Dihybrid Crosses: examining two separate traits at a time in a cross between two individuals.

- This is how Mendel developed his **law of independent assortment**.
- From a series of dihybrid crosses, Mendel concluded that **alleles of different traits "assort" themselves independently of one another during gamete formation (meiosis)**.
- As long as the genes of the different traits are on different chromosomes (no linkage), each allele for each trait has an equal probability of ending up in a gamete with each allele of the second trait.
- This is true for any number of traits examined, provided the genes are not linked on the same chromosome.
- In a dihybrid cross with two individuals, one true breeding for the dominant trait and the other true breeding for the recessive trait, the following phenotypic and genotypic ratios will be observed in the F_1 and F_2 generations:

P (parent generation): TTGG x ttgg
Tall/Green Short/Yellow

F1:	**Genotypic Ratio**	100% TtGg	
	Phenotypic Ratio	100% Tall Green	
F2:	**Phenotypic Ratio**	9 Tall/Green	(T_G_)
		3 Tall/Yellow	(T_gg)
		3 Short/Green	(ttG_)
		1Short/Yellow	(ttgg)

1. List the possible gametes produced by an individual with each of the following genotypes:

TtGg _____ _____ _____ _____

TtGG _____ _____ _____ _____

ttGg _____ _____ _____ _____

ttgg _____ _____ _____ _____

TtGgRr _____ _____ _____ _____ _____ _____ _____ _____

2. Given the following two loci, complete the Punnet square, provided below, for a mating between two individuals who are heterozygous for both traits. Fill in the table in part b) indicating the frequencies of each phenotype. (Capital letters denote dominant alleles)

SCALE COLOR: G = green g = orange

FIN COLOR: Y = yellow y = blue

Genotypes of parents: _____ x _____

a) complete the Punnet square

Female Gametes → Male Gametes ↓				

b) Indicate the expected phenotypic ratios from this mating:

PHENOTYPE	FREQUENCY or RATIO

3. Use a Punnet square to determine the phenotypic ratio of the offspring of the following dihybrid cross. (T = tall and t = short; R = round and r = wrinkled)

TtRr	x	Ttrr
Tall/Round		Tall/Wrinkled

<u>Test Crosses</u>: An individual with the dominant phenotype may have one of two genotypes: homozygous dominant or heterozygous. If the genotype of the individual is unknown, that individual is crossed with an individual known to be true breeding for the recessive phenotype (ie., homozygous recessive) and the phenotypic ratio of the offspring are used to determine the unknown genotype.

1. A tall individual of unknown genotype (T_) is mated with a short individual (tt) in a test cross.

    a) If the phenotypic ratio of the offspring is 100% tall, what is the genotype of the tall parent?

    _____

    b) If the phenotypic ratio of the offspring is 1 tall : 1 short, what is the genotype of the tall parent?

    _____

2. A tall/green (T_G_) individual is bred with a short/yellow (ttgg) individual in a test cross, and the phenotypic ratio of the offspring is 1 tall/green : 1 tall/yellow. What is the genotype of the tall/green (T_G_) parent?

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