Mendelian Genetics

What is Gregor Mendel known for and what plant did he use?

When did Mendel conduct most of his work?

What Mendel called particles are really…

Define the following:

Trait-Any characteristic that can be passed down from a _____ to their _____

Heredity-The _____of traits from parent to offspring

Genetics-The study of _____

Monohybrid Cross-Crosses involving a _____trait

Example-

Dihybrid Cross-Crosses involving _____ traits

Example

Alleles-The _____ forms of a gene (_____ and _____)

Dominant-_____of the two genes represented by a _____ letter

Recessive-The gene that shows up _____ often represented by a _____ letter. **You will need both copies of the recessive allele for that trait to be seen in an individual.

Genotype-The _____ combination for a trait. (ex _____ _____ _____)

Phenotype-The _____features such as _____ o r _____

Genotypes

Homozygous-When both alleles are the _____

Examples- _____ or _____ also called _____

Heterozygous-When both alleles are different

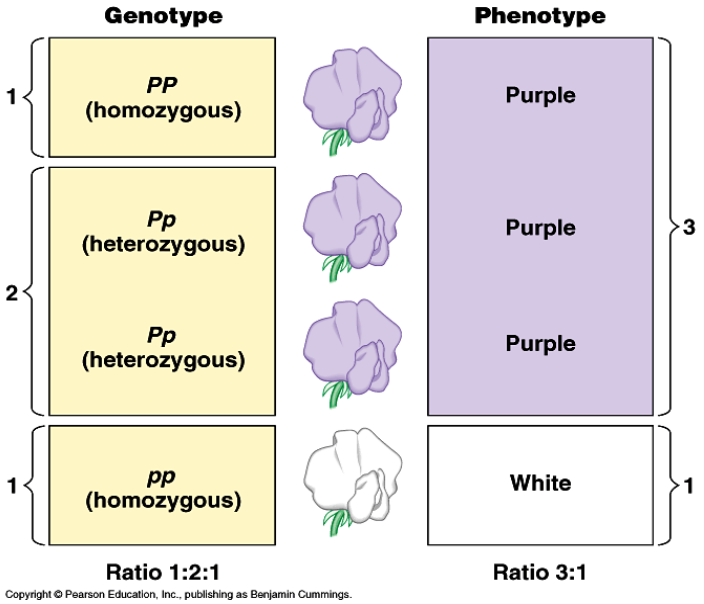
Example-_____ also called _____

Genotype Examples

Describe the general rule used for choosing genotypic letters.

Phenotypic Examples

	Genotype	Phenotype
If P = PURLPLE THEN…….	PP	
	Pp	
If p = WHITE THEN……	pp	



Pollen contains _____ produced by the _____ and the ovary contains _____

and is found inside the _____

Self-fertilization-

Cross-fertilization-

**List at least 4 reasons why Mendel used the garden pea *Pisum sativum*.

How did Mendel begin the process and produce pure strains?

Why is this so important?

Table 11.1 Pea-Plant Characters Studied by Mendel

Character studied	Dominant trait	Recessive trait
Seed shape	smooth	wrinkled
Seed color	yellow	green
Pod shape	inflated	wrinkled
Pod color	green	yellow

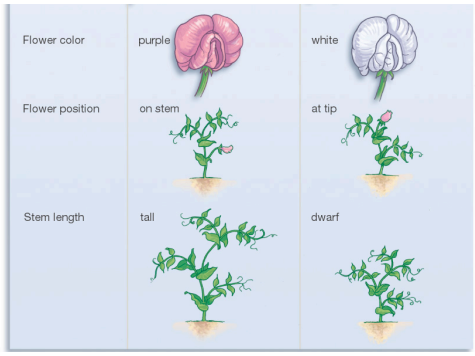
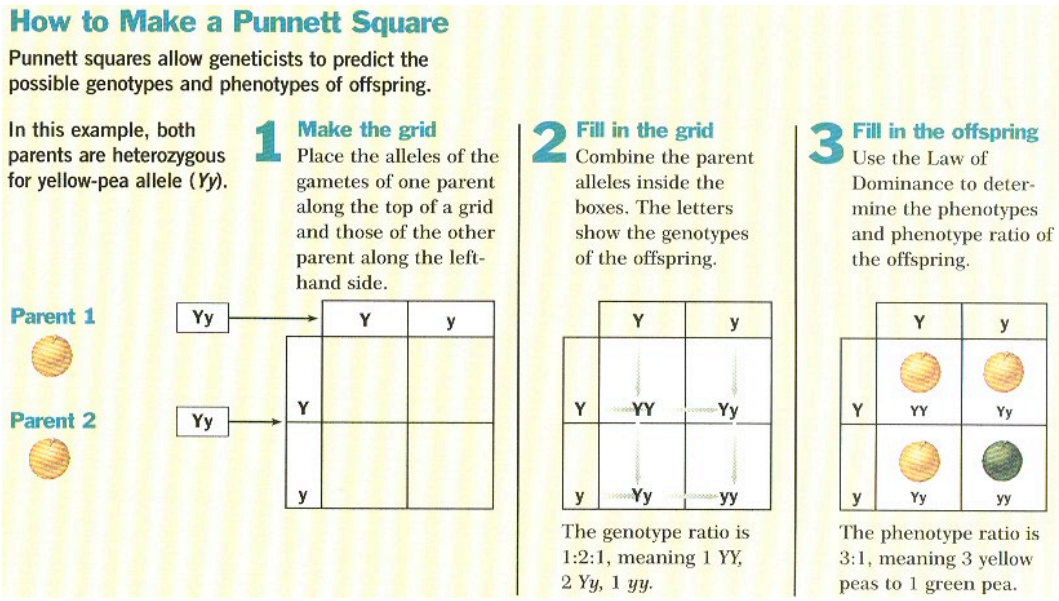


Table 11.2 Ratios of Dominant to Recessive in Mendel's Plants

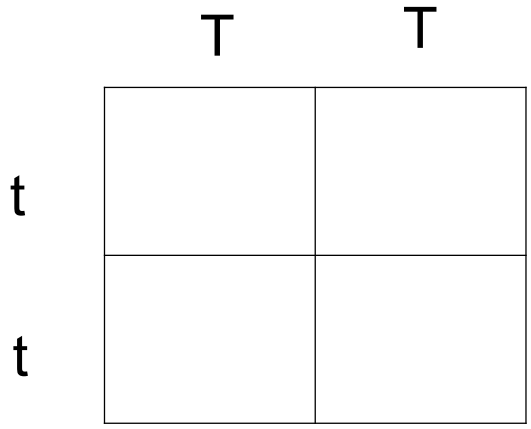
Dominant trait	Recessive trait	Ratio of dominant to recessive in F_2 generation
Smooth seed	Wrinkled seed	2.96:1 (5,474 smooth, 1,850 wrinkled)
Yellow seed	Green seed	3.01:1 (6,022 yellow, 2,001 green)
Inflated pod	Wrinkled pod	2.95:1 (882 inflated, 299 wrinkled)
Green pod	Yellow pod	2.82:1 (428 green, 152 yellow)
Purple flower	White flower	3.14:1 (705 purple, 224 white)
Flower on stem	Flower at tip	3.14:1 (651 along stem, 207 at tip)
Tall stem	Dwarf stem	2.84:1 (787 tall plants, 277 dwarfs)
	Average ratio, all traits:	**3:1**

How To Make A Punnett Square



Here Are The Steps How Mendel Ultimately Arrived At His 3:1 Ratio

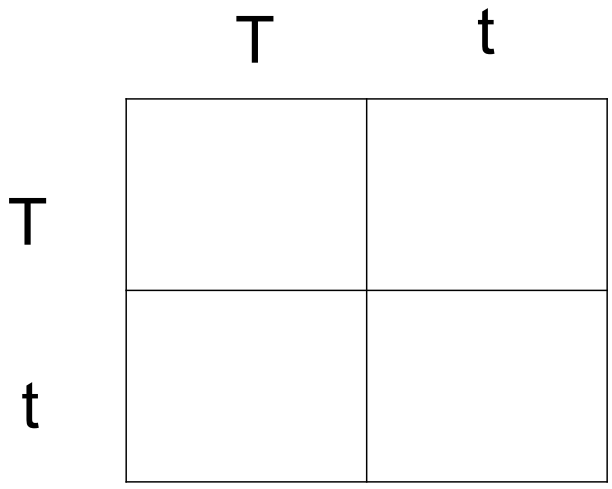
Step 1-He crossed a _____ with a _____. This cross is called the _____. The offspring of this cross are all _____ and are considered the _____.



**All of the offspring will be hybrids (Tt) showing the dominant trait.

****All of the offspring will have the genotype _____ and the phenotype _____**

Step 2-He crossed the offspring of the F_1 generation. This will yield offspring with a _____:_____ phenotypic ratio. This is called the F_2 generation. The only one that shows the recessive phenotype is tt.



Here is his 3:1 ration- 3 show the dominant trait and one shows the recessive trait.

What actual ratio did Mendel observe? _____

Why was his calculation not the same? _____

How could he have done the experiment better?

What is so strange about that pea pod?????

Following The Generations

1. Cross 2 pure plants.
2. Cross 2 hybrid plants.

Let's try one. **R=Round r=Wrinkled**

Do the P_1 Cross for RR x rr

RR x rr

What is the genotype and ratio?

What is the phenotype and ratio?

What is the term given to these offspring? _____

What happens when you cross the F_1 generation?

Monohybrid Cross

Rr x Rr

What are the genotypes and ratio?

What are the phenotypes and ratios?

What is term given to these offspring? _____

The Test Cross

If you think you have a pure dominant, there is a way to find out. Cross it with a pure recessive **RR (You think it may be pure) x rr. If it is pure, there will NOT be any showing the recessive phenotype**

Genotypes and ratio-

Phenotypes and ratio-

What would happen if you cross a hybrid with a pure recessive?

Rr (You think it may be pure) x rr If it is a hybrid, there will be some showing the recessive phenotype. 50% to be exact.

Genotypes and ratio-

Phenotypes and ratio-

Do we have in imposter? _____

Lets practice some simple monohybrid Punnett Squares.
****Always remember the capital letter is the dominant trait and use the same letters.**

In pea plants, the trait for tall stems is dominant over the trait for short stems. If two heterozygous tall plants are crossed, what percentage of the offspring would be expected to have the same *phenotype* as the parents?

1) 25%
2) 50%
3) 75%
4) 100%

In summer squash, white-colored fruit is dominant over yellow-colored fruit. If homozygous yellow-fruited plants are crossed with heterozygous white-fruited plants, what is the expected percentage of fruit color produced in the offspring?

1) 100 % yellow
2) 100% white
3) 50% yellow, 50% white
4) 25% yellow, 75% white

In certain rats, black fur is dominant over white fur. If two rats, both heterozygous for fur color, are mated, their offspring would be expected to have

1) four different genotypes and two different colors
2) two different genotypes and three different colors
3) three different genotypes and two different colors
4) three different genotypes and three different colors

In humans, the ability to roll the tongue is dominant over the inability to roll the tongue. If two parents who are homozygous dominant for this trait have 8 children, how many children would be expected to be *unable* to roll their tongues?

1) 0
2) 2
3) 8
4) 4

In canaries, the gene for singing (*S*) is dominant over the gene for non-singing (*s*). When hybrid singing canaries are mated with non-singing canaries, what percentage of the offspring is likely to possess the singing trait?

1) 0%
2) 25%
3) 50%
4) 100%

Crossing More Than One Trait

The first thing you need to determine is the total number of possible outcomes. We will focus mainly on 2 traits, but you should know how to do multiple traits.

We will use the formula 2^n, where n equals the number of HETEROZYGOUS TRAITS. If there are no HETEROZYGOUS TRAITS, the number will be zero and $2^0 = 1$

Magic Formula 2^n

Alleles	n=	Possible Outcomes
MMTtFFssWwDd	_____	_____
nnHHRrYyEeQq	_____	_____
RrYyCcHHPpAa	_____	_____
TTYYnnRReeWW	_____	_____

Let's Practice

T-Tall t-Short B-Brown b-Tan

TTBb

ttBb

Ttbb

TtBB

TTBB

ttBB

TtBb

Our first practice problem involves 2 traits.

TTBb x Ttbb

Since each side only has one heterozygous, there are only two different outcomes on each side of the equation. **The only problem is that they are different!**

_____ _____ X _____ _____

2: _____ and _____

2: _____ and _____

Unfortunately we need to fit this to a 16 space Punnet Square. In this case we simply double each. Later we will see variations of what to do.

The cool thing is that we will still see the same ratio. It will simply be 8:8 not 2:2

Another Practice

ttBb x TTbb

_____ _____ X _____

Possible Outcomes

Cross Two Traits-Dihybrid Cross

In a dihybrid cross you are testing _____ traits at the same time. To be considered a dihybrid cross each trait has to be _____.

What if both traits are heterozygous? We only look at one side to determine the outcomes.

TtBb x TtBb

In the dihybrd cross, what does n stand for? _____How many possible outcomes? _____

T=Tall t=Short B=Brown b=Tan

TtBb

Possible outcomes/look like _____ _____

_____ _____

_____ _____

_____ _____

Now comes the hard part. Each outcome you got on the last page will go over/next to each box on the large Punnett Square below. Keep them in the same order so it will be easier. Once this is done you will have 16 possible outcomes. The outcomes will always be in the same ratio. Each time you see one of the outcomes, give it a symbol. It will be much easier to count later.

□ : _____ and _____

△ : _____ and _____

◇ : _____ and _____

* : _____ and _____

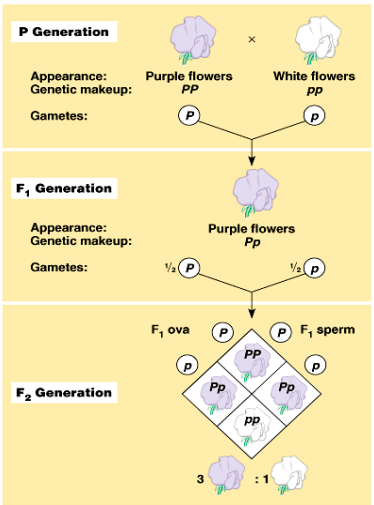
Place the symbol in the bottom corner of each box.

What is the ratio when finally done?

Reviewing Mendel's Three Laws

Law of Dominance-The principle stating that one factor in a pair of traits dominates the other. If one dominant allele and one recessive allele are in a pair, the dominant trait shows up in the phenotype. The only way for a recessive phenotype to show up is if both alleles are recessive.

Law of Segregation-The principle stating that during the production of gametes only one allele from each parent. Two different alleles are rejoined during fertilization.



Law of Independent Assortment-If two different traits are on two different chromosomes; they can be inherited independent of each other.

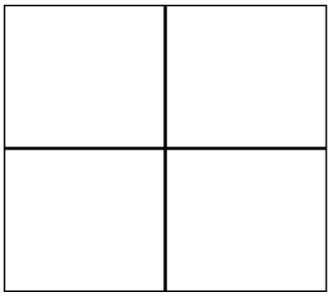
Mom has blonde hair and blue eyes
while dad has brown hair and brown eyes

The kids could have:
Brown hair and blue eyes
Blonde hair and brown eyes
Brown hair and brown eyes
Blonde hair and blue eyes

Two variations of Mendel's Laws

Incomplete Dominance

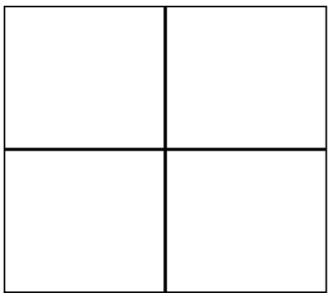
F1 hybrids have an appearance somewhat _____ the _____ of the two parental varieties. Red (RR) x White (rr)



What color will these samples be? _____

What happens if you cross two of the pink offspring?

Genotypic Ratio



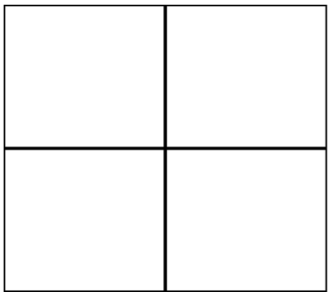
Phenotypic Ratio

Codominance

_____the alleles can be expressed

Eg. Red cows crossed with white will generate

_____ cows.



Summary

Which of Mendel's Dominance Laws

_____

_____

_____

Blood as Codominant and Multiple Alleles

Blood type is controlled by three alleles, _____ _____ and _____.

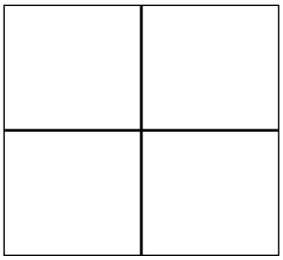
O is recessive and is usually written as an _____

A is usually written as _____ or _____

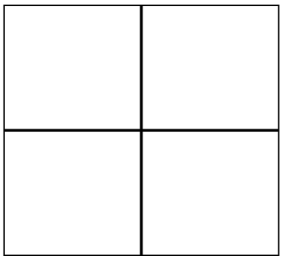
B is usually written as _____ or _____

AB is usually written as _____

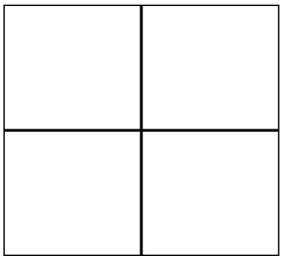
Can parents (mom has type A blood and dad has type O blood) have a child with type O blood if type O blood is recessive? Yes or No…Prove it.



Can parents (mom has type AB blood and dad has type O blood) have a child with type O blood Yes or No…Prove it.



Can parents (mom has type AB blood and dad has type A blood) have a child with type B blood? Yes or No…Prove it.



Can parents (mom has type AB blood and dad has PURE type A blood) have a child with type B blood? Yes or No…Prove it.