Dihybrid cross are explained by Mendel's 3rd law: Law of Assortment

Two different genes with different alleles are crossed at the same time:
http://www.siskiyous.edu/class/bio1/genetics/dihybrid_v2.html

2 traits-Dihybrid Cross

The Law of Independent Assortment (for most traits)

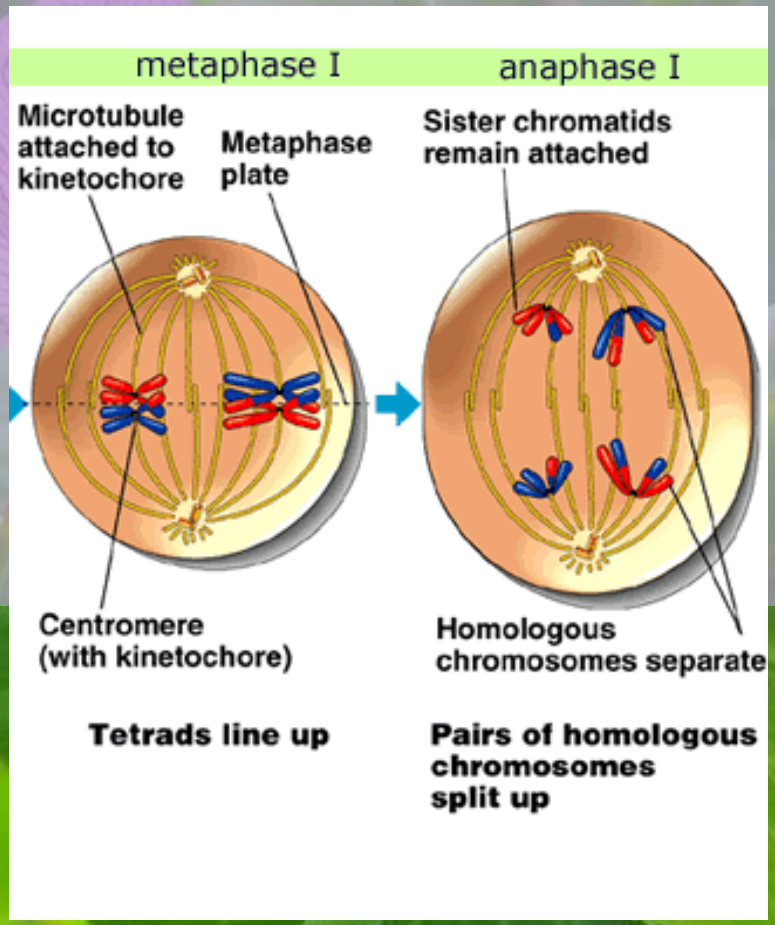
During metaphase I of meiosis I-Homologous chromosomes line up randomly and *usually* independent ly of each other. The random alignment of homologous chromosome pairs produces all combo's of genes in the gametes.

2 traits-Dihybrid Cross

Alleles for *different* parental traits are distributed to sex cells (& offspring) independently of one another assuming they are on different chromosomes or are located far apart on the same chromosome.

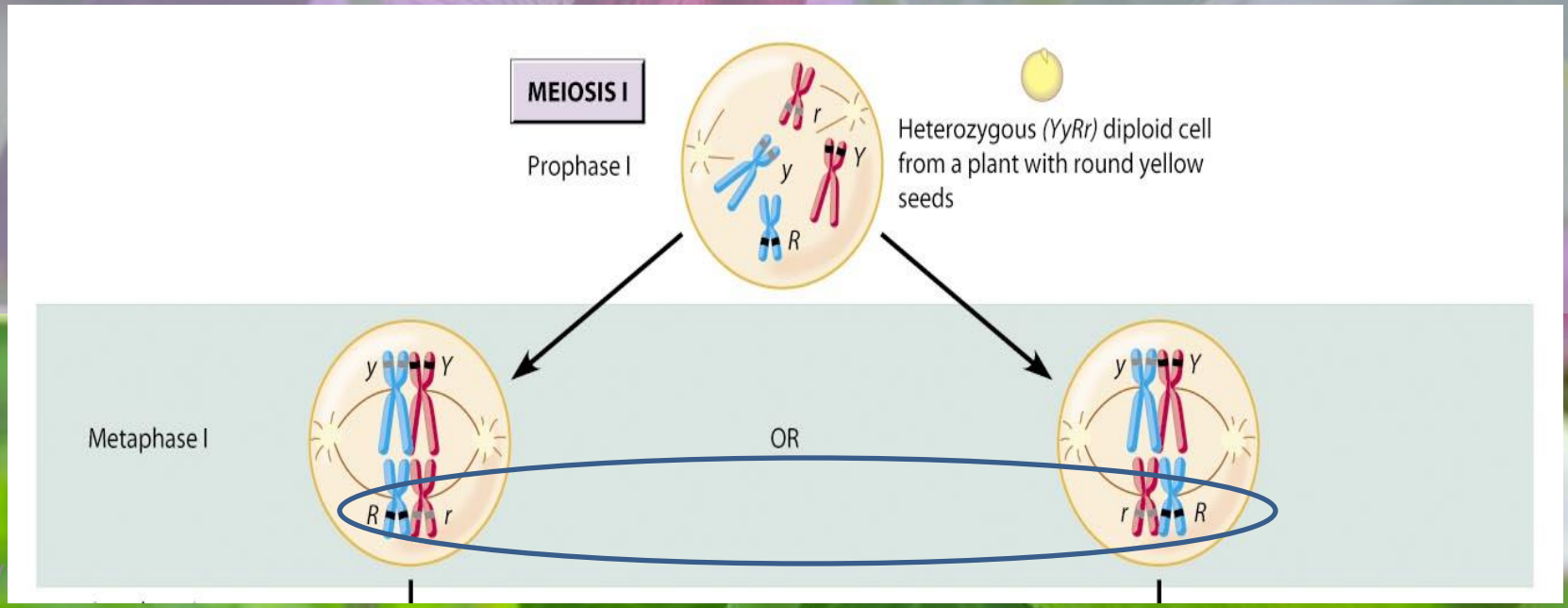
Law of Independent Assortment cont.

- During meiosis I, Homologous pairs line up and one trait/chromosome from each parent is separated from the homologous pair.
-



Law of Independent Assortment cont.

Lining up of pairs can occur in different combinations of chromosomes on each side of the metaphase equatorial plate . So for the two traits YyRr (Round yellow seeds) of one parent, there are four possible ways for chromosome traits to divide for gametes: YR, Yr, Ry, or ry.



2 traits-Dihybrid Cross

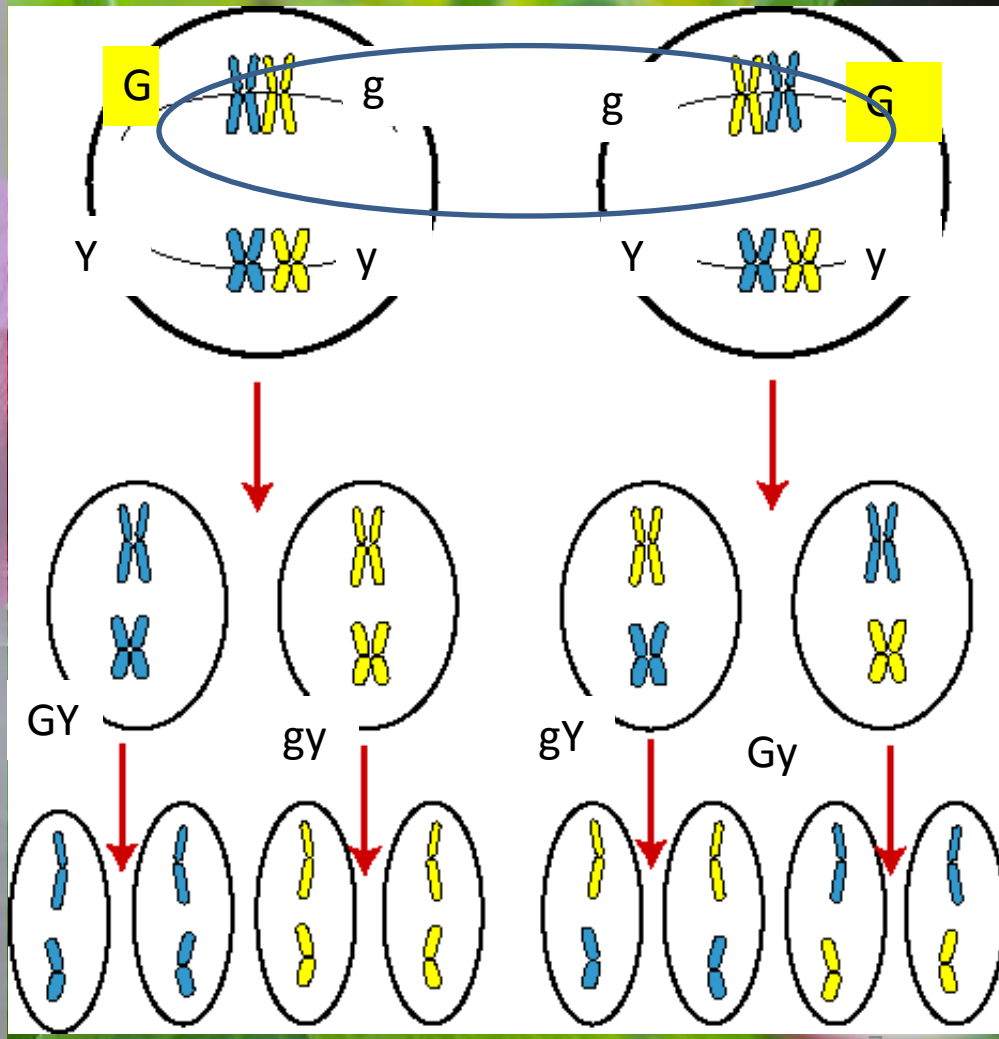
This pattern can result in a “dihybrid” cross—meaning two trait cross. Example:

- **YyRr x YyRr**
- **where**
  “Y" = dominant allele for yellow seeds
  “y" = recessive allele for green seeds
  “R" = dominant allele for round seeds
  “r" = recessive allele for wrinkled seeds

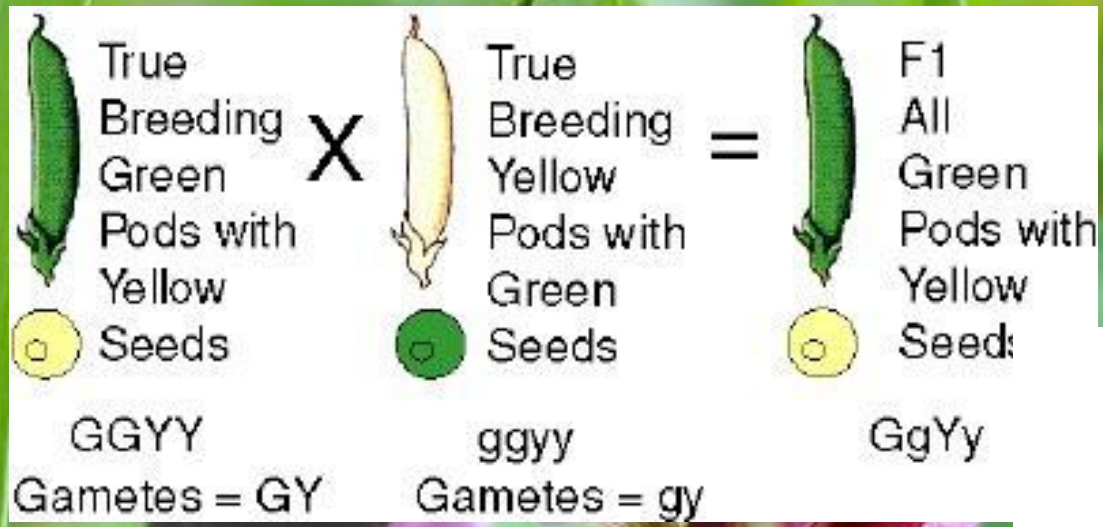
Chromosomes can line up in different order

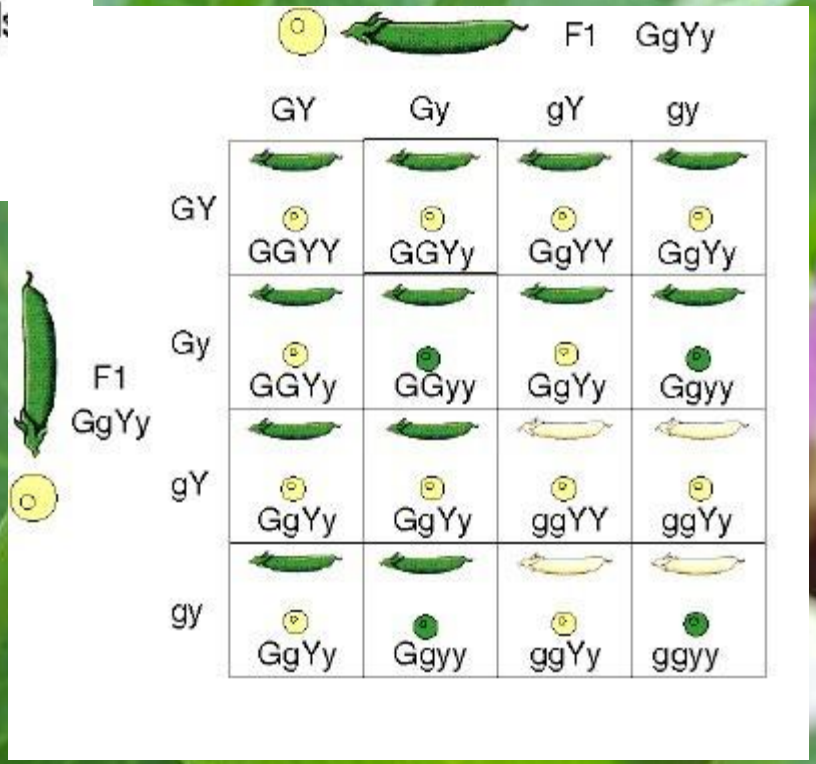
- If the chromosome pairs did not line up along the equator and separate randomly, offspring would have less genetic differences from their parents.

- For each meiotic division, there are two possible ways homologous pairs can match up during metaphase I. So, there are four gamete combination probabilities.



Dihybrid (2 trait) Cross for peas





Meiosis-exceptions to law of assortment

- Mendel's predictions of dihybrid crosses due to assortment are generally accurate--***Unless*** the alleles are very close together on the same chromosome. The closer together the traits are located on the chromosome, the more likely they will be inherited together.

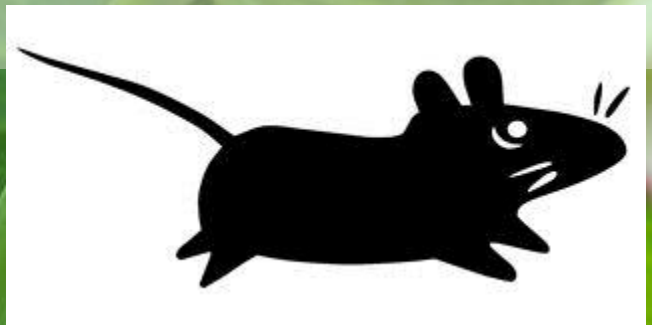
Steps in Creating this cross

Choose letters to represent the genes.

Example:

In mice, the ability to run normally is a dominant trait. Mice with this trait are called running mice (R).

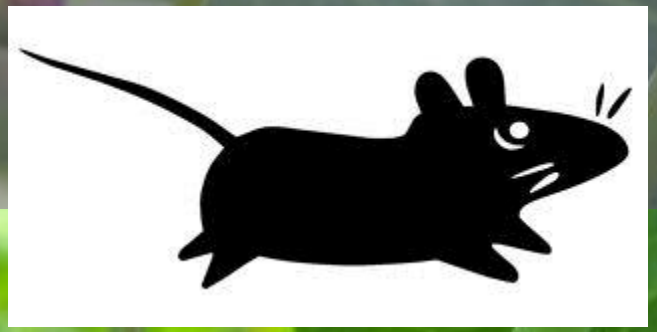
The recessive trait causes mice to run in circles only. Mice with this trait are called waltzing mice (r). Hair color is also inherited in mice. Black hair (B) is dominant over brown hair (b).

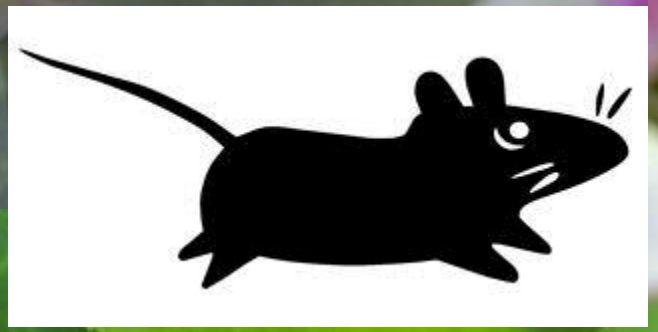


Steps in Creating this cross

QUESTION: Cross a heterozygous running, heterozygous black mouse with a heterozygous running, heterozygous black mouse. What is the phenotypic ratio of the offspring?

2) Write the genotypes of the parents.





Steps in Creating this cross

3) Determine the possible gametes each parent can produce.

Heterozygous Running: Rr

Heterozygous Color: Bb

Each parent has both traits: RrBb x RrBb

F O I L

FOIL is used to determine possible gamete combinations

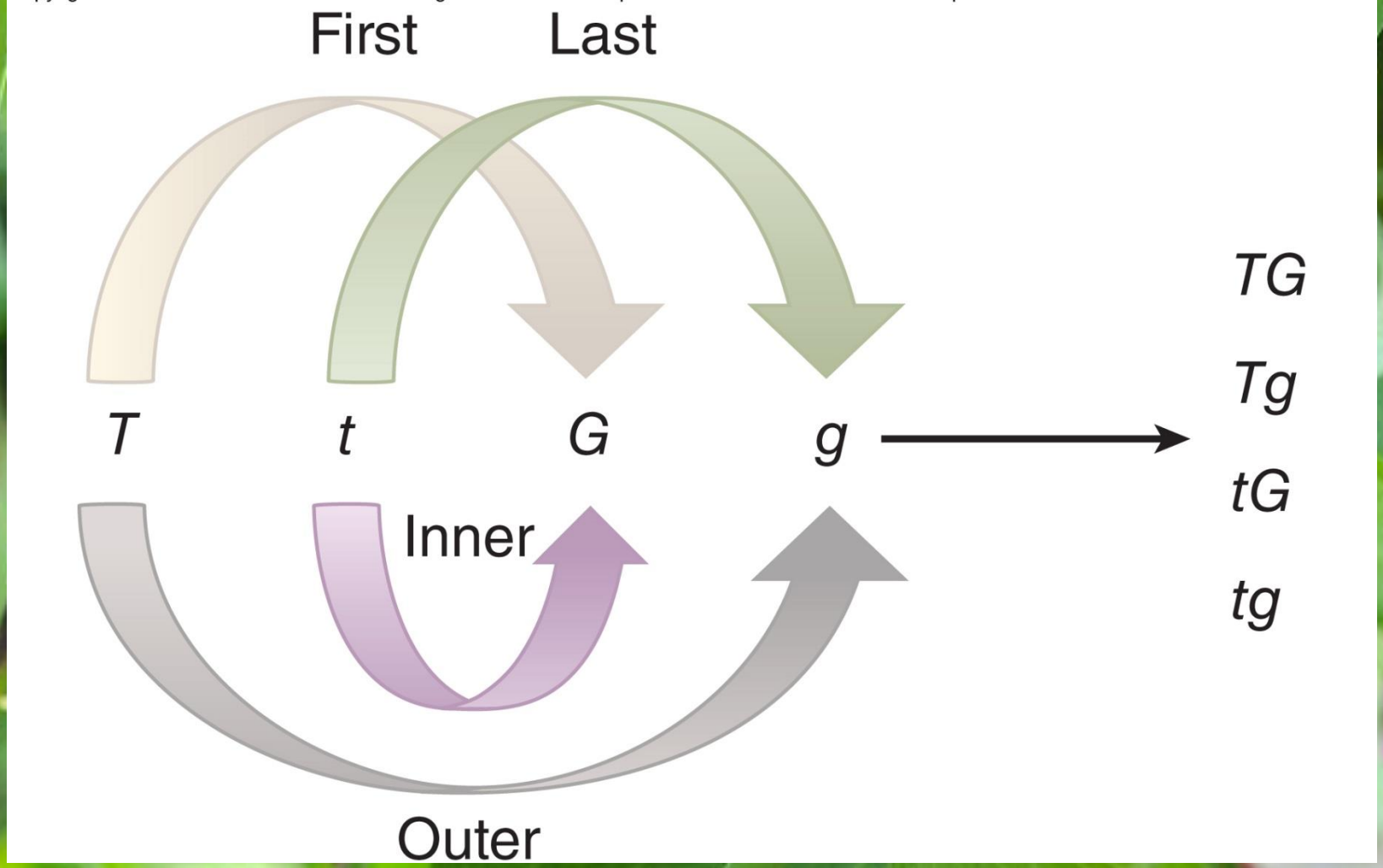


Figure 10.3B

Steps in Creating this cross

5) Enter the possible gametes on the top and sides of the square. **RrBb x RrBb**

FOIL	RB	Rb	rB	rb
RB				
Rb				
rB				
rb				

Steps in Creating this cross

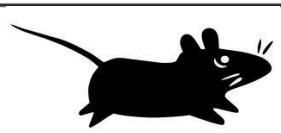
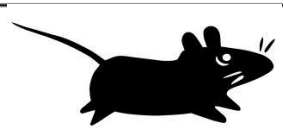
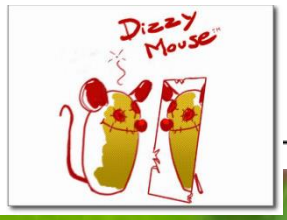
7) Genotype ratio is the ratio of boxes/offspring that match EXACTLY: 1: 2 RRBb: 2:4: 1:2:1:2:1

Does the total add up to 16?

	RB	Rb	rB	rb
RB	RRBB	RRBb	RrBB	RrBb
Rb	RRBb	RRbb	RrBb	Rrbb
rB	RrBB	RrBb	rrBB	rrBb
rb	RrBb	Rrbb	rrBb	rrbb

Steps in Creating this cross

5) Determine phenotypes possible: 9:3:3:1

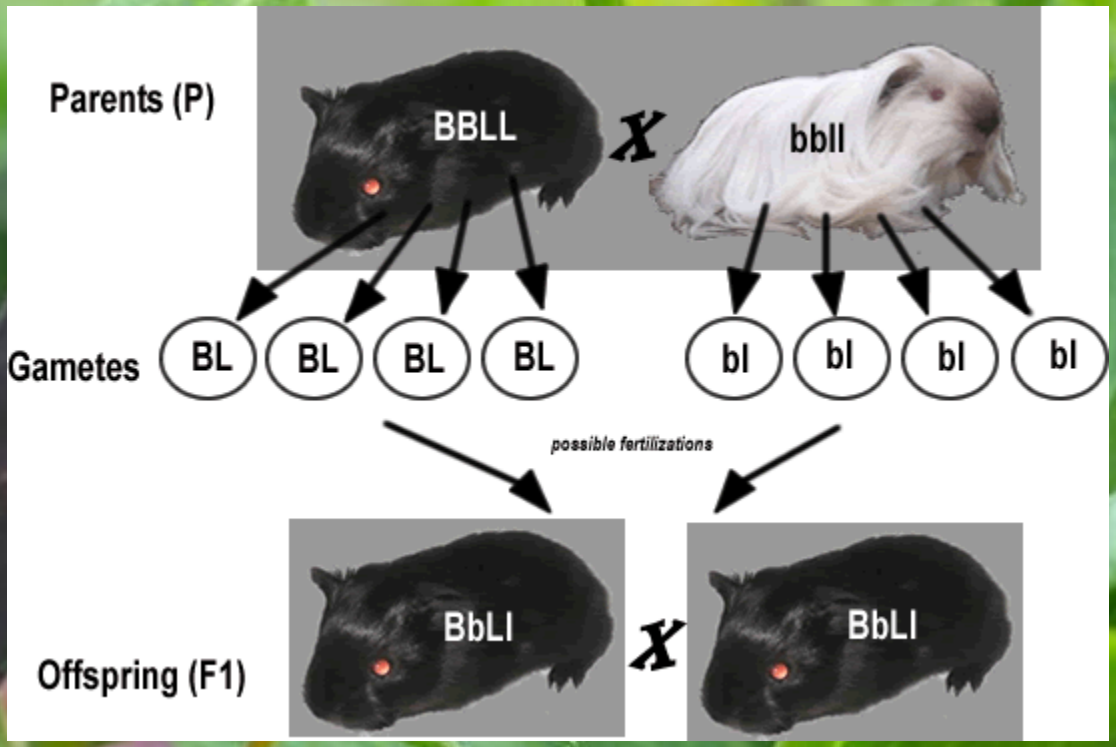
	RB	Rb	rB	rb
RB				
Rb				
rB				
rb				

PRACTICE!!!!

1)Lets review dihybrid crosses again:

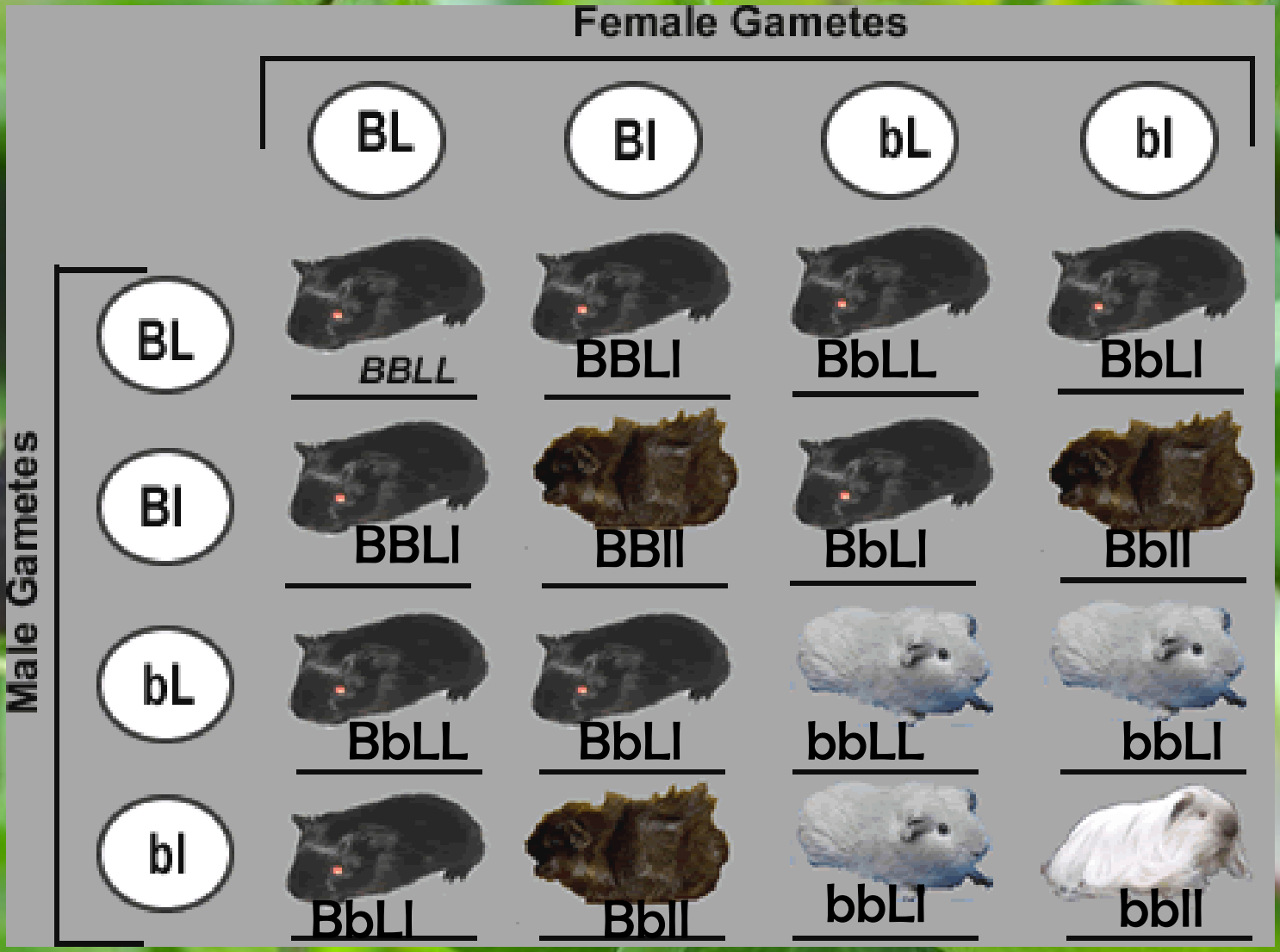
http://www.dnaftb.org/5/problem.html

Guinea Pig Cross



Can you tell which traits are dominant and which traits are recessive? How?

Fill in the possible F1 heterozygous cross genotypes on the chart provided:



Phenotypic ratios

How many, out of 16 are:

Black, Short ___9/16_____

Black, Long ____3/16_____

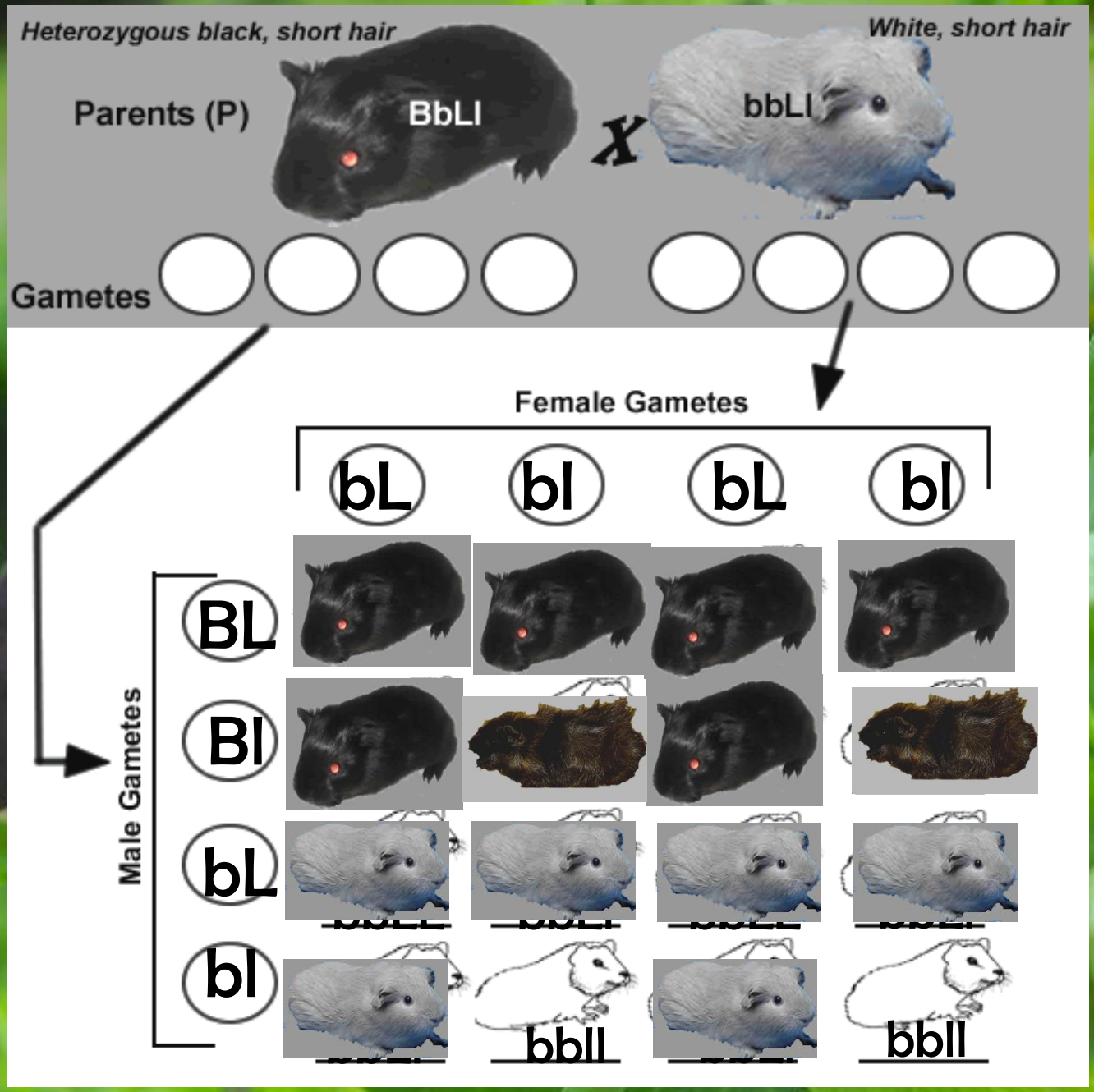
White, Short ____3/16_____

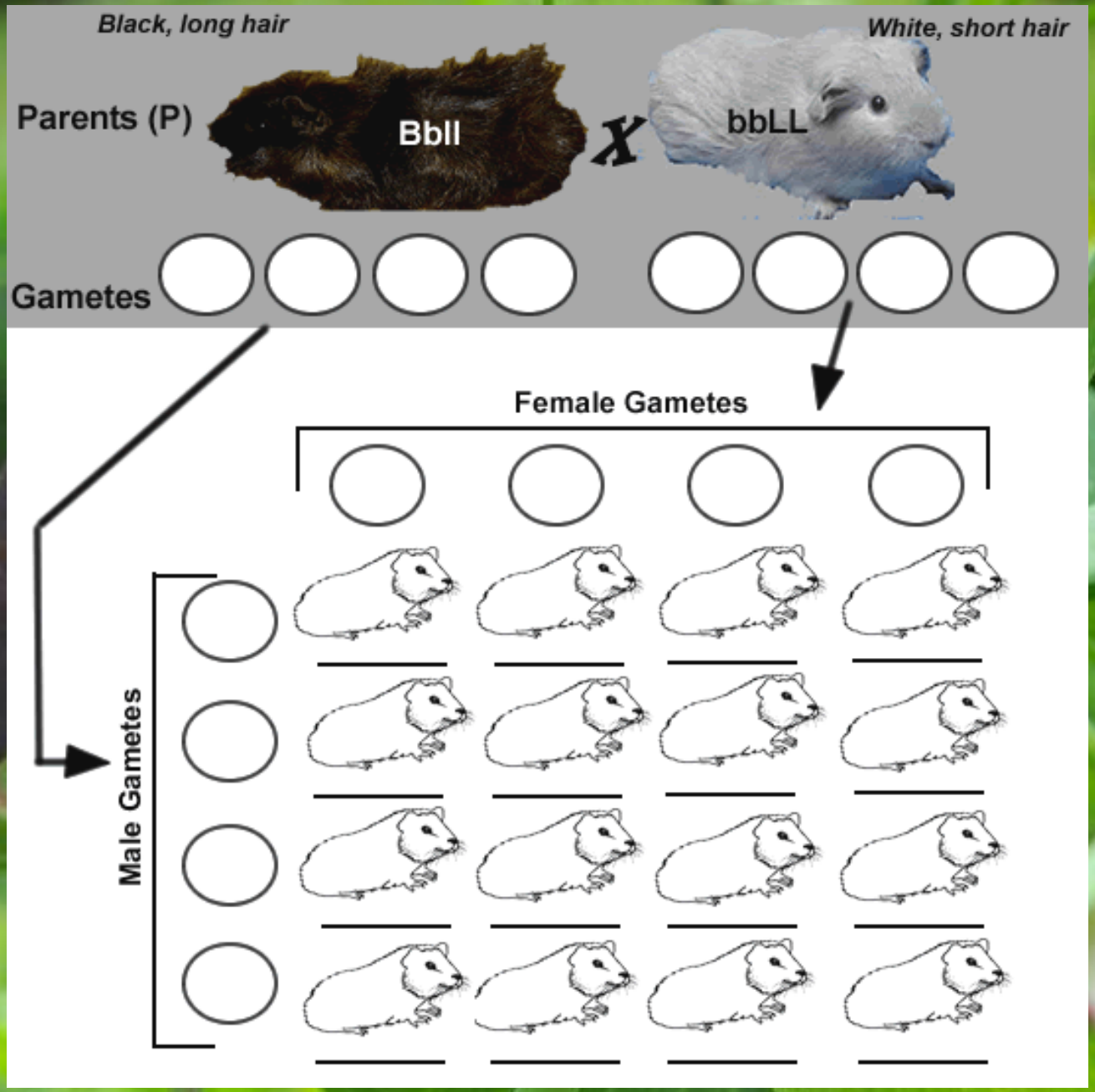
White, Long ____1/16_____

Phenotypeic Ratio for the cross is 9:3:3:1 (=16)

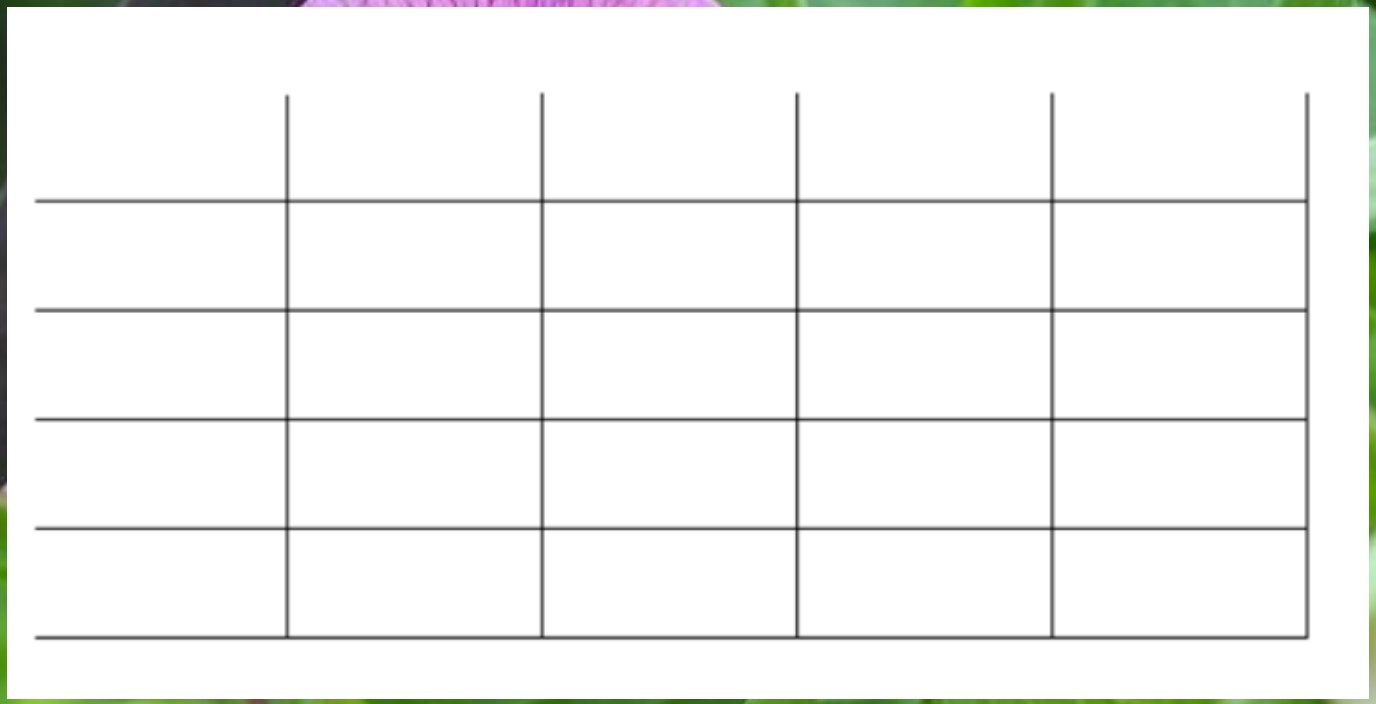
<u>Genotypic ratio</u>—add up all of the boxes with same letter combinations—what do you get? Check your answer by seeing if the total equals 16

1:2:2:4:1:2:3:1


Heterozygous black, short hair
White, short hair
Parents (P)
BbLl
X
bbLl
Gametes
Female Gametes
bL
bl
bL
bl
Male Gametes
BL
Bl
bL
bl
bbll
bbll


Black, long hair
White, short hair
Parents (P)
BbII
X
bbLL
Gametes
Female Gametes
Male Gametes

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



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

Cross a waltzing brown mouse with a waltzing brown mouse

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

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