KEY

drott

## Dihybrid Crosses

Dihybrid crosses use Punnett squares to distribute parental alleles from *two* genes into gametes (eggs and sperm or pollen and ovum) as would be predicted by meiosis.

In garden peas, tallness (T) is dominant to shortness (t) and axillary flowers (A) are dominant to terminal flowers (a). What are the expected ratios for the genotypes and phenotypes of the offspring if a heterozygous tall, heterozygous axillary plant is crossed with a heterozygous tall, terminal plant?

| | TA | Ta | +A | +a |
|---|---|---|---|---|
| TA | TTAa | TTaa | T+Aa | T+aa |
| Ta | TTAa | TTaa | T+Aa | T+aa |
| +a | T+Aa | T+aa | ++Aa | ++aa |
| +a | T+Aa | T+aa | ++Aa | ++aa |

**Guidelines for Dihybrid Punnett Squares**

1. Dihybrid crosses - use the *FOIL* method from the binomial distributive property of multiplication.
ex: gamete distribution for AaBb: AB Ab aB ab

2. Dominant alleles (upper case) are written before recessive allele (lower case) - except for distributing alleles in dihybrid crosses.

3. Alleles of the same gene always stay

parent 1: T+Aa
parent 2: T+aa

Genotypes:

Phenotypes:

Genotype Ratios:

$\frac{2}{16}$ TTAa : $\frac{2}{16}$ TTaa : $\frac{4}{16}$ T+Aa :

$\frac{4}{16}$ T+aa : $\frac{2}{16}$ ++Aa : $\frac{2}{16}$ ++aa

Phenotype Ratios: $\frac{6}{16}$ Tall Axial $\frac{2}{16}$ short Axial

$\frac{6}{16}$ Tall terminal $\frac{2}{16}$ short terminal

1. In horses, the coat color black is dominant (B) over chestnut (b). The trotting gait is dominant (T) over the pacing gait (t). If a homozygous black pacer is mated to a homozygous chestnut, heterozygous trotter, what will be the ratios for genotype and phenotype of the F1 generation?

| | B+ | B+ | B+ | B+ |
|---|---|---|---|---|
| bT | BbT+ | | | |
| b+ | Bb++ | | | |
| bT | BbT+ | | | |
| b+ | Bb++ | | | |

| | Parents 1 | Parent 2 |
|---|---|---|
| Genotypes: | BB++ | bbT+ |
| Phenotypes: | Black pacer | chestnut trotter |

Genotype Ratios:

~~$\frac{1}{4}$ BbT+ : $\frac{1}{4}$ Bb++ $\frac{1}{4}$ Bb~~

$\frac{1}{2}$ BbT+ : $\frac{1}{2}$ Bb++

Phenotype Ratios:

$\frac{1}{2}$ Black trotter : $\frac{1}{2}$ Black pacer

F. O. I. L.

2. In rabbits, the coat color black dominant (B) over brown (b). Short hair is dominant (S) over long (s). In a cross between a homozygous black short-haired male and a brown homozygous long-haired female, what would be the ratios for genotype and phenotype of the F1 generation?

| | BS | BS | BS | BS |
|---|---|---|---|---|
| bs | Bb Ss | | | |
| bs | Bb Ss | | | |
| bs | Bb Ss | | | |
| bs | Bb Ss | | | |

P1: BBSS
P2: bbss

BBSS

Genotypes:

Phenotypes: P1: Homozygous black short
P2: brown homozygous long

Genotype Ratios:

All BbSs

Phenotype Ratios:

All Black short

3. Imagine that a couple is planning to have children. The male is heterozygous for Huntington's disease and homozygous dominant for Tay-Sachs. The female is homozygous recessive for Huntington's disease and heterozygous for Tay-Sachs. The couple is curious about the possibility and probability of their offspring inheriting Tay-Sachs and/or Huntington's. For humans, Huntington's disease is dominant (H) over the "normal" condition (h), and the "normal" condition is dominant (T) over Tay-Sachs (t). Complete a Punnett square for this cross and record the probabilities for genotypes and phenotypes of the offspring as ratios.

| | HT | hT | HT | hT |
|---|---|---|---|---|
| hT | HhTT | hhTT | HhTT | hhTT |
| h+ | Hh T+ | hhT+ | HhT+ | hhT+ |
| hT | HhTT | hhTT | HhTT | hhTT |
| h+ | HhT+ | hhT+ | HhT+ | hhT+ |

| | Parent 1 | Parent 2 |
|---|---|---|
| Genotypes: | Hh TT | hh T+ |
| Phenotypes: | Huntington's & normal | normal<br>normal |

Genotype Ratios:

$\frac{1}{4}$ HhTT : $\frac{1}{4}$ HhT+ :

$\frac{1}{4}$ hhTT : $\frac{1}{4}$ hhT+

Phenotype Ratios:

$\frac{1}{2}$ Huntington's & no Tay-Sachs :

$\frac{1}{2}$ no Huntington's & no Tay-Sachs