

Mendel's Peas Exercise 1- Part 3

ISOLATING TRUE-BREEDING STRAINS

Goal

In this exercise you will use StarGenetics, a genetics experiment simulator, to design a set of experiments that will allow you to identify and isolate a true-breeding strain.

Prerequisite knowledge

Before completing this exercise, students should complete $\ensuremath{\text{Exercise 1}}$ - $\ensuremath{\text{Parts 1}}$ and $\ensuremath{\text{2}}$ and should be able to:

- 1. Explain important genetic terms including: allele, genotype, phenotype, dominant, recessive, homozygous, heterozygous, and true breeding.
- 2. Implement genetics experiments in the genetics cross simulator, StarGenetics.
- 3. Determine if an organism is true breeding through the analysis of results from genetic crosses.
- 4. Determine whether a phenotype is dominant or recessive relative to another phenotype.
- 5. Infer and assign genotypes of individual organisms using proper nomenclature of alleles.
- 6. Use Punnett Squares to predict and confirm expected genotypic and phenotypic ratios.

Learning objectives

After completing this exercise, you will be able to:

- 1. Design an experimental strategy to isolate organisms with a specific genotype
- 2. Design an experimental strategy to isolate a true-breeding strain.

Getting started with StarGenetics

- To access StarGenetics, please navigate to: http://star.mit.edu/genetics/.
- Click on the **Start** button to launch the application.
- Click **Trust** when a prompt appears asking if you trust the certificate.
- Click on File \rightarrow New in the drop-down menu in the upper left hand corner.
- Click on the Mendel's Peas Exercise 1 Part 3 file.

You are working in a company that produces strains of pea plants and ships them out all over the world to research labs. Your company prides itself on supplying only true-breeding pea plants that produce the identical pea plant offspring for many generations. You and your co-worker previously characterized two new <u>true-breeding</u> strains of pea plants: one with white flowers and one with purple flowers. Using representative plants from these two strains, *White Parent 1* and *Purple Parent 1*, you previously determined that the purple flower phenotype is dominant to the white flower phenotype. You also characterized a pea plant that appeared on your desk with purple flowers (*Purple Parent 2*) and determined that *Purple Parent 2* is <u>not</u> true breeding. All three plants can be found in the Strains box in StarGenetics.

You already know that a <u>single gene</u> controls flower color. You are not sure if the allele that confers purple flowers in *Purple Parent 2* is the same allele that confers purple flowers in *Purple Parent 1*. To further study the purple allele in *Purple Parent 2*, you will need to generate a true-breeding strain with purple-flowered plants using *Purple Parent 2*.

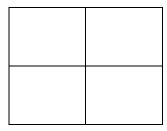
1 Based on the fact that *Purple Parent 2* is not true breeding, and the purple flower color of this plant is dominant to the white flower color of *White Parent 1*, what is the genotype of *Purple Parent 2* with

respect to flower color? Assign letters to represent the alleles corresponding to the dominant and recessive phenotypes. Provide an explanation for your genotype nomenclature, making sure to include a description of which phenotype each allele represents.

Answer	
Genotype of <i>Purple Parent 2</i> :	
Description:	

2 What are the expected genotypic and phenotypic ratios of the F1 offspring resulting from a self-cross of *Purple Parent 2*? Fill in the Punnett Square below to determine the expected potential genotypes of the offspring resulting from this cross.

Answer



Expected Genotypic ratio:

Expected Phenotypic ratio:

 $\mathbf{3}$ Now perform the cross in StarGenetics (one self-mating for a total of 20 offspring). What is the observed phenotypic ratio? What are the possible genotype(s) of the purple plants and white plants?

Answer		
Phenotypic Ratio:		
Purple genotype(s):		
White genotype(s):		

4 You will now create a true-breeding purple strain from *Purple Parent 2*. Are any of the <u>purple F1</u> plants in the cross in Question 3 true breeding with respect to flower color? If some of the F1 purple plants ARE true breeding, describe how you could isolate the purple true-breeding plants from the other purple F1 plants and create a true-breeding purple strain from these. If no F1 plants are true breeding, describe the additional crosses you would need perform to generate a true-breeding strain with purple flowers. Use Punnett squares to support your answer.

Answer

Advanced

5 Now, produce a true-breeding strain that has <u>purple flowers and inflated, green pods</u> derived from the *Purple Parent 3* plant in your Strains box. *Purple Parent 3* is heterozygous for all three traits (purple, inflated, green). Include the genotype of *Purple Parent 3* and a description of which phenotype each allele represents. You can assume that each trait is controlled by a unique, single gene. Explain how your derived a true-breeding strain from the *Purple Parent 3* plant, including a summary of the crosses you performed in StarGenetics and their outcomes in your explanation.

Answer

Genotype of Purple Parent 3:

Description:

Strategy: