Natural Selection and Population Genetics Review 2015

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| **Essential Knowledge on These Topics:**   * Natural selection is a major mechanism of evolution. * Natural selection acts on phenotypic variations in populations. * Evolutionary change is also driven by random processes. * Biological evolution is supported by scientific evidence from many disciplines, including mathematics. * Populations of organisms continue to evolve. |

**Concepts You Should be Familiar With:**

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| evolution  descent with modification  natural selection  adaptation  fitness  gene pool  microevolution | genetic drift  bottleneck effect  gene flow  founder effect  selection  genetic equilibrium |

**Vocabulary You Must Know:**

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| evolution  natural selection  fitness  genes  gene pool  mutation  phenotype  directional selection  disruptive selection (balancing selection)  stabilizing selection  bottleneck | Hardy-Weinberg Equilibrium  founder effect  species  population  heterozygous  homozygous  genotype  gene flow  artificial selection  sexual selection  microevolution  genetic drift |

**Math Formulas You Need to Understand, But Not Memorize:**

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| **Hardy-Weinberg Equation**  p2 + 2pq + q2 = 1 | p = frequency of dominant allele  q = frequency of recessive allele |
| **NOTE: You can always be given a set of data and be asked to find a mean, median or mode of that data set. You could potentially be asked to interpret statistical significance of a set of data (i.e. looking at the standard error of the mean, or the standard deviation)** | |

**Past Free Response Questions on This Topic:** [Link to questions here](http://apcentral.collegeboard.com/apc/members/exam/exam_information/219291.html)

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| **Year** | **Topic** |
| 2014 | Q8: [Genetic variation, Allele Frequency](http://media.collegeboard.com/digitalServices/pdf/ap/ap14_frq_Biology.pdf) |
| 2010A | Q3: [Genetic Cross and HW Equilibrium](http://apcentral.collegeboard.com/apc/public/repository/ap10_frq_biology.pdf) |
| 2010B | Q2: [Point Mutation and Allele Frequency](http://apcentral.collegeboard.com/apc/public/repository/ap10_frq_biology_formb.pdf) |
| 2008B | Q3: [Conditions for HW Equilbrium, calculation](http://apcentral.collegeboard.com/apc/public/repository/ap08_biology_form_b_frq.pdf) |

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| 2004A | Q2: [Darwin’s Contributions to Evolutionary Biology](http://apcentral.collegeboard.com/apc/public/repository/ap04_frq_biology_36187.pdf) |
| 2001A | Q2: [Darwin, Natural Selection, Convergent Evolution, Speciation, Behavior, Heterozygote Advantage](http://apcentral.collegeboard.com/apc/members/repository/biology_01.pdf) |

**Videos You Can Watch:**

Natural Selection: <http://goo.gl/2aMwQS>

Examples of Natural Selection: <http://goo.gl/bsXYde>

Crash Course Natural Selection: <http://goo.gl/Arz57p>

Crash Course Population Genetics: <http://goo.gl/c8lbLN>

Solving Hardy-Weinberg Problems: <https://youtu.be/xPkOAnK20kw>

Hardy-Weinberg Equation: <https://youtu.be/oEBNom3K9cQ>

Evolution Continues: <https://youtu.be/fCu1RVq40QI>

**Practice Questions You Can Try:**

Learnerator: [Evolution and Genetic Change](http://www.learnerator.com/ap-biology/q/195/evolutionary-fitness)

**Common Misconceptions Students Have About This Topic:**

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| **Misconception** | **Correct Statement** |
| Individuals can evolve. | Individuals can be selected for or against, but it is the population that evolves. Remember that the smallest unit of life that evolves is a population. |
| “Survival of the Fittest” means the best/fastest/strongest/smartest organisms in a population survive. | Best/fastest/strongest/smartest doesn’t always mean most fit. Fitness is relative to the environment in which the organism lives and whether or not the organism possesses adaptations that make it suited to that environment. Also, fitness is not a measure of strength, size, speed or intelligence--it is a measure of reproductive capacity: how many fertile offspring will an organism leave behind? |
| Organisms can adapt new traits. | Organisms either possess an adaptation that makes them suited to their environment or that causes them to be selected against in that environment. What may be a favored adaptation in one environment may not be favored in another. |
| Humans can’t influence the process of evolution because species will just adapt to the environment and get what they need to survive. | Natural selection doesn’t provide organisms with what they need to survive; remember, organisms either have characteristics that make them suited to their environment or not. Environmental changes can be (and often are) the direct result of human behaviors such as pollution, climate change, habitat loss, and overharvesting/overfishing. |
| Natural selection works to improve a species. | Natural selection does not always result in traits that favor a species. |

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