Speciation, Evidence and Phylogenetics Review 2015

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| **Essential Knowledge on These Topics:**   * Biological evolution is supported by scientific evidence from many disciplines, including mathematics. * Organisms share many conserved core processes and features that evolved and are widely distributed among organisms today. * Phylogenetic trees and cladograms are graphical representations (models) of evolutionary history that can be tested. * Speciation and extinction have occurred throughout the Earth’s history. * Speciation may occur when two populations become reproductively isolated from one another. |

**Concepts You Should be Familiar With:**

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| evolution  biogeography  molecular evidence  phylogeny  species  adaptive radiation  hybridization  parsimony  divergent evolution  hybrid  gene flow | speciation  natural selection  extinction  reproductive isolation  homology  analogy  common ancestry  systematics  convergent evolution  endosymbiotic theory  taxonomy |

**Vocabulary You Must Know:**

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| evolution  species  homologous structures  analogous structures  phylogenetic tree  cladogram  reproductive isolation  extinction  fossil  vestigial structures  taxon  clade  endosymbiosis  Archaea  Bacteria  Eukarya  polyploidy | pre-zygotic isolating mechanisms  geographic isolation  behavioral isolation  temporal isolation  mechanical isolation  gametic isolation  post-zygotic isolating mechanisms  hybrid  hybrid sterility  biogeography  sympatric speciation  allopatric speciation  niche  convergent evolution  divergent evolution  gradualism  punctuated equilibrium |

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

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| **Misconception** | **Correct Statement** |
| If a species appears on the top of a phylogenetic tree, it is the most advanced one. | An organism’s position on a phylogenetic tree only indicates its relationship to the other organisms on the tree. Its location on the tree does not imply that it is more or less advanced as these are subjective, judgmental descriptions and not objective, evidence-based descriptions. |
| Species located at the bottom of a phylogenetic tree are the ancestors of the species above them. | Ancestral species on a phylogenetic tree are found at branching points or as branches of the tree itself. |
| Species located on the far left side of a tree are the oldest species on the tree. | It is the order of branching points from root to tip on a phylogeny that indicate the order in which different [clades](http://evolution.berkeley.edu/evolibrary/glossary/glossary_popup.php?word=clade) split from one another — not the order of taxa at the tips of the phylogeny. On the phylogeny below, the earliest and most recent branching points are labeled. (from <http://evolution.berkeley.edu/evolibrary/misconceptions_teacherfaq.php#a7>) |

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

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| **None for this topic, specifically. But 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 | Q2a: [Phylogeny, analysis of character matrix, constructing a cladogram](http://media.collegeboard.com/digitalServices/pdf/ap/ap14_frq_Biology.pdf) |
| 2013 | Q2c: [Evolutionary history in plants and development of photosystems](http://media.collegeboard.com/digitalServices/pdf/ap/apcentral/ap13_frq_biology.pdf)  Q3: [Evolutionary history, fossils, evidence of evolution](http://media.collegeboard.com/digitalServices/pdf/ap/apcentral/ap13_frq_biology.pdf) |
| 2009A | Q3: [Phylogeny, genetic variations in cytochrome c](http://apcentral.collegeboard.com/apc/public/repository/ap09_frq_biology.pdf) |
| 2008B | Q4: [Homologies identify evolutionary relationships](http://apcentral.collegeboard.com/apc/public/repository/ap08_biology_form_b_frq.pdf) |
| 2001A | Q2b(iii): [Darwin, natural selection, convergent evolution, speciation, behavior, heterozygote advantage](http://apcentral.collegeboard.com/apc/members/repository/biology_01.pdf) |

**Videos You Can Watch:**

Speciation: <https://youtu.be/rlfNvoyijmo>

Speciation and Extinction: <https://youtu.be/yJLRl2G41nQ>

Phylogenetics: <https://youtu.be/fQwI90bkJl4>

Cladograms: <https://youtu.be/ouZ9zEkxGWg>

Evidence for Evolution: <https://youtu.be/ooGKYediys8>

Essential Characteristics for Life: <https://youtu.be/bILvTe2_FEE>

Crash Course, Taxonomy--Life’s Filing System: <https://youtu.be/F38BmgPcZ_I>

**Practice Questions You Can Try:**

Learnerator: [Drivers of Evolution](http://www.learnerator.com/ap-biology/q/197/causes-of-adaptive-radiation)

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