***Unit 7 AP Biology Master HyperDoc of Expectations and Resources***

[****](https://www.nps.gov/whsa/learn/nature/bleachedearlesslizard.htm)

**Natural Selection: 13-20% of AP Exam**

**Big Ideas~ 1: Evolution *(EVO)*, 2: Energetics *(ENE)*, 3: Information Storage & Transmission *(IST)*, 4: System Interactions *(SYI)***

**EXPECTATIONS: *This is a LARGE Unit, we will use two review videos for this unit for your review.***

| **Topic** | **Learning Targets (I can …) and** Success Criteria (I am learning how …)  *Learning targets are in bold with their success criteria listed beneath* | **4 or 1** |
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| **7.1** | **Introduction to Natural Selection** |  |
|  | **Describe the causes of natural selection. *EVO-1.C*** |  |
| Natural selection is a major mechanism of evolution. | 4 |
| According to Darwin’s theory of natural selection, competition for limited resources results in differential survival. Individuals with more favorable phenotypes are more likely to survive and produce more offspring, thus passing traits to subsequent generations. |  |
|  | **Explain how natural selection affects populations. *EVO-1.D*** |  |
| Evolutionary fitness is measured by reproductive success. |  |
| Biotic and abiotic environments can be more or less stable/fluctuating, and this affects the rate and direction of evolution; different genetic variations can be selected in each generation. |  |
| **7.2** | **Natural Selection** |  |
|  | **Describe the importance of phenotypic variation in a population. *EVO-1.E*** |  |
| Natural selection acts on phenotypic variations in populations. |  |
| Environments change and apply selective pressures to populations. |  |
| Some phenotypic variations significantly increase or decrease fitness of the organism in particular environments. |  |
| **7.3** | **Artificial Selection** |  |
|  | **Explain how humans can affect diversity within a population. *EVO-1.F*** |  |
| Through artificial selection, humans affect variation in other species. |  |
|  | **Explain the relationship between changes in the environment and evolutionary changes in the population. *EVO-1.G*** |  |
| Convergent evolution occurs when similar selective pressures result in similar phenotypic adaptations in different populations or species. |  |
| **7.4** | **Population Genetics** |  |
|  | **Explain how random occurrences affect the genetic makeup of a population. *EVO-1.H*** |  |
| Evolution is also driven by random occurrences - |  |
| 1. Mutation is a random process that contributes to evolution. |  |
| 1. Genetic drift is a nonselective process occurring in small populations -    1. Bottlenecks.    2. Founder effect. |  |
| 1. Migration/gene flow can drive evolution. |  |
|  | **Describe the role of random processes in the evolution of specific populations. *EVO-1.I*** |  |
| Reduction of genetic variation within a given population can increase the differences between populations of the same species. |  |
|  | **Describe the change in the genetic makeup of a population over time. *EVO-1.J*** |  |
| Mutation results in genetic variation, which provides phenotypes on which natural selection acts. |  |
| **7.5** | **Hardy-Weinberg Equilibrium** |  |
|  | **Describe the conditions under which allele and genotype frequencies will change in populations. *EVO-1.K*** |  |
| Hardy-Weinberg is a model for describing and predicting allele frequencies in non-evolving population. Conditions for a population or an allele to be in Hardy-Weinberg equilibrium are - (1) a large population size, (2) absence of migration, (3) no net mutations, (4) random mating, and (5) absence of selection. These conditions are seldom met, but they provide a valuable null hypothesis. |  |
| Allele frequencies in a population can be calculated from a genotype frequencies.  **RELEVANT EQUATION**  Hardy-Weinberg Equation -  *p*2 + 2*pq* + *q*2 = 1  *p* = *q* = 1  where:  *p* = frequency of allele 1 in the population  *q =* frequency of allele 2 in the population |  |
|  | **Explain the impacts on the population if any of the conditions of Hardy-Weinberg are not met. *EVO-1.L*** |  |
| Changes in allele frequencies provide evidence for the occurence of evolution in a population. |  |
| Small populations are more susceptible to random environmental impact than large populations. |  |
| **7.6** | **Evidence of Evolution** |  |
|  | **Describe the types of data that provide evidence for evolution. *EVO-1.M*** |  |
| Evolution is supported by scientific evidence from many disciples (geographical, geological, physical, biochemical, and mathematical data.) |  |
|  | **Explain how morphological, biochemical, and geological data provide evidence that organisms have changed over time. *EVO-1.N*** |  |
| Molecular, morphological, and genetic evidence from extant and extinct organisms adds to our understanding of evolution - |  |
| 1. Fossils can be dated by a variety of methods. These include:    1. The age of the rocks where a fossil is found.    2. The rate of decay of isotopes including carbon-14    3. Geographical data |  |
| 1. Morphological homologies, including vestigial structures, represent features shared by common ancestry. |  |
| A comparison of DNA nucleotide sequences and/or protein amino acid sequences provides evidence for evolution and common ancestry. |  |
|  | **Describe the fundamental molecular and cellular features shared across all domains of life, which provide evidence of common ancestry. *EVO-2.B*** |  |
| Many fundamental molecular and cellular features and processes are conserved across organisms. |  |
| Structural and functional evidence supports the relatedness of organisms in all domains. |  |
| **7.7** | **Common Ancestry** |  |
|  | **Describe structural and functional evidence on cellular and molecular levels that provides evidence for the common ancestry of all eukaryotes. *EVO-2.C*** |  |
| Structural evidence indicates common ancestry of all eukaryotes -   1. Membrane-bound organelles 2. Linear chromosomes 3. Genes that contain introns |  |
| **7.8** | **Continuing Evolution** |  |
|  | **Explain how evolution is an ongoing process in all living organisms. *EVO-3.A*** |  |
| Populations of organisms continue to evolve. |  |
| All species have evolved and continue to evolve -   1. Genomic changes over time. 2. Continuous change in the fossil record. 3. Evolution of resistance to antibiotics, pesticides, herbicides, or chemotherapy drugs. 4. Pathogens evolve and cause emergent diseases. |  |
| **7.9** | **Phylogeny** |  |
|  | **Describe the types of evidence that can be used to infer an evolutionary relationship. *EVO-3.B*** |  |
| Phylogenetic trees and cladograms show evolutionary relationships among lineages - |  |
| 1. Phylogenetic trees and cladograms both show relationships between lineage, but phylogenetic trees show the amount of change over time calibrated by fossils or a molecular clock. |  |
| 1. Traits that are either gained or lost during evolution can be used to construct phylogenetic trees and cladograms -    1. Shared characters are present in more than one lineage.    2. Shared, derived characters indicate common ancestry and are informative for the construction of phylogenetic trees and cladograms.    3. The out-group represents the lineage that is least closely related to the remainder of the organisms in the phylogenetic tree of cladogram. |  |
| 1. Molecular data typically provide more accurate and reliable evidence than morphological traits in the construction of phylogenetic trees or cladograms. |  |
|  | **Explain how a phylogenetic tree and/or cladogram can be used to infer evolutionary relatedness. *EVO-3.C*** |  |
| Phylogenetic trees and cladograms can be used to illustrate speciation that has occurred. The nodes on a tree represents the most recent common ancestor of any two groups or lineages. |  |
| Phylogenetic trees and cladograms can be constructed from morphological similarities of living or fossil species and from DNA and protein sequence similarities. |  |
| Phylogenetic trees and cladograms represent hypotheses and are constantly being revised, based on evidence. |  |
| **7.10** | **Speciation** |  |
|  | **Describe the conditions under which new species may arise. *EVO-3.D*** |  |
| Speciation may occur when two populations become reproductively isolated from each other. |  |
| The biological species concept provides a commonly used definition of species for sexually reproducing organisms. It states that species can be defined as a group capable of interbreeding and exchanging genetic information to produce viable, fertile offspring. |  |
|  | **Describe the rate of evolution and speciation under different ecological conditions. *EVO-3.E*** |  |
| Punctuated equilibrium is when evolution occurs rapidly after a long period of stasis. Gradualism is when evolution occurs slowly over hundreds of thousands or millions of years. |  |
| Divergent evolution occurs when adaptation to new habitats results in phenotypic diversification. Speciation rates can be especially rapid during times of adaptive radiation as new habitats become available. |  |
|  | **Explain the processes and mechanisms that drive speciation. *EVO-3.F*** |  |
| Speciation results in the diversity of life forms. |  |
| Speciation may be sympatric or allopatric. |  |
| Various prezygotic and postzygotic mechanisms can maintain reproductive isolation and prevent gene flow between populations. |  |
| **7.11** | **Extinction** |  |
|  | **Describe factors that lead to the extinction of a population *EVO-3.G*** |  |
| Extinctions have occurred throughout Earth’s history. |  |
| Extinction rates can be rapid during times of ecological stress. |  |
|  | **Explain how the risk of extinction is affected by changes in the environment. *EVO-3.H*** |  |
| Human activity can drive changes in ecosystems that cause extinctions. |  |
|  | **Explain species diversity in an ecosystem as a function of speciation and extinction rates. *EVO-3.I*** |  |
| The amount of diversity in an ecosystem can be determined by the rate of speciation and the rate of extinction. |  |
|  | **Explain how extinction can make new environments available for adaptive radiation. *EVO-3.J*** |  |
| Extinction provides newly available niches that can then be exploited by different species. |  |
| **7.12** | **Variations in Populations** |  |
|  | **Explain how the genetic diversity of a species or population affects its ability to withstand environmental pressures. *SYI-3.D*** |  |
| The level of variation in a population affects population dynamics - |  |
| 1. Population ability to respond to changes in the environment is influenced by genetic diversity. Species and populations with little genetic diversity are at risk of decline or extinction. |  |
| 1. Genetically diverse populations are more resilient to environmental perturbation because they are more likely to contain individuals who can withstand the environmental pressure. |  |
| 1. Alleles that are adaptive in one environmental condition may be deleterious in another because of different selective pressures. |  |
| **7.13** | **Origins of Life on Earth** |  |
|  | **Describe the scientific evidence that provides support for models of the origin of life on Earth. *SYI-3.E*** |  |
| Several hypotheses about the origin of life on Earth are supported with scientific evidence - |  |
| 1. Geological evidence provides support for models of the origin of life on Earth.    1. Earth formed approximately 4.6 billion years ago (bya). The environment was too hostile for life until 3.9 bya, and the earliest fossil evidence for life dates to 3.5 bya. Taken together, this evidence provides a plausible range of dates when the origin of life could have occurred. |  |
| 1. There are several models about the origin of life on Earth -    1. Primitive Earth provided inorganic precursors from which organic molecules could have been synthesized because of the presence of available free energy and the absence of a significant quantity of atmospheric oxygen (O2).    2. Organic molecules could have been transported to Earth by a meteorite or other celestial event. |  |
| 1. Chemical experiments have shown that it is possible to form complex organic molecules from inorganic molecules in the absence of life -    1. Organic molecules/monomers served as building blocks for the formation of more complex molecules, including amino acids and nucleotides.    2. The joining of these monomers produces polymers with the ability to replicate, store, and transfer information. |  |
| The RNA World Hypothesis proposes RNA could have been the earliest genetic material. |  |

**RESOURCES: *(Tip: Insert your (GSN) and helpful resources in the table below to a copy of this document)***

| **AP Bio Topics** | **Classroom Discussions (GSN), Labs, Activities & Assignments:** | **Additional Materials:**  [**Khan Academy: Natural Selection**](https://www.khanacademy.org/science/ap-biology/natural-selection) |
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| **7.1-6, 7.8, 7.12**  (more on 7.12 in Ch47, Unit 8) |  | **MsLitten’s YouTube (Reviews/Classes):**   * [15: Darwin and Evolution](https://www.youtube.com/watch?v=do-OTNBfOnU&t=8s) (**Review**) * [15: History of Evolutionary Thought](https://www.youtube.com/watch?v=TLqHBFpg5yQ) (Class) * [15: Evidence for Evolution](https://www.youtube.com/watch?v=AzyWwb4jGIg) (Class) * 16: (Review) * [16: Population Genetics](https://www.youtube.com/watch?v=HWQNZYBOFsQ&list=PLvs-TOnIKAzZAad3NDhdDJvnT3nUPtsiB&index=22) (Class) * [16: How Populations Evolve](https://www.youtube.com/watch?v=ONIbigl6Hdg&list=PLvs-TOnIKAzZAad3NDhdDJvnT3nUPtsiB&index=23) (Class)   **Bozeman**:   * [Natural Selection](http://www.bozemanscience.com/001-natural-selection) * [Examples of Natural Selection](http://www.bozemanscience.com/002-examples-of-natural-selection) * [Genetic Drift](http://www.bozemanscience.com/003-genetic-drift) * [Evidence for Evolution](http://www.bozemanscience.com/004-evidence-for-evolution) * [Population Genetics and Evolution](http://www.bozemanscience.com/ap-bio-lab-8-population-genetics-evolution) * [Population Modeling](http://www.bozemanscience.com/population-modeling) * [REVIEW - Natural Selection](http://www.bozemanscience.com/ap-natural-selection-review) * [Solving Hardy-Weinberg Problems](http://www.bozemanscience.com/solving-hardy-weinberg-problems)   **Knuffke Prezis:**   * [Introduction to Evolution](https://prezi.com/-ofhckjwu0lg/ap-bio-evolution-1-introduction-to-evolution/) * [Measuring Evolution](https://prezi.com/1knzh50i8ksq/ap-bio-evolution-4-measuring-evolution/) * [Evidence of Evolution](https://prezi.com/qh5lmnepfcrt/ap-bio-evolution-3-evidence-of-evolution/)   **Quizizz:**   * [Darwin and Evolution](https://quizizz.com/admin/quiz/5aabb69835ce5d0019d3e895) * [How Populations Evolve](https://quizizz.com/admin/quiz/5aabe6c870125900197edc9e) |
| **7.10** |  | **MsLitten’s 7th Period Reviews:**   * [17: How New Species Evolve](https://www.youtube.com/watch?v=k9dU6C2ecdQ&t=11s) (class)   **Bozeman**:   * [Speciation and Extinction](http://www.bozemanscience.com/007-speciation-and-extinction) * [Speciation](http://www.bozemanscience.com/speciation) * [Evolution continues](http://www.bozemanscience.com/evolution-continues) * [REVIEW - Speciation](http://www.bozemanscience.com/ap-speciation-reivew) * [Stickleback Evolution](http://www.bozemanscience.com/stickleback-evolution)   **Knuffke Prezis:**   * [Speciation](https://prezi.com/r5uuvst4zdbr/ap-bio-evolution-6-speciation/) * [Evolutionary Forces](https://prezi.com/s9srf-stybue/ap-bio-evolution-2-evolutionary-forces/)   **Quizizz:**   * [Evolution](https://quizizz.com/admin/quiz/5c3be2d7dcd1c8001a5e38e1) * [Speciation and Macroevolution](https://quizizz.com/admin/quiz/5ab7d281c751ae0019f8a646) |
| **7.6, 7.11, 7.13** |  | **MsLitten’s 7th Period Reviews:**   * [18: Origin and History of Life](https://www.youtube.com/watch?v=bu8ji-2czhc) (**Review**) * [18: Origin of LIfe](https://www.youtube.com/watch?v=Amwlf0lS7V0) (class) * [18: History of Life](https://www.youtube.com/watch?v=nS9M2_KlaCo) (class)   **Bozeman**:   * [The Origin of Life - Scientific Evidence](http://www.bozemanscience.com/011-the-origin-of-life-scientific-evidence) * [Biodiversity](http://www.bozemanscience.com/055-biodiversity)   **Knuffke Prezis:**   * [A (Brief) History of Life](https://prezi.com/boa21ytdaoxy/ap-bio-evolution-7-brief-history-of-life/)   **Quizizz:**   * [Origin and History of Life](https://quizizz.com/admin/quiz/5c3be2d7dcd1c8001a5e38e1) |
| **7.7, 7.9** |  | **MsLitten’s 7th Period Reviews:**   * 19: Taxonomy, Systematics, and Phylogeny (**Review**) * [19: Systematic Biology](https://www.youtube.com/watch?v=Tq4Ajq95S6s) (class) * [19: Domains](https://www.youtube.com/watch?v=ZIzVXAFVkBU) (class) * [19: Phylogeny](https://www.youtube.com/watch?v=ZiMb53SM2K4) (class) * [Investigation 3: Blast Lab](https://www.youtube.com/watch?v=IWSCT5DWrM4&t=129s)   **Bozeman**:   * [Phylogenetics](http://www.bozemanscience.com/006-phylogenetics)   **Knuffke Prezis:**   * [Classification of Life](https://prezi.com/-5o1wcu39exk/ap-bio-evolution-5-classification/)   **Quizizz:**   * [Phylogeny And Cladograms](https://quizizz.com/admin/quiz/5c47eafac9053f001bfc7d9e) |

**CONNECTIONS: *A Step Further (Choose one connection below and take a digital step further for your assessment)***

| **Sustainability** | [UN Sustainability Goal #15: Life on Land](https://www.un.org/sustainabledevelopment/biodiversity/)  [Millions of Bangladeshi children at risk from climate crisis, warns UNICEF](https://news.un.org/en/story/2019/04/1036141)  [Living in harmony with nature](https://www.cbd.int/undb/media/factsheets/undb-factsheet-sustainable-en.pdf) |
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| **NGSS** | [HS-LS4-1](https://www.nextgenscience.org/pe/hs-ls4-1-biological-evolution-unity-and-diversity)  [HS-LS4-4](https://www.nextgenscience.org/pe/hs-ls4-4-biological-evolution-unity-and-diversity)  Identify which [Science Practices](https://ngss.nsta.org/PracticesFull.aspx) you have “practiced” this unit - provide evidence |
| **Careers** | [Opportunities in science editing](https://esajournals.onlinelibrary.wiley.com/doi/10.1002/fee.1814)  [Population Genetics Jobs](https://www.ziprecruiter.com/Jobs/Population-Genetics)  [Careers in Paleontology](https://jobs.lovetoknow.com/careers-paleontology)  [Evolutionary Biologist: Job Description, Salary and Outlook](https://study.com/articles/Evolutionary_Biologist_Job_Description_Salary_and_Outlook.html) |
| **Interesting Information** | [Killifish survive polluted waters thanks to genes from another fish](https://www.the-scientist.com/news-opinion/killifish-survive-polluted-waters-thanks-to-genes-from-another-fish-65838)  [Humans’ maternal ancestors may have arisen 200,000 years ago in southern Africa](https://www.sciencenews.org/article/humans-oldest-maternal-ancestors-may-have-arisen-southern-africa)  [Some Salamanders Can Regrow Lost Body Parts. Could Humans One Day Do the Same?](https://www.smithsonianmag.com/innovation/some-salamanders-can-regrow-lost-body-parts-could-humans-one-day-do-same-180974090/) |

| **Big Idea** | **Enduring Understandings:** | **Topic** |
| --- | --- | --- |
| EVO-1 | **Evolution is characterized by a change in the genetic makeup of a population over time and is supported by multiple lines of evidence.** | 7.1-6 |
| EVO-2 | **Organisms are linked by lines of descent from common ancestry.** | 7.6-7 |
| EVO-3 | **Life continues to evolve within a changing environment.** | 7.8-11 |
| SYI-3 | **Naturally occurring diversity among and between components within biological systems affects interactions with the environment.** | 7.12-13 |

Document framework provided by Winnie Litten

| **Unit 7: Natural Selection Review Resources** | | |
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| The APsolute RecAP | [Episode 40: Natural Selection](https://the-apsolute-recap-biology-edition.simplecast.com/episodes/the-apsolute-recap-biology-edition-natural-selection)  [Episode 41: Population Genetics](https://the-apsolute-recap-biology-edition.simplecast.com/episodes/the-apsolute-recap-biology-edition-population-genetics)  [Episode 42: Evidence of Evolution](https://the-apsolute-recap-biology-edition.simplecast.com/episodes/the-apsolute-recap-biology-edition-evidence-of-evolution) | [Website: Biology — The APsolute RecAP](https://www.theapsoluterecap.com/subjects/biology)  [Instagram](https://www.instagram.com/theapsoluterecap/) |
| Bozeman | [Natural Selection](http://www.bozemanscience.com/001-natural-selection)  [Examples of Natural Selection](http://www.bozemanscience.com/002-examples-of-natural-selection)  [Genetic Drift](http://www.bozemanscience.com/003-genetic-drift)  [Evidence of Evolution](http://www.bozemanscience.com/004-evidence-for-evolution)  [Speciation and Extinction](http://www.bozemanscience.com/007-speciation-and-extinction)  [Stickleback Evolution](http://www.bozemanscience.com/stickleback-evolution) | [Website](http://www.bozemanscience.com/ap-biology) |
| Khan | Natural Selection | [Website](https://www.khanacademy.org/science/ap-biology/gene-expression-and-regulation) |
| APBioPenguins | Instagram Review - Story Highlights Organized by Unit | [Instagram](https://www.instagram.com/apbiopenguins/) |
| Crash Course | 14 - Natural Selection  15 - Speciation of Ligers and Men  17 - Evolutionary Development  19 - Population Genetics  20 - Taxonomy  21 - Evolution - its a thing | [You Tube](https://www.youtube.com/playlist?list=PL3EED4C1D684D3ADF) |
| Amoeba Sisters | [HW Equilibrium](https://www.youtube.com/watch?v=7S4WMwesMts)  [Speciation](https://www.youtube.com/watch?v=udZUaNKXbJA)  [Natural Selection](https://www.youtube.com/watch?v=7VM9YxmULuo) | [You Tube](https://www.youtube.com/user/AmoebaSisters/videos) |
| College Board | Live YouTube Classes | [YouTube](https://www.youtube.com/user/advancedplacement) |