Natural Selection in the Natural Environment

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| **At Camp Thunderbird (An Overview):** |
| **General Overview:**  Students will gain a deep understanding of the evolutionary concepts of adaptation, mutation and natural selection.  Students will explore real mammal skulls with an inquiry-based approach, create their own phylogenetic trees, play games to simulate natural selection, go on a scavenger hunt to look for adaptations in our local environment, and more. |
| **Learning Objectives:**   * Solidify the concept of adaptation through exploring it in plants and animals. * Compare and contrast differences in adaptations found in a variety of mammal skulls. * Create phylogenetic tree to visualize evolutionary concepts such as descent with modification. * Experience and interpret adaptations within the local environment. * Simulate natural selection through play-based learning to understand how changes occur over generations. * Understand mutations and how they can impact individuals, populations, and species. |
| **Curriculum Connections:**   * Evolution by natural selection provides an explanation for the diversity and survival of living things * Experience and interpret the local environment * Apply First Peoples perspectives and knowledge, other ways of knowing, and local knowledge as sources of information * Express and reflect on a variety of experiences and perspectives of place * Organisms have evolved over time, survival needs, natural selection |

Pre-Program

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| **Guiding Questions and Resources:**  Introduce the topic of evolution in your classroom before your Camp Thunderbird program to create a base understanding. Explore the history of evolutionary theory with a focus on Charles Darwin. Look at evidence of evolution through fossil records and structural similarities. To help with this, the resources we have linked below have been carefully curated and are some of the best sources for teaching about evolution.  *Who is Charles Darwin and what is the history of evolutionary theory?*   * Charles Darwin: English naturalist whose theory of evolution became the foundation of modern evolutionary theory. *Why was he important? And who else played a large role in shaping modern evolutionary theory?*   + Science NetLinks Charles Darwin and the origin of species (browse the various lesson resources below the introduction): <http://sciencenetlinks.com/collections/charles-darwin-and-origin-species/>   + PBS learning Charles Darwin Resource: <https://www.pbslearningmedia.org/resource/tdc02.sci.life.evo.lp_darwin/charles-darwin/>   + Charles Darwin resource and comic: <https://www.natgeokids.com/nz/primary-resource/charles-darwin-primary-resource/>   *What is the theory of evolution?*   * Introduce the theory of evolution to students. Relate it to humans and familiar animals, and keep it fairly general. There are several evolutionary concepts to dive in to. At Camp Thunderbird we will focus on adaptation and natural selection.   + PBS learning Introduction to Evolution: <https://www.pbslearningmedia.org/resource/hs11.global.ancient.earl.lpintroevol/introduction-to-evolution-how-did-we-get-here/>   + UC Berkeley site with several resources (check out the teaching materials, or use “evolution in the news” to pull on recent events): <https://evolution.berkeley.edu/evolibrary/home.php> * Adaptation: Our Camp Thunderbird program has a large focus on adaptation. Consider introducing the concept in your classroom before the program.   + A great BEETLES Project resource introducing adaptation through observing a live organism (find something in your school yard!). Some overlap of concepts with the Camp Thunderbird Program. <http://beetlesproject.org/cms/wp-content/uploads/2017/06/Adaptation-Intro-Live.pdf>   *What are some forms of evidence that prove the theory of evolution?*   * Fossil records have supported the theory of evolution through helping us build phylogenetic trees and understanding the history of species. *What are other forms of evidence?*   + PBS Learning resource on the fossil evidence for evolution: <https://www.pbslearningmedia.org/resource/tdc02.sci.life.evo.lp_fossilevid/the-fossil-evidence-for-evolution/>   + Evidence of evolution worksheet: <https://www.aurumscience.com/biology/11_evolution/evidence.html> |

Post-Program

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| **Wrap up at Camp Thunderbird:**  At the end of the lesson full of activities and games based on adaptation, natural selection, and mutations, the students will wrap up with a debrief using the following prompts:   * What was the most interesting thing you learnt today? * What further questions do you have about natural selection and adaptation? * How do you think climate change will impact species adaptations?   This may help guide where you will take the learning when you return to your classroom. |
| **Guiding Questions and Resources:**  Here are our recommended big ideas and guiding questions:  Review and expand on evolutionary concepts covered at Camp Thunderbird: Do a few activities on adaptation, mutations, and natural selection to solidify learning and tie it into the classroom.   * *What is adaptation? What are some adaptations of other plants and animals not explored at Camp Thunderbird?*   + Flap to the future online adaptation game: <https://academy.allaboutbirds.org/features/flaptothefuture/>   + NGSS Biology (check out Darwin’s Finches activity): <https://www.ngsslifescience.com/science.php?/biology/lessonplans/C394/>   Introduce more evolutionary concepts: Dive into other evolutionary concepts such as the various mechanisms of natural selection, speciation, genetic drift, survival, sexual selection, or others.   * *What are some different mechanisms of evolution? What are some examples of these in evolutionary history? What do these mechanisms look like in simulation?*   + OCR jelly bear evolution game resource (explores many evolutionary concepts including genetic drift, adaptation, polymorphism, selection pressures and more): <https://www.ocr.org.uk/Images/163772-bear-island-the-jelly-bear-evolution-game.pdf> * *What is speciation and what type of event might need to happen for speciation to occur?*   + Speciation Exercise: <https://whs.rocklinusd.org/subsites/Biology/documents/Biology/Unit%207/Speciation%20Activity.pdf>   Climate change and evolution: Explore the relationship between climate change and adaptation.   * *How might a changing climate impact animals and plants that are adapted to current climatic conditions? Do you think they will be able to adapt quickly enough? If not, what might happen? For animals – will we see more migration to more suitable habitats? If so, how might this impact environments?*   + Canadian Forestry Association Teaching Kit – activity that illustrates how climate change may impact species and their habitats: <https://www.abca.ca/downloads/GC_Hot_and_Cold.pdf>   + Natural selection and climate change lesson plan (high school level): <https://tropicsu.org/lesson-plan-natural-selection/>   + Evolutionary adaptations to climate change (senior high school level): <https://tropicsu.org/lesson-plan-evolutionary-adaptations-to-climate-change/> * *What does adaptation look like for humans in a changing climate? What are some ways that we have had to be adaptable in the past? What are some creative ways that we can adapt to projected changes?*   + UNESCO climate change education resource “day three” focusses on climate change adaptation stories and mitigation: <https://www.uncclearn.org/sites/default/files/inventory/pdf.pdf>   + UBC CALP teacher resource – activity and stories on climate change adaptation and mitigation: <https://calp2016.sites.olt.ubc.ca/files/2019/05/Introduction-to-Climate-Change_CALP-UBC.pdf> |