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| **Lesson Title :** Designing the Challenge | **Unit #:****1** | **Lesson #:****2** | **Activity #:****3** |
| **Activity Title: Grafting Activity Research** |

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| **Estimated Lesson Duration:** | **One week** |
| **Estimated Activity Duration:** | **Three days** |

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| **Setting:** |  |

The classroom or lab will be used for the activity. The computer lab will be used for research.

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| **Activity Objectives:**  |

Students will be able to construct an argument based on scientific evidence as to how specialized structures of a plant can be used to influence the growth of an organism.

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| **Activity Guiding Questions:** |

**What are glochids?**

**What do cacti fruit taste like?**

**Do all cacti produce fruit?**

**How can one cacti be grafted onto another?**

| **Next Generation Science Standards (NGSS)**  |
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| **Science and Engineering Practices (Check all that apply)**  | **Crosscutting Concepts (Check all that apply)** |
| ☒ Asking questions (for science) and defining problems (for engineering) | ☐ Patterns |
| ☐ Developing and using models | ☐ Cause and effect |
| ☒ Planning and carrying out investigations | ☐ Scale, proportion, and quantity |
| ☒ Analyzing and interpreting data | ☐ Systems and system models |
| ☐ Using mathematics and computational thinking | ☐ Energy and matter: Flows, cycles, and conservation |
| ☒ Constructing explanations (for science) and designing solutions (for engineering) | ☒ Structure and function.  |
| ☐ Engaging in argument from evidence | ☐ Stability and change.  |
| ☒ Obtaining, evaluating, and communicating information  |  |

| **Ohio’s Learning Standards for Science (OLS)** |
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| **Expectations for Learning - Cognitive Demands (Check all that apply)** |
| ☐ Designing Technological/Engineering Solutions Using Science concepts **(T)** |
| ☒ Demonstrating Science Knowledge **(D)** |
| ☒ Interpreting and Communicating Science Concepts **(C)** |
| ☒ Recalling Accurate Science **(R)** |

| **Ohio’s Learning Standards for Math (OLS) and/or** **Common Core State Standards -- Mathematics (CCSS)** |
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| **Standards for Mathematical Practice (Check all that apply)** |
| ☐ Make sense of problems and persevere in solving them | ☐ Useappropriate tools strategically |
| ☐ Reason abstractly and quantitatively | ☐ Attendto precision |
| ☐ Construct viable arguments and critique the reasoning of others | ☐ Look for and make use of structure |
| ☐ Model with mathematics | ☐ Look for and express regularity in repeated reasoning |

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| **Unit Academic Standards (NGSS, OLS and/or CCSS):** |

**MS-LS4-5.** Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

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| **MS-LS1-5.** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.  |

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| **MS-LS1-4.** Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.  |

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| **Materials**: (Link Handouts, Power Points, Resources, Websites, Supplies) |

Computer or similar device capable of looking up websites

[Research Activity Worksheet](https://docs.google.com/a/stspp.com/viewer?a=v&pid=sites&srcid=c3RzcHAuY29tfG1yLWJydW5uZXItMjAxNnxneDo3MDc0NmI3MWM0ZjJlOGI5)

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| **Teacher Advance Preparation:** |

Teacher should research grafting techniques, propagation by cutting, gibberellins, Indole Butyric Acid, Plant hormones and how seeds are formed ahead of time.

Students should be familiar with gibberellins, auxin and other plant hormones. Students should understand basic plant anatomy. Be familiar with the use of Sulphur on grafts.

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| **Activity Procedures:** |

Ask students about their experiences with cacti.

Hand out the Activity Sheet. Remind students that cacti grafting is fairly universal. They do not need specific types of cacti, any type will work to understand the concept.

Remind students that they need to look up two different types of cacti grafting. Remind them of the apple grafting that they looked up in the previous lessons. There are different ways and methods to graft. They need to answer questions for each type of grafting. Instruct them to tape the page into their lab journal.

Have students read over the directions before going to the computer lab.

Take students to the computer lab with their lab journals. Give students time to write down and answer questions.

Once students have had time to answer questions, have them return to the classroom and discuss the methods they found for grafting. Write down notes about these methods on the board.

Ask for similarities that may be found.

**Formative Assessments:** Link the items in the Activities that will be used as formative assessments.

Discussion post lab.

**Summative Assessments:** These are optional; there may be summative assessments at the end of a set of Activities or only at the end of the entire Unit.

Read students lab journals for accuracy.

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| **Differentiation:** Describe how you modified parts of the Lesson to support the needs of different learners.Refer to Activity Template for details. |

Group students based on what they can do, not their grades necessarily. I try to have a student who is great with hands on things, one that is good with math, one that is good with reasoning/science and one that is a reader. This allows for students to have an area they are ‘experts’ with and gives them a sense of being a part of a team, rather than a member of a group.

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| **Reflection:** Reflect upon the successes and shortcomings of the lesson. |

Students did well with remembering the grafting from previous lessons. They caught on quickly about how to graft a cactus. Students were able to narrow down what should and should not be used when grafting.