OBJECTIVES:

1. Testing heredity models.
2. Comparing and interpreting hereditary plant data.
3. Students determine different genotypes.

VOCABULARY:

genotype
phenotype

MATERIALS:

worksheet
2 sheets of “gametes”

BACKGROUND:

Genetics can be complicated in all organisms. Plant genetics has been able to be manipulated, as humans wanted to create better foods and crops.

Genetics is the study of heredity or the passing of traits from parents to offspring. Offspring can inherit dominant traits or recessive traits. A dominant trait is one that prevents another trait from appearing. A recessive trait is one that does not appear when a dominant trait is present. A pure trait (homozygous) is one that is made up of all dominant traits or all recessive traits. A hybrid trait (heterozygous) is a trait that is made up of a combination of dominant and recessive traits.

A gene is the unit of inheritance which is passed from parents to offspring. Genes occur in pairs in chromosomes inside the nucleus of a cell. There are dominant genes for dominant traits and recessive genes for recessive traits. Dominant genes mask recessive genes when paired. Gregor Mendel's experiments on hybridizing garden peas was the first recorded experiment on plant breeding. Mendel successfully studied the inheritance of unit characters. He also kept accurate records of how the characters reappeared in the offspring of selected parents. Mendel was also the first to control pollination techniques. These procedures are understood today, but in 1865 when Mendel's work was done, this was revolutionary. Mendel's work laid unnoticed for 35 years until European plant breeders rediscovered his work.

Mendel selected garden peas for his experiment. He took pollen from a dwarf growing pea and dusted it on a tall growing variety. The seeds resulting from this cross pollination were collected and planted the following season. All the plants that grew from these seeds were tall. Mendel reversed the situation and

dusted the dwarf peas with pollen from the tall variety, and this resulted in offspring that were all tall.

Mendel then allowed the tall plants to self-pollinate and found that 3/4 were tall plants and 1/4 were dwarf. From this result Mendel concluded that the expression of a given character was dominant, while the other character was recessive.

A phenotype is a visible, noticeable, and recognizable trait. An organism's genotype is his genetic make-up which is located in the nuclei of his cells. For example, the physical traits of a tall pea may be made of a dominant tall pea gene and a recessive dwarf pea gene. The phenotype of this plant will be tall, whereas the genotype will be heterozygous (i.e., a dominant and a recessive gene).

When a cross is performed upon parents that differ in only one single character (i.e., tall, short, etc.) it is termed a monohybrid cross. However, in many cases genes have more than one trait. When two sets of hereditary traits are considered it is called a dihybrid.

Mendel continued his experiments with a pure (homozygous) tall, round shaped pea plant (TTRR) and crossed it with a pure dwarf, wrinkled pea plant (ttrr). All the offspring will be hybrid (heterozygous) tall, round seed (TtRr). Since the genes for height are on a different pair of chromosomes from the genes for pea shape, the genes sort into characters independently. This allows for four different types of "gametes" to form: TR, Tr, tR, and tr.

There can be 16 different combinations that the offspring can have, with any one of them just as likely to occur. However, there are only nine different combinations (different genotypes) and four different phenotypes possible.

PROCEDURE:

1. In the lab the students will find the 16 different combinations by using the "gamete" circles to fill in the grid on their worksheets.
2. Give students 2 sheet and have them color the same gamete the same color. There should be total of 32 gametes.
3. Instruct the students to cut out the circles. They use the circles to find out how to fill in the boxes. Making a grid that has each gamete as vertical and horizontal.
4. On the second part of the lab sheet the students need to tabulate how many different genotypes there are.

There are 1 TTRR, 2 TtRR, 2 TTRr, and 4 TtRr; 1 TTrr, 2 Ttrr; 1 ttRR, 2 ttRr; 1 ttrr; 9 tall round, 3 tall wrinkled, 3 dwarf round, 1 dwarf wrinkled.

PROBLEM: How can you predict the phenotype of a hybrid with 2 traits?

PREDICTION:

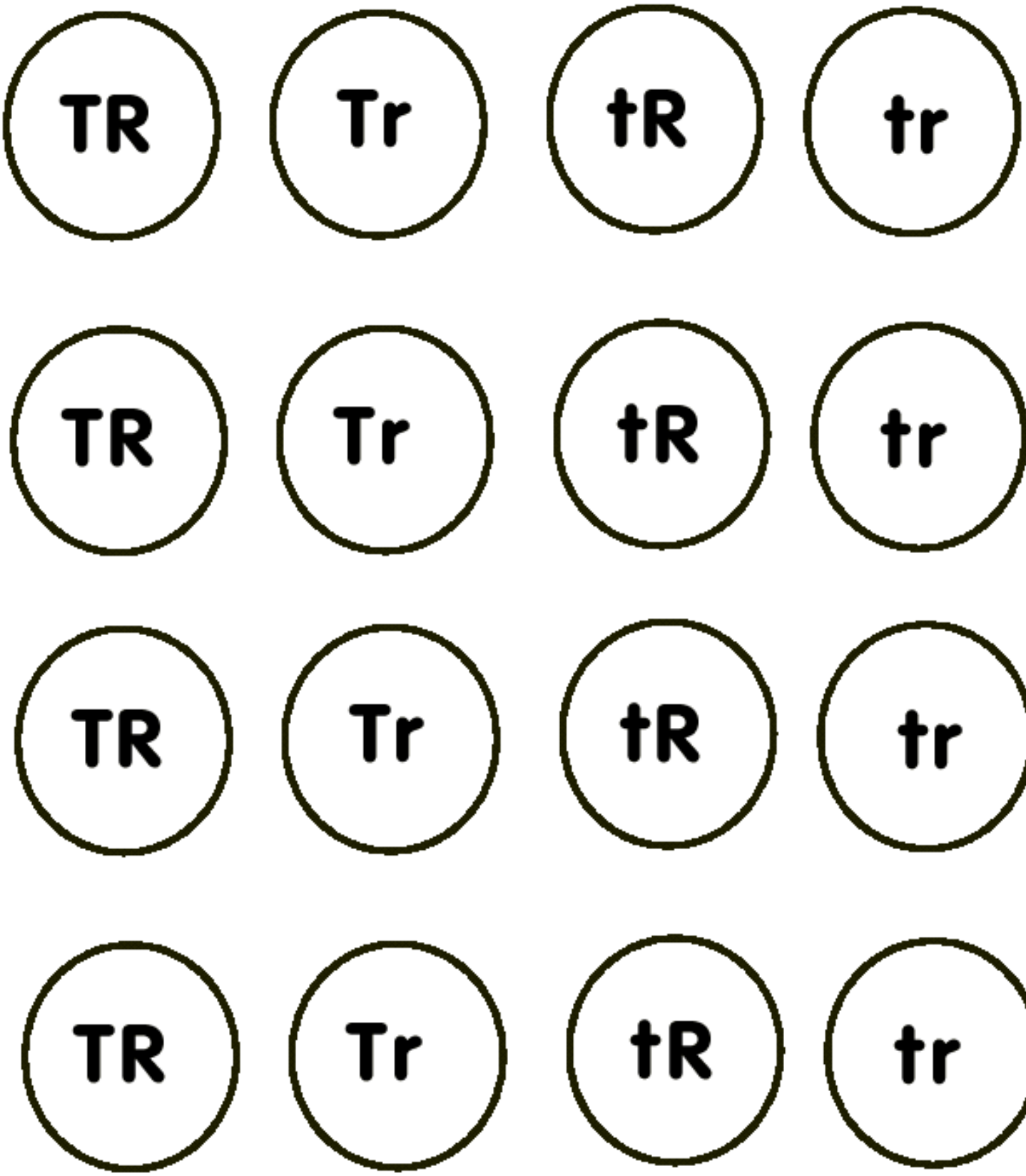
MATERIALS: circle "gametes"

PROCEDURE: 2 hybrid plants can each produce 4 possible genotypes. By using a grid like below (Punnett square) determine the genotypes and phenotypes. Use the circle “gametes” to move them around

	TR	Tr	tR	tr
TR				
Tr				
tR				
tr				

number	GENOTYPE	number	PHENOTYPE
_____ _____ _____ _____	TTRR TtRR TTRr TtRr	_____	tall, red
_____ _____	TTrr Ttrr	_____	tall, white
_____ _____	ttRR ttRr	_____	dwarf, red
_____	ttrr	_____	dwarf, white

CONCLUSIONS: Summarize the graph above.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