

REVIEW UNIT 2: EVOLUTION — “TOP TEN”

AP Biology

Key Concepts from this unit

1. Darwin's Principle of Natural Selection

- a. Variation - individuals within a population possess heritable variation within traits
 - i. sexual recombination
 - ii. mutation
- b. Overproduction - organisms produce more offspring than can survive
- c. Competition - those individuals with advantageous adaptations will out-compete others
- d. Differential Survival - individuals with favorable characteristics tend to survive more
- e. Differential Reproduction - individuals with favorable characteristics tend to have more offspring & pass on these traits to their offspring
 - i. alleles for favorable traits increase in the population
 - ii. individuals are selected, but populations evolve

2. Selection

- a. directional vs. stabilizing vs. disruptive
- b. sexual selection
- c. genetic drift = effect of chance events
 - i. bottleneck effect (cheetahs)
 - ii. founder's effect (European settlers in Americas)
- d. gene flow

3. Evidence

- a. fossil record
- b. biogeography
- c. convergent evolution (analogous structures)
- d. comparative anatomy
 - i. homologous structures
 - ii. vestigial structures
- e. comparative embryology
- f. comparative genomics (molecular biology)
 - i. universal genetic code
 - ii. conserved proteins (hemoglobin, cytochrome C)
- g. artificial selection
 - i. agriculture, dog breeding, pesticide resistance, antibiotic resistance

4. Hardy Weinberg equilibrium

- a. $p + q = 1$ (allele frequency)
- b. $p^2 + 2pq + q^2 = 1$ (phenotype frequency)
- c. H-W conditions:
 - i. infinitely large population
- d. random mating
- e. no mutation

- f. no gene flow (migration in or out)
- g. no selection

5. Speciation

- a. biological species concept (Ernst Mayr) - population able to interbreed & produce viable, fertile offspring
- b. allopatric = geographically isolated populations
- c. sympatric = populations in same environment adapt to fill different niches
 - i. adaptive radiation (Galapagos finches)
 - ii. mechanisms:
 - 1. pre-zygotic: habitat factors, temporal factors, behavioral factors, mechanical factors, gamete factors
 - 2. post-zygotic: reduced hybrid viability, reduced hybrid fertility
- d. rate of speciation
 - i. gradualism (Darwin)
 - ii. punctuated equilibrium (Stephen Jay Gould & Niles Eldridge)

6. Origin of Life

- a. Earth is 4.5 billion years old
- b. abiotic origin
 - i. atmosphere of CO₂, methane (CH₄) & ammonia (NH₃) energized by lightning & UV rays
 - ii. formation of organic compounds in seas (Miller – Urey experiment)
 - iii. formation of protobionts & then bacteria (3.5 bya)

7. Hardy-Weinberg Population Genetics Lab

- a. Be sure to review the procedures and the conclusions, and understand:
 - i. Factors that affect evolution (changes in allele frequency) in populations
 - ii. How & when to use both H-W formulas
 - iii. Compare expected frequencies to actual to test for evolution