

Science Objectives

- Students will use a Punnett square simulation to predict phenotypic and genotypic ratios of F1 generation.
- Students will predict parental genotypes.
- Students will explain the relationship between Punnett squares and probability.

Vocabulary

- allele
- dominant
- genotype
- heterozygous
- homozygous
- phenotype
- Punnett square
- recessive

About the Lesson

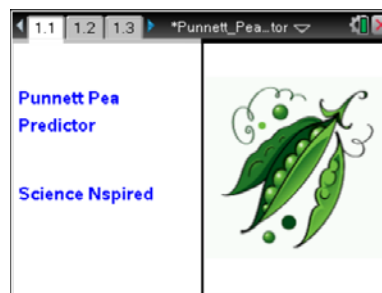
- This lesson allows students to explore patterns of genetic inheritance through a simulation.
- As a result, students will:
 - Manipulate Punnett squares to model the inheritance of height in pea plants.
 - Predict genotypic and phenotypic ratios of offspring.

TI-Nspire™ Navigator™

- Send out the *Punnett_Pea_Predictor.tns* file.
- Monitor student progress using Screen Captures.
- Use Live Presenter to spotlight student answers.
- Enter items as appropriate for use of TI-Nspire Navigator.

Activity Materials

- *Punnett_Pea_Predictor.tns* document
- TI-Nspire™ Technology



TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Use a slider
- Drag an object to a target area

Lesson Materials:

Student Activity

- *Punnett_Pea_Predictor_Student.doc*
- *Punnett_Pea_Predictor_Student.pdf*

TI-Nspire document

- *Punnett_Pea_Predictor.tns*

Discussion Points and Possible Answers

Students will read the following background information in the student activity sheet.

An allele is an alternative form of a gene located at a specific position on a specific chromosome, a DNA molecule. Alleles determine traits that can be passed on from parents to offspring. In many cases, a trait is determined by one pair of alleles—one allele from each parent. Complete dominance occurs when one allele is dominant and the other is recessive.

The dominant allele is expressed and the recessive allele is masked. If an organism's **genotype** is homozygous, then the two alleles are the same; two dominant or two recessive. If the genotype is heterozygous, one of each allele is present. An organism's **phenotype** is the trait that is outwardly expressed by the organism.

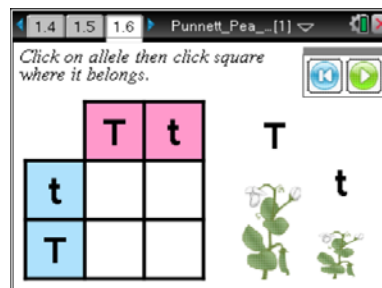
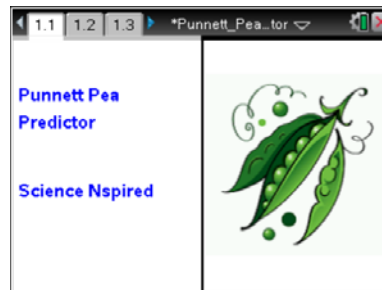
The example explored here, height in pea plants, is determined by one pair of alleles: tall (T) is dominant and short(t) is recessive. The letters "T" and "t" are used to describe the genotype. The terms "tall" and "short" are used to describe the phenotype.

Move to pages 1.2–1.4.

- Students should read the instructions on pages 1.2–1.4 and then move to page 1.5.

Move to page 1.5.

- On page 1.5, students will run the Punnett square simulation several times. Students should click on the alleles on the right side of the page in order to drag them into the appropriate squares. You may need to remind them to make sure they put TWO alleles into each square. This would be a good time to review with them the need for two alleles for a trait—one coming from the mother and the other from the father.



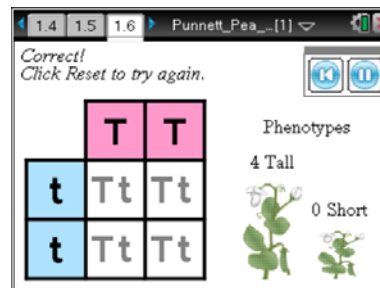
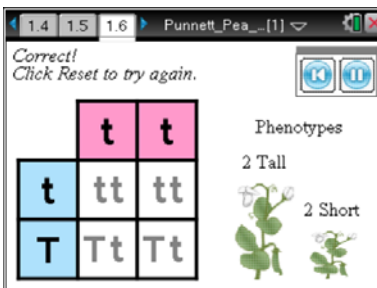
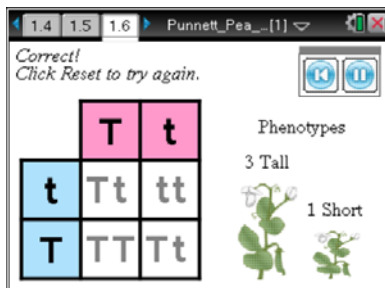
Tech Tip: To fill in a Punnett square (instead of dragging the boxes), click where the 1 is in the slider, type in –1 and hit **enter** and it will fill in automatically. You can choose whether or not to share this with students.

Teaching Tip: After the students have gone through a couple of simulations, ask them to predict results BEFORE filling in the Punnett square. Use the tech tip below to automatically fill in the squares to check the students' predictions.

TI-Nspire Navigator Opportunities

Create a new Punnett square and project for the class to see. Have students predict what the results will be before filling in the square. Use the Tech Tip (below) to quickly complete the square and see if students' predictions were correct.

Below are possible results from the Punnett Square simulation.



- Instruct students to repeat the simulation until they recognize the different patterns of height inheritance in pea plants.

Move to pages 1.6–1.11.

Have students answer the questions on either the handheld, on the activity sheet, or both.

- Q1. Two tall parent pea plants will produce tall offspring.

Answer: B. sometimes

- Q2. Two short parent pea plants will produce short offspring.

Answer: A. always

- Q3. One parent pea plant is heterozygous for height. In order to have an equal chance of producing either tall or short offspring, the other parent pea plant must be _____.

Answer: C. homozygous (short)

- Q4. One parent pea plant is homozygous tall. In order to have an equal chance of producing tall and short offspring, the other parent pea plant must be _____.

Answer: D. The genotype of the other parent does not matter. There can never be an equal chance.

- Q5. How many different parent combinations could lead to an equal chance of tall and short offspring?

Answer: C. 2

Q6. Explain your response to the Question 5.

Answer: The parents have to be Tt and tt to have a chance to have an equal number of tall and short offspring.

Wrap Up

When students are finished with the activity, pull back the .tns file using TI-Nspire Navigator. Save grades to Portfolio. Discuss activity questions using Slide Show.

Assessment

- Formative assessment will consist of questions embedded in the .tns file. The questions will be graded when the .tns file is retrieved by TI-Nspire Navigator. The TI-Nspire Navigator Slide Show can be utilized to give students immediate feedback on their assessment.
- Summative assessment will consist of questions/problems on the chapter test, inquiry project, performance assessment, or an application/elaborate activity.