Genetic Variation Lesson 3: “The Engineer”
Student Handout

Your Challenge:

In this last phase of our unit, you will genetically engineer for a trait to be inherited by alien babies. The trait that you engineer will be a solution to a hypothetical (which means “made up”) alien problem that you choose. For instance, a problem could be that there is a shortage of water, so baby alien skin has spots that can absorb water efficiently.

Your task is to create two parents whose combined genes result in an offspring with a specific trait. Think back to the Make activity to remember how traits are passed down through sexual reproduction.

Directions:

Pair off in teams of two. As teams (alien mating pairs):

1. What alien problem are you going to solve? Brainstorm some ideas. Once you've made your choice, record your alien problem in the planning organizer. For example, perhaps there is a water shortage in the area in which the alien lives.

2. Identify the trait needed to solve the problem for the baby alien (this is called the “target trait”). Record your target trait in the planning organizer. For example, the target trait for the aliens would be spots on their skin that can absorb water from the air.

3. Create alleles for the problem-solving trait in the baby alien (the target trait alleles). Record the target trait alleles in the planning organizer. For example, the alleles for the spots on the skin could be ww (two lower case letters that represent the recessive trait for the water-absorbing spots on the baby alien).

4. Using reverse engineer, sketch parents that have a trait with alleles that could combine (in sexual reproduction) to result in the target trait in the baby alien. Record the parent traits and alleles in the planning organizer.
There are many combinations that could lead to the alien baby getting two recessive alleles (ww). One solution would be if the father has ww and the mother has Ww. The alien baby would get one w from the father and one w from the mother.

5. Based on the parent alleles, sketch out what traits the parents would have and record this in your planning organizer. For example, if the mother has ww, draw a mother with spots. If the father has Ww, draw a father with no spots or spots that do not absorb water.

6. For your Design Presentation, you will create a Family Tree indicating how the baby alien’s problem-solving alleles came from a combination of the parent’s allele’s. Use the checklist to develop your family tree.

The Design Planning Organizer - Genetic Engineering

1. What is the hypothetical problem challenging alien life forms?

2. Describe the target trait that your baby alien will have to solve to problem:

3. Brainstorm some ideas for alleles that will represent the target trait for your baby alien. Draw the alien baby with the target trait. Label the target trait with its alleles.
4. Brainstorm some ideas for parents that have a trait with alleles that could combine (in sexual reproduction) to result in the target trait in the baby alien. Record your final choices.

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<thead>
<tr>
<th>Mother’s Alleles</th>
<th>Father’s Alleles</th>
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5. Based on the parent alleles above, sketch what the parent aliens would look like.

<table>
<thead>
<tr>
<th>Sketch of the Mother</th>
<th>Sketch of the Father</th>
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Draw sketches of your Genetically Engineered Baby Alien and its Parents here.
The Design: Suggested Family Tree Organization - Genetically Engineered Baby
*frames for family portraits*
Assessment: Genetically Engineered Alien Baby Family Tree

You designed a solution to a problem that has been a challenge for the aliens! On a separate piece of printer paper, draw a visual Family Tree with diagrams and arrows to show how you created the perfect parents so that their alleles combined and the alien baby received problem-solving genes. Use the checklist and Science & Engineering Practices rubric to ensure you have addressed all aspects of the “Engineer” with quality work.

Genetic Variation Engineer Checklist: Content Concepts and Practices

- A visual drawing of your alien baby with its problem-solving trait:
  - Label the trait AND
  - Show the allele for the trait
- A visual drawing of the father and mother alien with the traits that give rise to the problem-solving trait in the baby alien:
  - Labels the traits AND
  - Show your parent alien alleles for each of the traits
- Uses arrows to clearly show where the alien baby's problem-solving genes come from
  - Origin of each allele: Which allele for the problem-solving trait is passed from mother to baby? Father to baby?
- Result of the combination of the alleles from parents for a particular trait in baby:
  - Has a clear, but brief caption under baby alien's combined allele for the problem-solving trait explaining:
    - The problem that challenges the aliens
    - How sexual reproduction created genetic variation in the baby alien to make the problem-solving trait
- Has a clear and creative title
- Family Tree shows relationships in a logical order
- Family Tree is neat and in color

Science & Engineering Practices Rubric

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<thead>
<tr>
<th></th>
<th>Emerging (1)</th>
<th>Developing (2)</th>
<th>Proficient (3)</th>
<th>Advanced (4)</th>
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</thead>
<tbody>
<tr>
<td><strong>Designing Solutions</strong></td>
<td>Applies no scientific principles and/or data to design, construct, and/or test a design of an object, tool, process or system.</td>
<td>Applies minimal scientific principles and/or data to design, construct, and/or test a design of an object, tool, process or system.</td>
<td>Applies adequate scientific principles and/or data to design, construct, and/or test a design of an object, tool, process or system.</td>
<td>Applies complete scientific principles and/or data to design, construct, and/or test a design of an object, tool, process or system.</td>
</tr>
<tr>
<td><strong>Communicating Findings/Design (Oral Presentation)</strong></td>
<td>Findings/Design are incompletely and inaccurately communicated. Or no evidence of using appropriate eye contact, adequate volume, or clear pronunciation.</td>
<td>Findings/Design are completely communicated with some misconceptions. Or Uses minimal eye contact, inappropriate volume, or inconsistent pronunciation.</td>
<td>Findings/Design are completely communicated but lacking depth and complexity. Or often uses eye contact and engaging and appropriate volume and pronunciation, but is inconsistent.</td>
<td>Findings/Design are completely communicated with depth and complexity. Or mostly uses eye contact and engaging and appropriate volume and pronunciation.</td>
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