Who decides who is fittest?
  - Evolutionary fitness is determined by **natural selection**
    - Natural selection is the sequence of events in which a certain inheritable characteristic that confers advantage to individual, increasing its likelihood of survival to reproduction, is preserved by environment
    - Darwin described natural selection as the “struggle for existence”
    - Thus, individuals that are best adapted to a specific environment are most likely to survive and produce more offspring
    - In the fewest words: natural selection is differential survival and reproduction

- For evolution to occur, there must be genetic variation present in the population, because selection is not possible if all the individuals in the population are genetically the same
  - What is the origin of genetic variation?
    - Recombination
      - In sexually reproducing organisms, recombination is the process in which DNA is exchanged between chromosomes, producing gametes containing genes from both parents on the same chromosome
    - Mutation
      - A mutation is a change in the amount or structure of DNA, resulting in a change in the characteristics of an organism

- Diversification
  - Through geological time, life has increased in the diversity of organisms, as reflected in the fossil record
  - Diversification has not been constant, but has been interrupted by a series of mass extinction events



Biologoical diversity has increased slowly over geological time, with occasional setbacks through global mass extinctions. There have been five such extinctions so far, indicated here by lightning flashes. The data given are for families (groups of related species) of marine organisms. A sixth major decline is now underway as a result of human activity. (Modified from Wilson, 1992).