

Notes: Dihybrid Cross (Two-Trait)

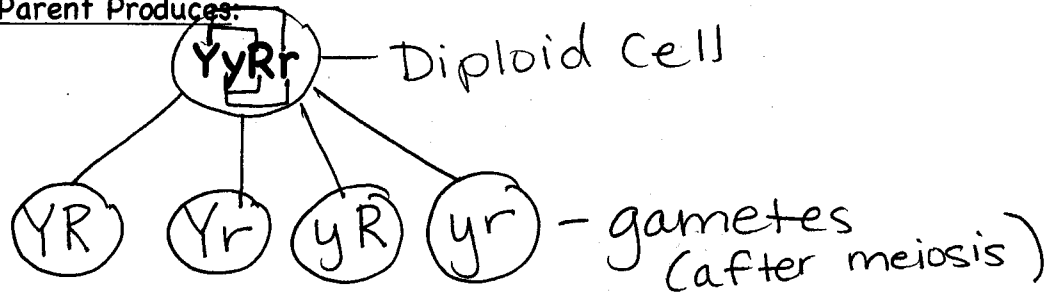
Background Information:

Pea Plants:

Seed Shape: Round (R) Dominant, Wrinkled (r) Recessive

Seed Color: Yellow (Y) Dominant, Green (y) Recessive

Determine Gametes that Parent Produces:



Questions:

1. How many pairs of alleles are in the gametes?

None (No Pairs)

2. How many total alleles are in the gametes?

2 (1 of each kind/trait)

Example #1: Cross the following parents. $\begin{matrix} \text{1st} \\ \boxed{\text{YyRr}} \\ \text{2nd} \end{matrix}$ and $\begin{matrix} \text{1st} \\ \boxed{\text{YyRr}} \\ \text{2nd} \end{matrix}$

a. Punnett Square

	YR	Yr	yR	yr
YR	YYRR	YYRr	YyRR	YyRr
Yr	YYRr	YYrr	YyRr	Yyrr
yR	YyRR	YyRr	yyRR	yyRr
yr	YyRr	Yyrr	yyRr	yyrr

b. Genotype Ratio

$1 \text{ YYRR} : 2 \text{ YYRr} : 1 \text{ YYrr} :$
 $2 \text{ YyRR} : 4 \text{ YyRr} : 2 \text{ Yyrr} :$
 $1 \text{ yyRR} : 2 \text{ yyRr} : 1 \text{ yyrr}$

c. Phenotype Ratio

$9 \text{ Round + Yellow} : 3 \text{ Round + Green} :$
 $3 \text{ Wrinkled + yellow} : 1 \text{ Wrinkled + Green}$

Example #2: Cross the following parents YYRr and yyRR

a. Punnett Square

	YR	Yr	YR	Yr
yR	YyRR	YyRr	YyRR	YyRr
yR	YyRR	YyRr	YyRR	YyRr
yR	YyRR	YyRr	YyRR	YyRr
yR	YyRR	YyRr	YyRR	YyRr

b. Genotype Ratio

\ominus YYRR : \ominus YYRr : \ominus YYrr :
 \ominus YyRR : \ominus YyRr : \ominus Yyrr :
 \ominus yyRR : \ominus yyRr : \ominus yyrr

c. Phenotype Ratio

16 Yellow + Round : \ominus Yellow + Wrinkled : \ominus Green + Round : \ominus Green + Wrinkled

Example #3: Cross a heterozygous yellow/wrinkled parent with a green/homozygous dominant round parent

Yyrr

yyRR

a. Punnett Square

	Yr	Yr	yr	yr
yR	YyRr	YyRr	yyRr	yyRr
yR	YyRr	YyRr	yyRr	yyRr
yR	YyRr	YyRr	yyRr	yyRr
yR	YyRr	YyRr	yyRr	yyRr

b. Genotype Ratio

\ominus YYRR : \ominus YYRr : \ominus YYrr :
 \ominus YyRR : \ominus YyRr : \ominus Yyrr :
 \ominus yyRR : \ominus yyRr : \ominus yyrr

c. Phenotype Ratio

8 Yellow + Round : \ominus Yellow + Wrinkled : 8 Green + Round : \ominus Green + Wrinkled

d. What are the odds of the parents having a yellow and round offspring?

~~50%~~ 8/16 or 50%

e. What are the odds of the parents having a green and round offspring?

~~50%~~ 8/16 or 50%

Notes: Incomplete & Codominance

I. Incomplete Dominance: (Neither is dominant)
 The phenotype of a heterozygote is an intermediate (blend) of the 2 homozygotes.

Example:

C = curly hair c = straight hair
 (could be written either way)

CC = Curly Hair Cc = Wavy Hair cc = Straight Hair

Information for Practice Problems:

R = Red Flower Petals r = White Flower Petals
 C = Curly Hair c = Straight Hair

Practice Problem #1: Cross the following flowers: Rr and Rr . Genotype ratio? Phenotype Ratio? Odds of having offspring with Red Flower Petals?

	R	r
R	RR	Rr
r	Rr	rr

$$GR = 1RR : 2Rr : 1rr$$

$$PR = 1 \text{ Red} : 2 \text{ Pink} : 1 \text{ White}$$

$$\text{Odds} = \frac{1}{4} = 25\%$$

Practice Problem #2: Cross a Wavy Haired Woman with a Straight Haired Man. Genotype Ratio? Phenotype Ratio? Odds of having Curly Haired offspring?

	C	c
c	Cc	cc
c	Cc	cc

$$GR = 0CC : 2Cc : 2cc$$

$$PR = 0 \text{ Curly} : 2 \text{ Wavy} : 2 \text{ Straight}$$

$$\text{Odds} = \frac{0}{4} = 0\%$$

II. Codominance:

Both alleles are equally expressed in the heterozygote.

Example:

B = Black BB = Black Bb = Speckled
b = White bb = white

Information for Practice Problems:

B = Black Fur b = White Fur
W = White Feathers w = Black Feathers

Practice Problem #1 Cross Bb and Bb parents. Genotype Ratio? Phenotype Ratio?

	B	b
B	BB	Bb
b	Bb	bb

GR = 1 BB : 2 Bb : 1 bb

PR = 1 Black : 2 Speckled : 1 white

Practice Problem #2 Cross a white-feathered chicken with a black-feathered chicken. Genotype Ratio? Phenotype Ratio?

	W	w
w	Ww	w
w	Ww	w

GR = 0 WW : 4 Ww : 0 ww

PR = 0 White : 4 Speckled : 0 Black

III. Blood Type: An example of complete dominance and codominance.

Possible Alleles:

I^A
 I^B } Codominant
i - recessive

Possible Genotypes:

Possible Phenotypes:

$I^A I^A$ → A
 $I^A i$ → A
 $I^B I^B$ → B
 $I^B i$ → B
 $I^A I^B$ → AB
i i → O

Practice Problem #1: Cross the following individuals: $I^A I^A$ and $I^B i$

	I^A	I^A
I^B	$I^A I^B$	$I^A I^B$
<i>i</i>	$I^A i$	$I^A i$

Possible Genotypes of Offspring? $I^A I^B + I^A i$

Possible Phenotypes of Offspring? $AB + A$

Odds of having a child with Type O blood? 0%

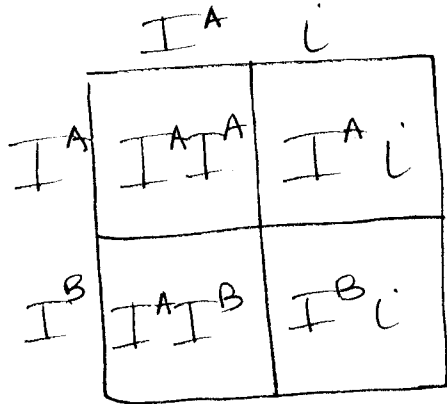
Practice Problem #2: Cross a Type O mother and a Type AB father. Possible Genotypes and Phenotypes of Offspring?

	<i>i</i>	<i>i</i>
I^A	$I^A i$	$I^A i$
I^B	$I^B i$	$I^B i$

G = $I^A i + I^B i$

P = $A + B$

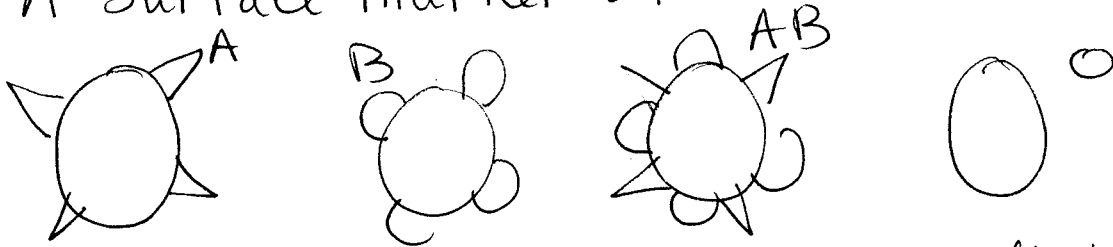
Practice Problem #3: Cross a Type A woman whose mother was Type O with a Type AB man.
Possible genotypes and phenotypes of offspring?



G = $I^A I^A, I^A i, I^A I^B, I^B i$
P = A, AB, B

What is an antigen?

A surface marker on a red blood cell.



Transfusions:

The transfer of blood from one individual to another.

Agglutination:

Clumping of blood that occurs when incompatible blood types are mixed.

Blood Transfusion Table:

		DONORS			
		A	B	AB	O
Reipients	A	NO	NO	NO	yes
	B	Yes	Yes	Yes	Yes
	AB	No	Yes	No	Yes
	O	Yes	No	No	Yes

What about Positive and Negative Blood Types?

Rh factor = Another Antigen

Have it = + Blood

Don't = - Blood

$I^A I^A$ = A+

$I^A I^B$ = AB-

O = O-

