

Name _____ Date _____ Period _____

Worksheet: Dihybrid Crosses

UNIT 3 : GENETICS

Directions: Answer the following genetic cross problems. You can refer to the "Punnett Square Cheat Sheet" attached at the end of this worksheet to help you solve the different types of problems. It is essential that you know the all of the vocabulary included in the "cheat sheet" as well. Remember when you are doing a genetic cross to follow the steps below to complete!

- STEP 1:** Determine what kind of problem you are trying to solve.
- STEP 2:** Determine letters you will use to specify traits.
- STEP 3:** Determine parent's genotypes.
- STEP 4:** Make your punnett square and make gametes
- STEP 5:** Complete cross and determine possible offspring.
- STEP 6:** Determine genotypic and phenotypic ratios.

Two-Factor Crosses (Di-hybrid)

1. In man, assume that spotted skin (S) is dominant over non-spotted skin (s) and that wooly hair (W) is dominant over non-wooly hair (w). Cross a marriage between a heterozygous spotted, non-wooly man with a wooly-haired, non-spotted woman. Give genotypic and phenotypic ratios of offspring.
2. In horses, black is dependent upon a dominant gene, B, and chestnut upon its recessive allele, b. The trotting gait is due to a dominant gene, T, the pacing gait to its recessive allele, t. If a homozygous black pacer is mated to a homozygous chestnut trotter, what will be the appearance of the F₁ generation?

3. In snapdragon flowers, red color is not completely dominant over white color and tall plants are dominant over short plants. What would expect to get from a genetic cross of a homozygous tall red snapdragon with a short white plant? Give genotypic and phenotypic ratios of the offspring.

4. What are the genotypic and phenotypic ratios in the offspring resulting from a cross between two pea plants that are heterozygous for pod color and pod shape?

Trait	Dominant Allele	Recessive Allele
pod shape	smooth (S)	constricted (s)
pod color	green (G)	yellow (g)
flower position	axial (A)	terminal (a)
plant height	tall (T)	short (t)

Parental genotypes _____
Possible gametes _____

5. In mice, the ability to run normally is a dominant trait. Mice with this trait are called running mice (R). The recessive trait causes mice to run in circles only. Mice with this trait are called waltzing mice (r). Hair color is also inherited in mice. Black hair (B) is dominant over brown hair (b).

For each of the following problems, determine the parent genotypes, possible gametes, then construct a Punnett square to solve.

a. Cross a heterozygous running, heterozygous black mouse with a homozygous running, homozygous black mouse

Parental genotypes _____
Possible gametes _____
Offspring phenotypic ratio _____

b. Cross a homozygous running, homozygous black mouse with a heterozygous running, brown mouse

Parental genotypes _____
Possible gametes _____
Offspring phenotypic ratio _____

Worksheet: Dihybrid Crosses

UNIT 3: GENETICS

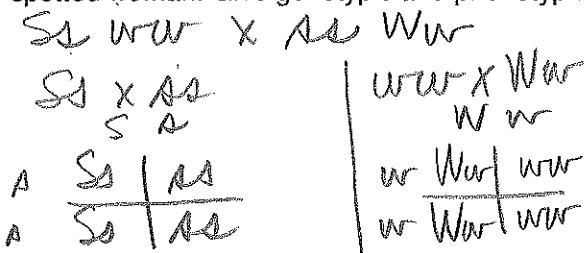
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Two-Factor Crosses (Di-hybrid)

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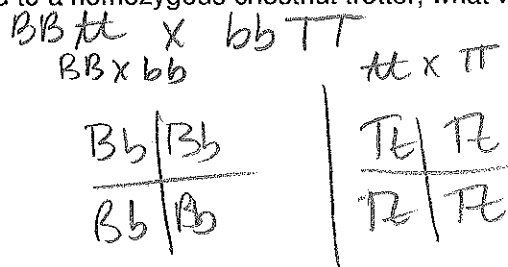
S spotted
s no spots
W woolly
w non woolly



Spot woolly $\frac{2}{4} \times \frac{2}{4} = \frac{4}{16}$
 Spot non woolly $\frac{2}{4} \times \frac{2}{4} = \frac{4}{16}$
 no spot woolly $\frac{2}{4} \times \frac{2}{4} = \frac{4}{16}$
 no spot no woolly $\frac{2}{4} \times \frac{2}{4} = \frac{4}{16}$
 * 1 : 1 : 1 : 1 16/16

2. In horses, black is dependent upon a dominant gene, B, and chestnut upon its recessive allele, b. The trotting gait is due to a dominant gene, T, the pacing gait to its recessive allele, t. If a homozygous black pacer is mated to a homozygous chestnut trotter, what will be the appearance of the F₁ generation?

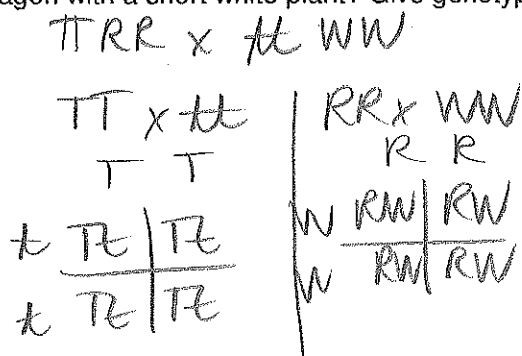
B black
b chestnut
T trotter
t pacer



black trotter $\frac{4}{4} \times \frac{4}{4} = \frac{16}{16}$
 black pacer $\frac{4}{4} \times \frac{0}{4} = \frac{0}{16}$
 chest. trotter $\frac{0}{4} \times \frac{4}{4} = \frac{0}{16}$
 chest. pacer $\frac{0}{4} \times \frac{0}{4} = \frac{0}{16}$
 * 100% black trotter 16/16

3. In snapdragon flowers, red color is not completely dominant over white color and tall plants are dominant over short plants. What would expect to get from a genetic cross of a homozygous tall red snapdragon with a short white plant? Give genotypic and phenotypic ratios of the offspring.

T tall
t short
RR - red
WW - white
RW - pink



tall red $\frac{4}{4} \times \frac{0}{4} = \frac{0}{16}$
 tall white $\frac{4}{4} \times \frac{0}{4} = \frac{0}{16}$
 tall pink $\frac{4}{4} \times \frac{4}{4} = \frac{16}{16}$
 short red $\frac{0}{4} \times \frac{0}{4} = \frac{0}{16}$
 short wh. $\frac{0}{4} \times \frac{0}{4} = \frac{0}{16}$
 short pink $\frac{0}{4} \times \frac{4}{4} = \frac{0}{16}$
 * 100% tall pink 16/16

4. What are the genotypic and phenotypic ratios in the offspring resulting from a cross between two pea plants that are heterozygous for pod color and pod shape?

Trait	Dominant Allele	Recessive Allele
pod shape	smooth (S)	constricted (s)
pod color	green (G)	yellow (g)
flower position	axial (A)	terminal (a)
plant height	tall (T)	short (t)

Parental genotypes $Gg Nn \times Gg Nn$

Possible gametes $GN Gn gN gn$

G Gg Gg
 g Gg gg

N NN Nn
 n Nn nn

9:3:3:1 (Rule of thumb)

N-smooth
 n-constricted
 G-green
 g-yellow

Smooth Green $3/4 \times 3/4 = 9/16$
 Smooth yellow $3/4 \times 1/4 = 3/16$
 Const. green $1/4 \times 3/4 = 3/16$
 Const. yellow $1/4 \times 1/4 = 1/16$

5. In mice, the ability to run normally is a dominant trait. Mice with this trait are called running mice (R). The recessive trait causes mice to run in circles only. Mice with this trait are called waltzing mice (r). Hair color is also inherited in mice. Black hair (B) is dominant over brown hair (b).

R - run r - waltzing B - black b - brown

For each of the following problems, determine the parent genotypes, possible gametes, then construct a Punnett square to solve.

a. Cross a heterozygous running, heterozygous black mouse with a homozygous running, homozygous black mouse

Parental genotypes $Rr Bb \times RR BB$

Possible gametes $RB Rb rB rb$

Offspring phenotypic ratio 100% run black

run black $4/4 \times 4/4 = 16/16$

run brown $4/4 \times 0/4 = 0/16$

waltz black $0/4 \times 4/4 = 0/16$

waltz brown $0/4 \times 0/4 = 0/16$

	R	R
R	RR	RR
r	Rr	Rr

	B	B
B	BB	BB
b	Bb	Bb

4:0:0:0

b. Cross a homozygous running, homozygous black mouse with a heterozygous running, brown mouse

Parental genotypes $RR BB \times Rr bb$

Possible gametes $RB Rb rB rb$

Offspring phenotypic ratio 100% run black

run black $4/4 \times 4/4 = 16/16$

run brown $4/4 \times 0/4 = 0/16$

waltz black $0/4 \times 4/4 = 0/16$

waltz brown $0/4 \times 0/4 = 0/16$

	R	R
R	RR	RR
r	Rr	Rr

	B	b
B	Bb	Bb
b	Bb	Bb

4:0:0:0

c. Cross a waltzing brown mouse with a waltzing brown mouse

Parental genotypes $rrbb \times rrbb$ $rr \times rr$ $bb \times bb$
 Possible gametes $rb \ rb \ rb \ rb$ $r \ r$ $b \ b$
 Offspring phenotypic ratio 100% waltz brown $rr \ rr$ $bb \ bb$

d. Cross a homozygous running, heterozygous black mouse with a waltzing brown mouse

Parental genotypes $RRBb \times rrbb$ $RR \times rr$ $Bb \times bb$
 Possible gametes $RB \ Rb \ rB \ rb$ $R \ R$ $b \ b$
 Offspring phenotypic ratio Run black Run brown $r \ rr$ $Bb \ bb$
 $r \ rr$ $Bb \ bb$

Run black $4/4 \times 2/4 = 8/16$
 Run brown $4/4 \times 2/4 = 8/16$
 waltz black $0/4 \times 2/4 = 0/16$
 waltz brown $0/4 \times 2/4 = 0/16$
 $16/16$

e. Cross a heterozygous running, brown mouse with a heterozygous running, homozygous black mouse

Parental genotypes $Rrbb \times RrBB$ $Rr \times Rr$ $bb \times BB$
 Possible gametes $Rb \ Rb \ rB \ rb$ $R \ r$ $b \ B$
 Offspring phenotypic ratio Run black Run brown waltz blk $r \ rr$ $Bb \ Bb$
 $r \ rr$ $Bb \ Bb$

Run black $3/4 \times 4/4 = 12/16$
 Run brown $3/4 \times 0/4 = 0/16$
 waltz black $1/4 \times 4/4 = 4/16$
 waltz brown $1/4 \times 0/4 = 0/16$
 $16/16$

f. Cross a heterozygous running, heterozygous black mouse with a heterozygous running, heterozygous black mouse

Parental genotypes $Rr Bb \times Rr Bb$

Possible gametes $RB Rb rB rb$

Offspring phenotypic ratio $9:3:3:1$

	R	r
R	RR	Rr
r	Rr	rr

	B	b
B	BB	Bb
b	Bb	bb

run black $3/4 \times 3/4 = 9/16$

run brown $3/4 \times 1/4 = 3/16$

waltz black $1/4 \times 3/4 = 3/16$

waltz brown $1/4 \times 1/4 = 1/16$

$9:3:3:1$
 dom dom rec rec
 dom rec dom rec

* Rule of thumb