Fishy Mendelian Genetics

Contributors

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Intended Audience

| K-4 | 5-8 | 9-12 | X |

Intended Audience

| Classroom setting | X |
| Requires special equipment | |
| Uses hands-on manipulates | |
| Can be performed individually | X |
| Requires group work | |
| Requires more than one (45 min.) period | |
| Appropriate for special needs students | X |
Introduction

Description

A worksheet-based activity designed to allow a student’s creative expression to drive understanding of genetic transmission.

Abstract

The process by which genetic information is passed to offspring was in-part discovered by Gregor Mendel in the 19th century. His pea-plant breeding experiments paved the way for modern genetics before DNA was even discovered. This activity models the classic pea-plants by substituting a different research animal unique to the MBI fellow in order to engage the students with something relevant to their lives.

Core Themes Addressed

<table>
<thead>
<tr>
<th>Microbial Cell Biology</th>
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<tr>
<td>Microbial Genetics</td>
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<td>Microorganisms and Humans</td>
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<td>Microorganisms and the Environment</td>
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<td>Microbial Evolution and Diversity</td>
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<td>Other – Eukaryotic Genetics</td>
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Keywords

Longhorn Sculpin
Monohybrid Crosses
Punnett Squares

Learning Objectives

At completion of this activity, learner will

1. Demonstrate proficiency with Punnett Squares and monohybrid crosses
2. Describe how two diploid parents can give rise to offspring with phenotypic traits that neither parent possesses.
3. Analyze an organism’s genotype to determine its phenotype.
4. Explain the difference between heterozygotes and homozygotes.
National Science Education Standards Addressed

Standard C: Life Sciences – This activity focuses on the molecular basis of heredity and biological evolution.
Student Prior Knowledge

Students should already understand that their own genetic information came from their parents. They may have some idea of recessive and dominant alleles. It is unlikely that they will understand the concepts of independent assortment and segregation.

Teacher Background Information

Instructor should be comfortable with Punnett Squares. It is necessary to understand the difference between heterozygotes and homozygotes and be able to explain dominant and recessive alleles.

Class Time

This activity will require a minimum of one 45-minute class period (example one 45 minute class period)

1. Take students through the lecture with examples on the board. This should take 10 minutes.
2. Allow students to complete the written activity. This can take from 20 to as many as 45 minutes depending on student creativity.
3. The drawing component can be completed as homework if desired.

Teacher Preparation Time

This lesson will require approximately 5 minutes of preparation time.

Materials and Equipment

1. Drawing and coloring materials for the students if needed.

Methods

1. First, for each trait, determine which allele is dominant and which is recessive.
2. Decide on the genotype of the parents with respect to each trait.
3. Perform monohybrid crosses for each trait and decide which outcome will be passed on to the offspring.
4. Fill in the offspring’s genotype and, using that information, make a written description of its phenotype.
5. Illustrate the resultant offspring.
Tips/Suggestions

1. Any animal and any series of traits can be substituted depending on the students’ interest and the research focus of the visiting MBI fellow.

References

This activity was modified from Kelly Dabney from Georgia Southern University’s MBI program.

Answers to Student Handouts

There are no correct answers to this activity, only the ability to follow directions. Each student will have a different offspring genotype and so the resulting phenotype will vary.
Introduction

By now you know that DNA is the molecule of genetic inheritance, but how does that information get passed on from your parents? Most organisms have two copies of their genome, one copy from each parent. However, if these two copies differ in some physical trait, how do we know which trait will be expressed? Gregor Mendel, in the mid 19th century, used a series of experiment with pea plants to discover that some versions of traits (alleles) are dominant while some are recessive. You will use your knowledge of genetic transmission to model the inheritance of an offspring sculpin from two adult sculpin.

Student Background Knowledge

Heterozygotes have two different alleles for a given trait while homozygotes have two of the same allele. Homozygotes can be either recessive or dominant, depending on which of the two alleles they have. Dominant alleles will mask recessive ones. While two individuals may have the same appearance, one may have a recessive allele which can be passed to future offspring.

Vocabulary

**Allele:** One of two or more forms of a gene.

**Heterozygote:** An individual with multiple different alleles for a given gene.

**Homozygote:** An individual with all of the same allele for a given gene.

**Genotype:** An individual’s genetic composition.

**Phenotype:** An individual’s appearance which is based on its genotype.

Procedure

1. First, for each trait, determine which allele is dominant and which is recessive.
2. Decide on the genotype of the parents with respect to each trait.
3. Perform monohybrid crosses for each trait and decide which outcome will be passed on to the offspring.
4. Fill in the offspring’s genotype and, using that information, make a written description of its phenotype.
5. Illustrate the resultant offspring.
Results

Compare your sculpin’s phenotype with that of other students. The variety that you see is due to the randomness of monohybrid crosses and the choices that students made about the adult sculpins’ genotype.
Student Worksheet

Fishy Mendelian Genetics

Name:

Block:

Sculpin Creation

Intro: The Mendelian Inheritance of traits is an important concept to understand and apply to modern genetics. Today you will be following the rules of inheritance to make up your own sculpin based on 5 traits.

Procedure: You are going to model the passage of genes from a mother and father sculpin to a baby sculpin. The traits will be:

- Spines (Short or Long) (A)
- Color (Banded or Speckled) (B)
- Eyes (Clear or Cloudy) (C)
- Teeth (Sharp or Blunt) (D)
- Tail (Short or Long) (E)

1. Decide which allele is dominant or recessive for your sculpins.
2. Decide which traits the parents will show (phenotype) and then decide whether they should be homozygous or heterozygous for that trait.
3. Do a Punnett Square for each trait, modeling inheritance from mother and father.
4. Of the 4 possibilities for each trait, pick the one you want to represent your sculpin.
5. Map out the completed genotype for the baby sculpin, and describe its appearance.
6. Draw your new sculpin, exhibiting the traits that it inherited.

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<thead>
<tr>
<th>Trait</th>
<th>Spines</th>
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<tbody>
<tr>
<td>Dominant</td>
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<td>Mother’s</td>
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<td>Genotype</td>
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Father’s Genotype

Now make a Punnett Square for each trait and cross your parents’ genotypes. Choose at random one of the outcomes for each trait and give that outcome to your offspring sculpin.

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<tr>
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</thead>
<tbody>
<tr>
<td>Your Sculpin’s Genotype</td>
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Briefly describe your sculpin’s appearance based on the genotype above. ________________________
______________________________________________________________________________
______________________________________________________________________________
______________________________________________________________________________

Now draw your sculpin below. Be sure to include its surroundings (sea floor).