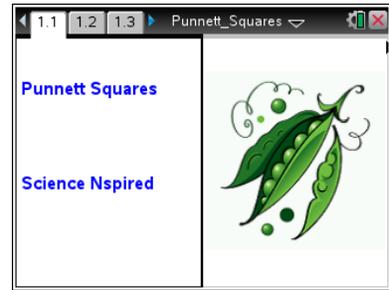




Open the TI-Nspire document *Punnett_Squares.tns*.

In this simulation, you will discover how some traits are passed on from parents to offspring. You will predict the traits parents will pass on to their offspring and identify how parents need to combine in order to produce a specific trait in their offspring.



Launch the simulation.

When you start the simulation you will see the title page for the Punnett Squares, which is named after geneticist Reginald C. Punnett.

Move to pages 1.2 – 1.5.

1. Read the information on pages 1.2 and 1.3. Then read the Instructions on pages 1.4 and 1.5 for navigating the activity.

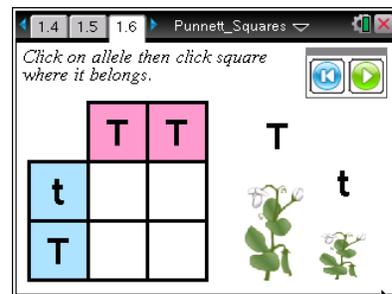
Part 1: Exploring Phenotypes

An **allele** is a different 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. If an offspring inherits different alleles from its parents, the offspring may only show the trait from one parent.

Using the simulation, you will see how pea plants pass along alleles that determine the height of their offspring. The **genotype** of an offspring refers to what genes (or alleles) it inherits from its parents. The **phenotype** of an offspring refers to what genes (or alleles) it expresses.

Move to page 1.6.

2. Complete the Punnett square by dragging the alleles, **T** or **t**, to where they belong. Click the Play button  to check the genotypes and see how many tall and short offspring are produced. If your genotypes are incorrect, you can click the blue reset button  to clear the squares and try again. Repeat this activity until you can record 9 trials in which your genotypes are correct.





Q1. Fill in the Punnett squares below with the results of the trials in which your genotypes are correct.

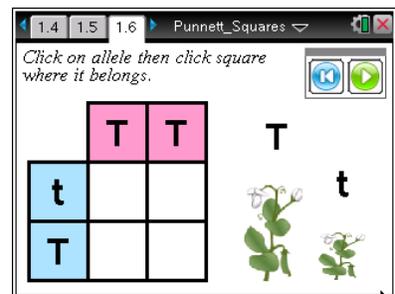
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Part 2: Analyzing Phenotypes

You've seen several examples of the phenotypic ratio of tall offspring to short offspring, given the allele combinations inherited from parents. Now you will look for a pattern in these allele combinations and the traits expressed in the offspring.



3. Review the data from your Punnett squares above in Part 1. Based on the phenotypic ratios you collected from each trial of the simulation, circle the pair of alleles in each square representing a tall offspring. For example, if the phenotypic ratio for a Punnett square is 3 tall and 1 short, circle 3 pairs of alleles in the squares representing tall offspring.

Q2. Which allele appears in all of your circled pairs, T or t?



In a phenotype, complete dominance occurs when one allele is **dominant** and the other is **recessive**. The dominant allele is expressed and the recessive allele is hidden. In the pea plant example explored here, height in pea plants is determined by a pair of alleles, **T** (tall) and **t** (short).

Q3. Based on your data and observations, which allele is dominant?

Q4. Based on your data and observations, which allele is recessive?

Part 3: Predicting Phenotypes

When a pair of alleles has one dominant and one recessive allele, it is **heterozygous**. If the pair has the same alleles, it is **homozygous**.

Q5. If a pea plant is heterozygous, will it always be tall or short?

Q6. If a pea plant is homozygous with the short allele, will it always be tall or short?

Q7. If a pea plant is homozygous with the tall allele, will it always be tall or short?

Q8. One parent is homozygous tall. To produce tall offspring, what must the other parent be?

- A. Homozygous (short)
- B. Homozygous (tall)
- C. Heterozygous
- D. It does not matter.