

Name _____

Date _____

ACTIVITY IV**Crossing Mendel's Peas . . . a Dihybrid Cross**

This activity investigates crosses between pea plants that are different in two trait characteristics: (a dihybrid cross) with each gene pair having one dominant and one recessive allele—and how each gene pair acts independently of the other. Phenotypes in the resultant generations will be, on average, in a ratio of 9:3:3:1—testifying to the independence, or *independent assortment*, of these two gene pairs.

Materials Needed (per team of 2 students)

- Cup shaker
- (2) Four-sided dice—each numbered side represents two gene pairs:
 - (1) = (RY) —round yellow
 - (2) = (Ry) —round green
 - (3) = (rY) —wrinkled yellow
 - (4) = (ry) —wrinkled green
- Student Study and Analysis Sheet

24. Use Table 1 to determine which traits (seed form and seed color) are dominant: _____ and which are recessive: _____
25. Predict the genotype and phenotype of the F_1 generation that results from a cross of a plant homozygous for round (RR) and yellow (YY) is crossed with a plant having wrinkled (rr) and green-colored (yy) peas. _____
26. Complete this Punnet square for self-fertilized F_1 plants from the above cross to predict future phenotypes:

PHENOTYPES: _____

27. Use four-sided dice for STEPS 27 through 28:
- (2) Four-sided dice—each numbered side represents two gene pairs:
- (1) = (RY) —round yellow
 - (2) = (Ry) —round green
 - (3) = (rY) —wrinkled yellow
 - (4) = (ry) —wrinkled green

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Each die is read by matching the number visible on the point, correlated to the gamete designation above. Thus when two die are cast (simulating fertilization) the genotype of the organism is established. For example: a cast die indicates "4" and "1". The corresponding genotype would be *RrYy*—round yellow.

28. Cast two dice 80 times (or as many times as your teacher directs) to arrive at organism genotypes. Tally likely phenotype combinations.

29. What is the phenotypic ratios? _____

30. Add your data to that of the rest of the class; are the phenotypic ratios altered much? How do they compare with your Punnet square prediction?

31. Write a statement that summarizes Mendel's principle of Independent assortment based upon your classroom data and Punnet square prediction.

A summary of Mendel's experimental results is provide in Table 1:

TABLE 1

TRAIT	ORIGINAL CROSSES	(F ₂) SECOND GENERATION		
	DOMINANT X RECESSIVE	DOMINANT	RECESSIVE	TOTAL
Seed form	Round x Wrinkled	5474	1850	7324
seed color	Yellow x Green	6022	2001	8023
Flower position	Axial x Terminal	651	207	858
Flower Color	Purple x White	705	224	929
Pod form	Inflated x Constricted	882	299	1181
Pod color	Green x Yellow	428	152	580
Stem length	Tall x Dwarf	787	277	1064

These relationships can be graphically expressed as a checkerboard or Punnet Square (see Figure 1) which indicates that the combination in each square has an equal chance of occurring. It was the observation that one-fourth of the offspring in the F₂ generation showed the recessive phenotype that indicated to Mendel that he was dealing with a simple case of the laws of probability.

Figure 1

