Dihybrid Cross – Example

1) Let's explore the basic inheritance patterns for a dihybrid cross. For any given cross, we always determine the following: 1) the *phenotypes* of the parents, 2) a completed Punnett Square including the genotypes of the parents and genotypes of the possible gametes, 3) the *phenotypic ratio* of possible offspring, and 4) the *genotypic ratio* of possible offspring. There are rules to how you set up the crosses: write the male genotype above the Punnett square and the female genotype to the left so you don't lose track, possible male gametes go above the columns while female gamete combinations go next to the rows.

Character Name	Dominant Trait	Recessive Trait
Flower Color	Purple (P)	White (p)
Flower Position	Axial (A)	Terminal (a)
Seed Color	Yellow (Y)	Green (y)
Seed Shape	Round (R)	Wrinkled (r)
Pod Shape	Inflated (I)	Constricted (i)
Pod Color	Green (G)	Yellow (g)
Stem Length	Tall (T)	Dwarf (t)

1) Let's try a dihybrid cross involving Flower color and Seed Color.
   a) The <u>genotype</u> of mom and dad, both hybrids for those two traits, would be written <u>PpYy</u>
   b) The <u>phenotype</u> of both parents is a description of the traits they express, and since they both have one copy of the dominant allele for each trait, both are <u>Purple Flower Yellow Seed</u>.
   c) When either parent goes through meiosis to produce gametes, we assume that the alleles segregate and independently assort:
      i) A PpYy individual can produce the following allele combinations: PY, Py, pY, & py. We write those allele combinations above the columns for dad and to the left of the rows for mom (see below), then fill in the possible gamete combinations in the 16 squares to find the genotypes of the offspring.

Dad (PpYy)

	PY	Py	pY	py
PY	PPYY	PPYy	PpYY	PpYy
Py	PPYy	PPyy	PpYy	Ppyy
pY	PpYY	PpYy	ppYY	ppYy
py	PpYy	Ppyy	ppYy	ppyy

Mom (PpYy)

d) The phenotypic ratio is the relative number of each possible phenotype produced by the cross. So, what are the possible phenotypes?
   i) Any individual who is P_Y_ is going to be Purple and Yellow; P_yy is Purple and Green; ppY_ is White and Yellow; ppyy is White and Green. Count them up!
      (1) 9 of 16 (9/16) are Purple and Yellow
      (2) 3 of 16 (3/16) are Purple and Green
      (3) 3 of 16 (3/16) are White and Yellow
      (4) 1 of 16 (1/16) is White and Green

      This could be written as 9:3:3:1

e) The genotypic ratio is the relative number of each possible genotype produced by the cross. Do this the same way as for phenotypes, but track genotypes instead (there are more of them than there are phenotypes since many genotypes have the same phenotype).
   i) 1/16 PPYY
   ii) 2/16 PPYy
   iii) 1/16 PPyy
   iv) 2/16 PpYY
   v) 4/16 PpYy   This could be written as 1:2:1:2:4:2:1:2:1
   vi) 2/16 Ppyy
   vii) 1/16 ppYY
   viii)   2/16 ppYy
   ix) 1/16 ppyy