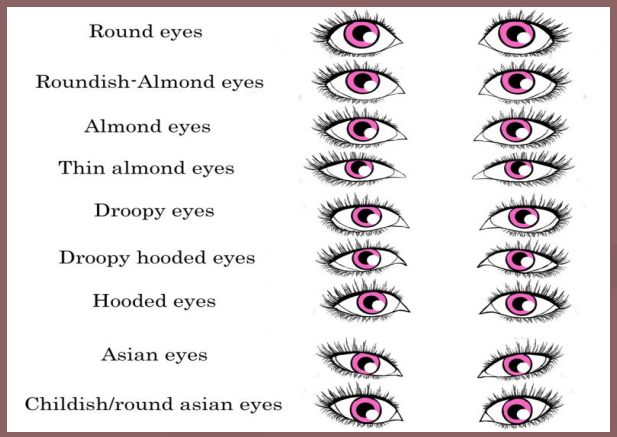
- Chapter 11
- Page 308

Genetics: The Work of Mendel

Pg 98

MY Traits! (Mrs. D's ☺)

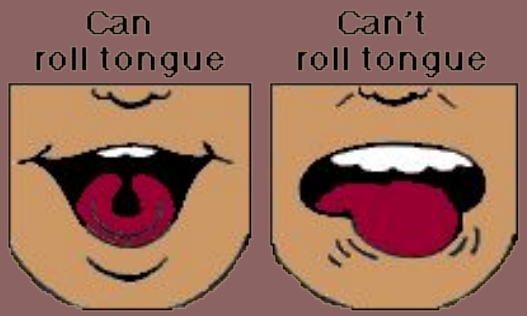
Test	Dominant	Recessive	Your Phenotype	Your Genotype
PTC Taste	Taste it	Don't Taste	Taste	
Widow's Peak	Peak	No Peak	Peak	
Eye Shape	Almond	Round	Round	
Eyelash Length	Long	Short	Long	



My Traits (Mrs. D's ☺)

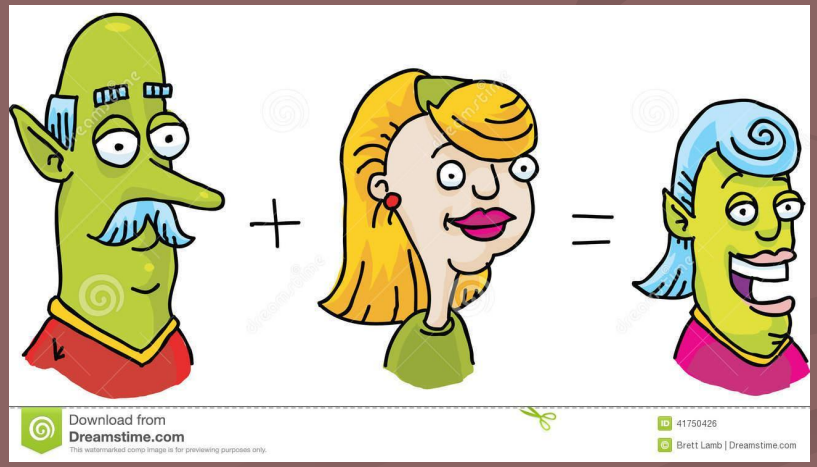
Pg 98

Test	Dominant	Recessive	Your Phenotype	Your Genotype
Tongue Dexterity	Roll	No Roll	Roll	
Thumb	Hitchhiker's Thumb	Straight thumb	Straight	
Lip Thickness	Thick	Thin	Thick	



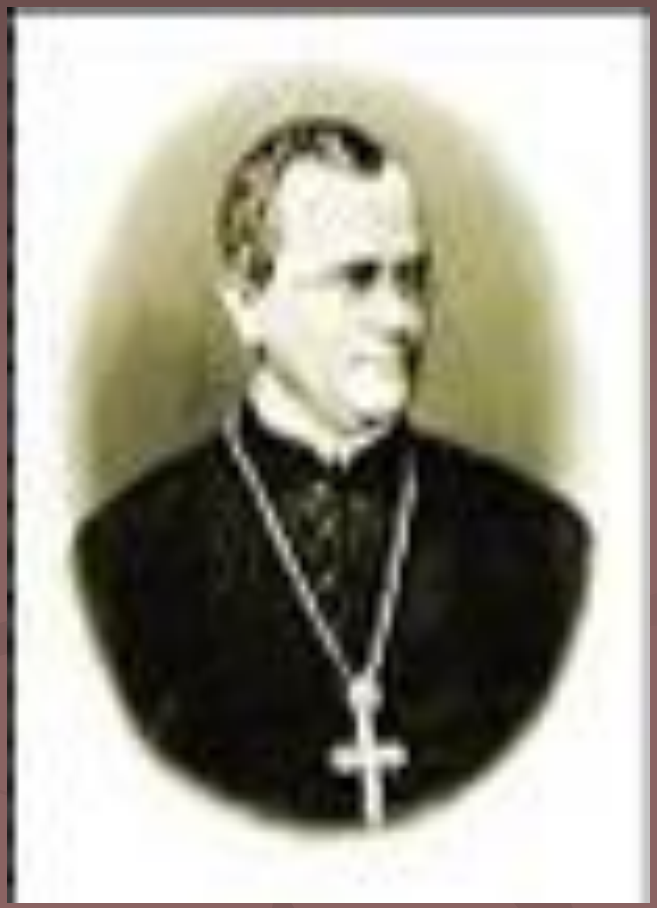
Genetics

- All organisms have a set of characteristics from their parents
- **HEREDITY**: the delivery of characteristics from your parents
- **GENETICS**: the study of heredity



Gregor Mendel

- The **Father of Genetics**
  - Austrian Monk
  - Worked in the monastery gardens
  - A plant breeder
  - Studied garden peas
  - Thus changed biology forever
    - Determined rules that predict patterns of heredity



What Did the Father Do?

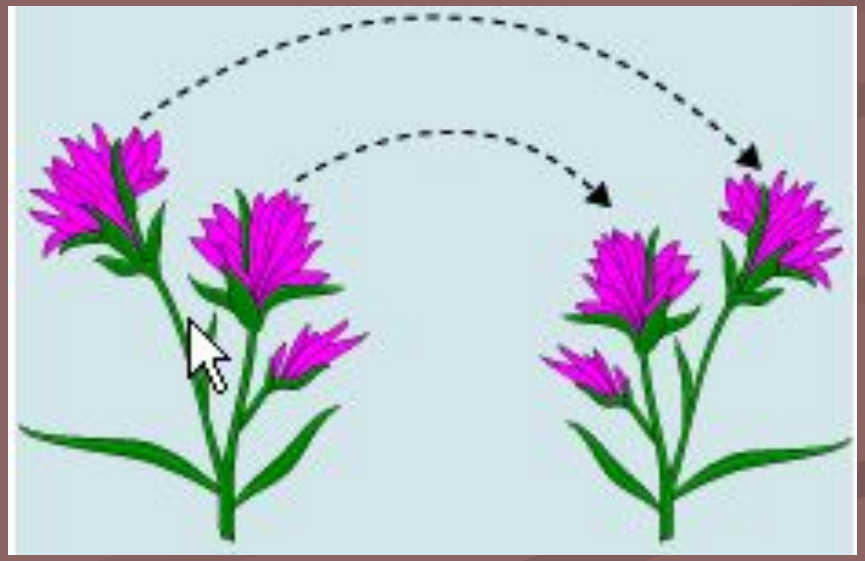
- Grew pea plants
- Studied the offspring results
- Noticed that certain things always happened when

Terminology

- **True-breed:** only demonstrates 1 form of a trait (pure-breed)
- **Self-pollination**: When a flower pollinates itself
  - Thus the offspring should be the same
  - **TRAIT**: a specific characteristic of an individual

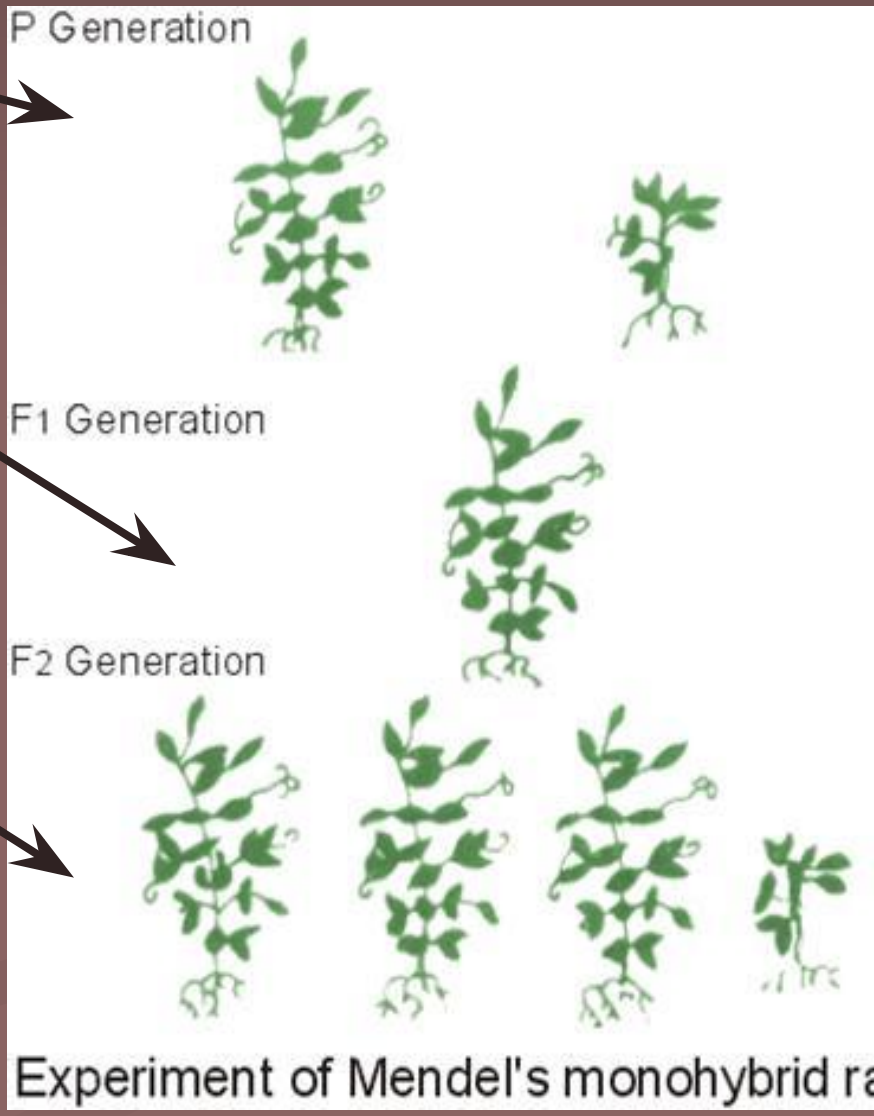
But why do some plants differ?

- **Cross-pollination**: when there is a transfer of pollen from one flower to another
- This creates a **hybrid**
  - The offspring of a cross between parents with different traits



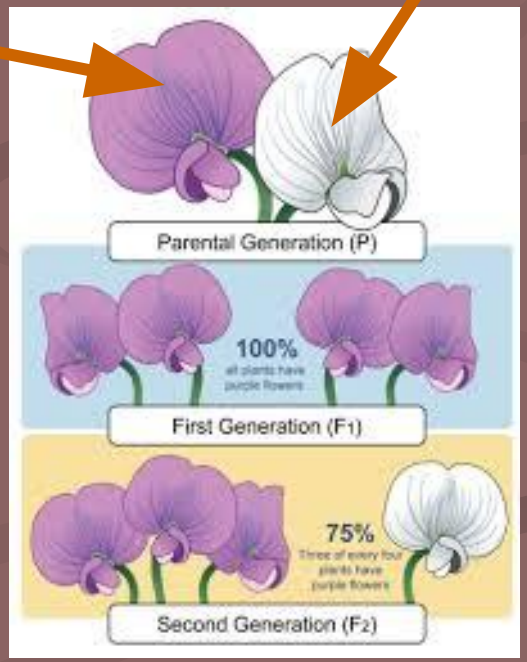
The 3 Generations

- **Parental Generation**
  - AKA P_1
- **First Filial ("son") Generation**
  - AKA F_1
- **Second Filial Generation**
  - AKA F_2



Parental Generation

- **Parental Generation**
  - AKA P_1 generation
  - These are the original parents
  - These are PURE for their trait
  - One dominant true-breed crossed with a recessive true-breed
  - What does this mean?



First Filial Generation

- AKA **F_1** Generation
- These are the offspring of the **P_1** generation
- All show the **dominant** trait

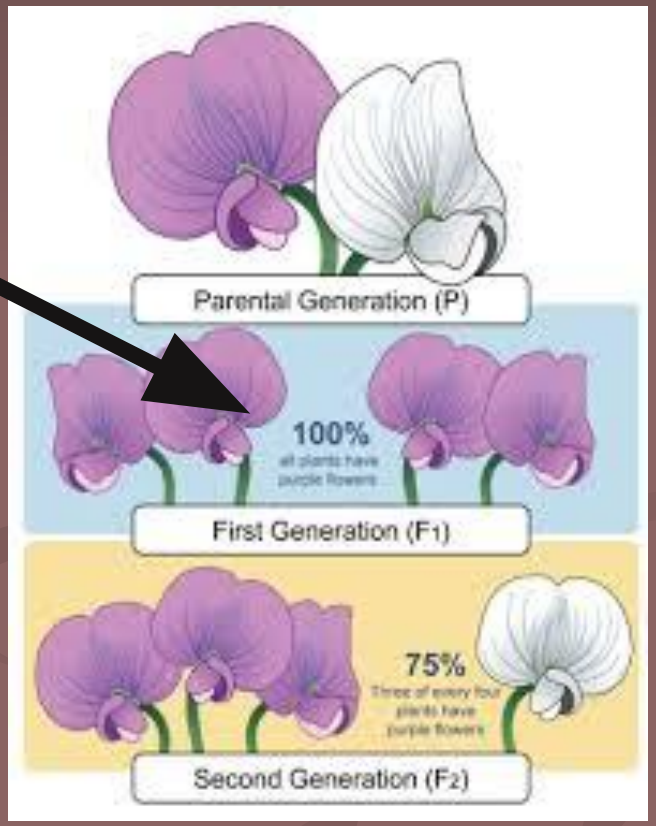
- WHY DO THEY ONLY SHOW THIS TRAIT?
  - **Mendel's Conclusion**: an individual **characteristics** are determined by factors that are **passed** from **1** parental generation to the **next**
  - These factors are called **GENES**
    - ***Factors passes from parent to offspring*** **= Gene**
    - he concluded that there must be different **contrasting** forms of a gene
    - These different forms are called an **ALLELE**
      - There are **2** alleles for every trait that you have

First Filial Generation

- This led to CONCLUSION #2: **Principle of Dominance**
  - Some alleles are considered to be **dominant** and some are **recessive**
- **DOMINANT**: form of trait that appears
  - Must be written with a **capital** letter
  - Only needs to have **1 out of the 2 alleles** to be considered dominant
  - Examples: T, F, R, B
- **RECESSIVE**: form of a trait masked by a dominant
  - Must be written with a **lowercase** letter
  - Must have **2 recessive** alleles to be considered recessive

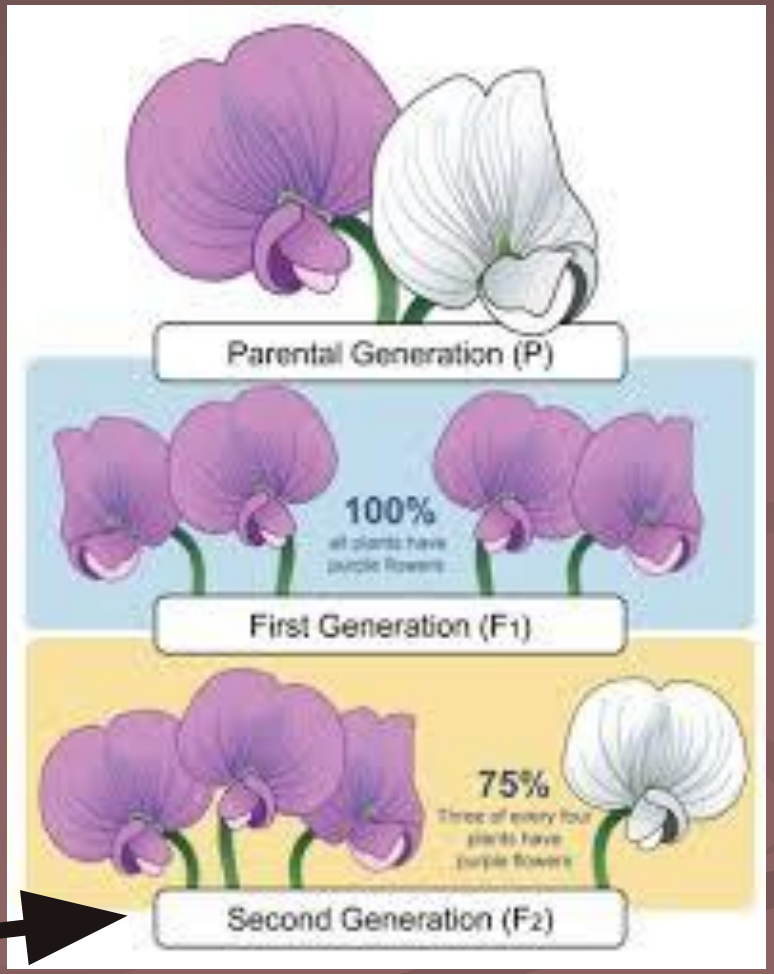
First Filial Generation

- So how can we prove that there are alternate forms of a gene
- The F1 generation is then **self-fertilized**
  - All offspring should be ????



Second Filial Generation

- AKA **F_2** generation
- These are the offspring of **F_1**
- All of a sudden the **recessive** allele traits showed up
  - **75% (3) dominant**
  - **25% (1) recessive**



Second filial (F_2) generation

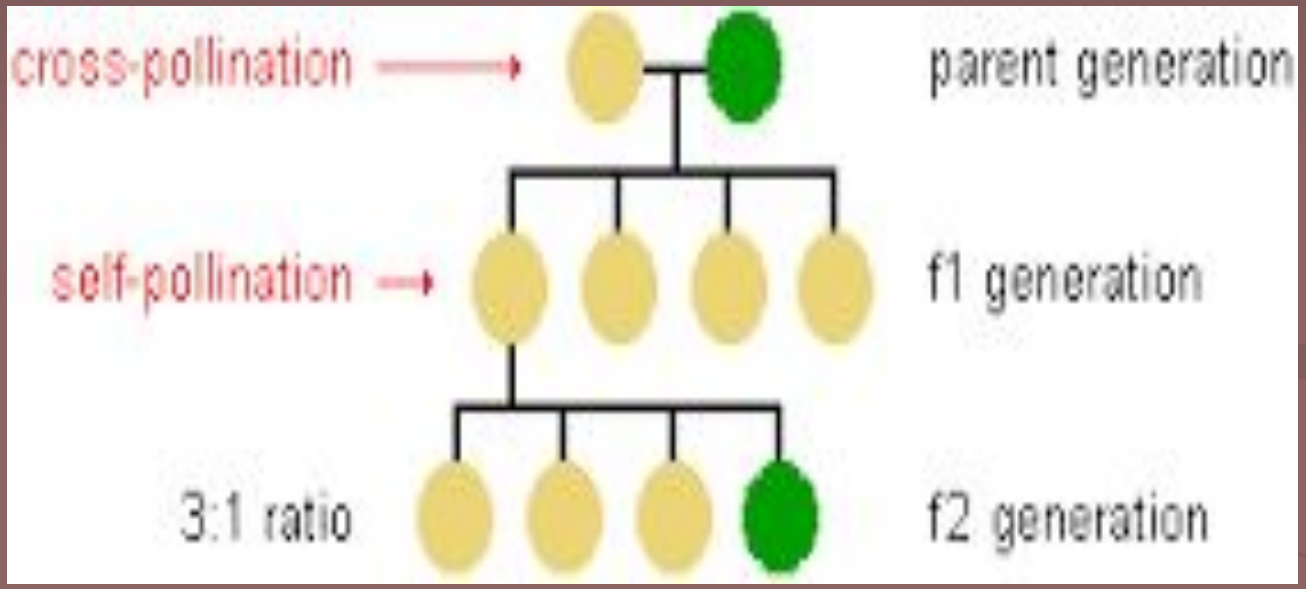
- These are the offspring of the F1 Generation
- All of a sudden he found the recessive trait showed up
  - There was 3 (75%) dominant
  - There was 1 (25%) recessive
  - How can this be???????????

How can this be?

- How can we have a 3 to 1 ratio?
- **Mendel's conclusion= Law of Segregation**
  - During **gamete** formation the **alleles** for each gene **segregate** from each other
  - So that each **gamete** carries only **1** for each **gene**
  - Thus the **F1** generation must have **1** of each allele but the **dominant** is seen
  - All of these are in a 3:1 ratio
    - (3 dominant to 1 recessive)
  - F2= is 3 dominant to 1 recessive

Generations

- P_1 F_1 F_2



Remember

P1 were all?

P1 crossed?

Remember

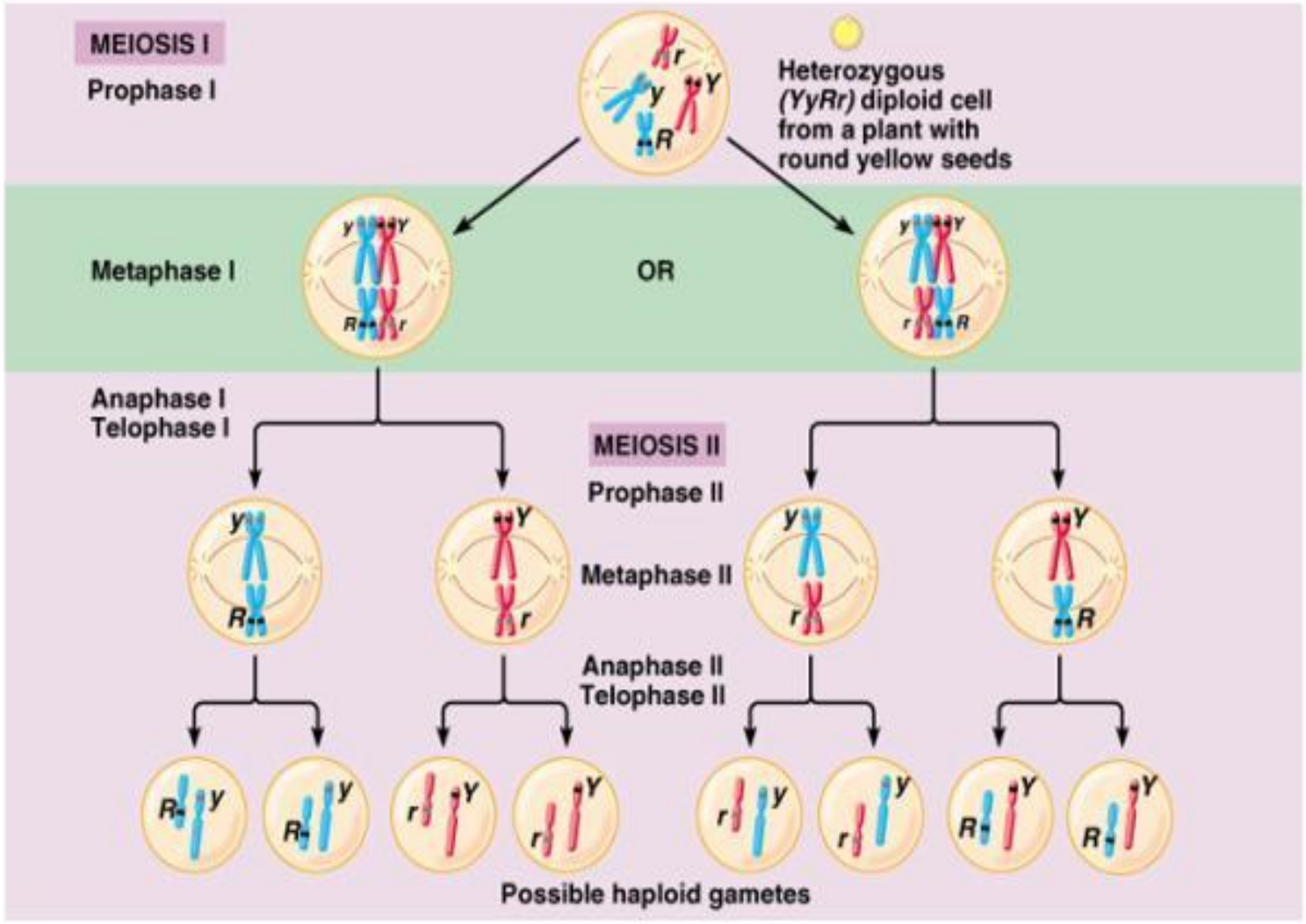
F1 were all?

F1 crossed?

Remember

F2 were all?

Law of Segregation



Probability

- **The likelihood that a specific event will occur**
- Number of one kind of possible outcome divided by the Total number of all possible outcomes

- What is the probability that a coin will land on heads?
- If it is flipped 2 times and lands on heads both times?

A few terms we MUST learn

- **Homozygous Alleles**: organism that have 2 identical alleles for a particular gene
  - 2 types
  - **Homozygous Dominant**: contains 2 dominant alleles
    - BB, TT, CC, RR
  - **Homozygous Recessive**: contains 2 recessive alleles
    - bb, tt, cc, rr,
- **Heterozygous**: organism that have 2 different alleles for the same gene
  - There must be 1 dominant and 1 recessive allele
  - The dominant gene is seen
  - Bb, Tt, Cc, Rr

Genetic Terminology

- ***Phenotype***
  - The physical characteristics of an organism
  - This is what is physically seen
    - Example: tall, short

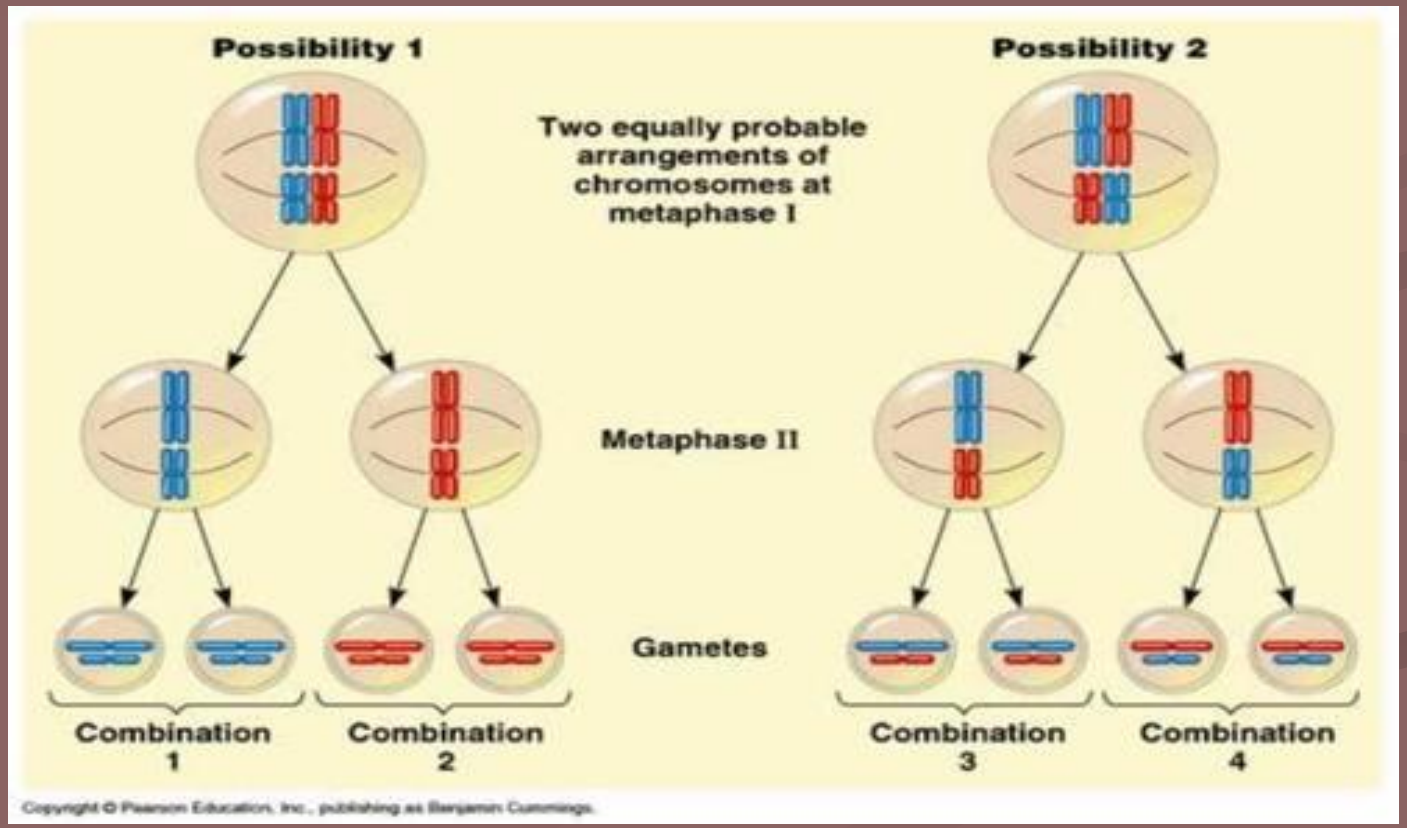
- ***Genotype***
  - The genetic make-up of an organism
  - This is the allele combination
    - Example: TT or Tt or tt

More Terminology

- **Punnett Square**: a diagram that uses mathematical probability to help predict the genotype and phenotype combinations of a genetic cross
- **Monohybrid Cross**: when **1** particular trait is crossed between a male and female to identify all possible outcomes
  - Has 3 possible genotypes
  - Has 2 possible phenotypes
- **Dihybrid Cross**: when **2** traits are simultaneously crossed between a male and female to identify all possible outcomes
  - Has *9* possible genotypes
  - Has 4 possible phenotypes

Independent Assortment

- The principle states that genes for different traits can segregate independently during formation of gametes



Allele Worksheet

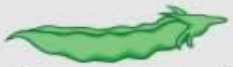
- **ALLELE**: an alternate form of a single gene passed from generation to generation
- Define the following terms to describe the allele combinations in the genotype for a given gene:
  - Heterozygous
  - Homozygous dominant
  - Homozygous recessive
- Use "A" to represent the following organisms genes
  - Heterozygous
  - Homozygous dominant
  - Homozygous recessive

Monohybrid Cross

- Remember that it has
  - 3 possible genotypes
  - 2 possible phenotypes

Pea Chart Handout

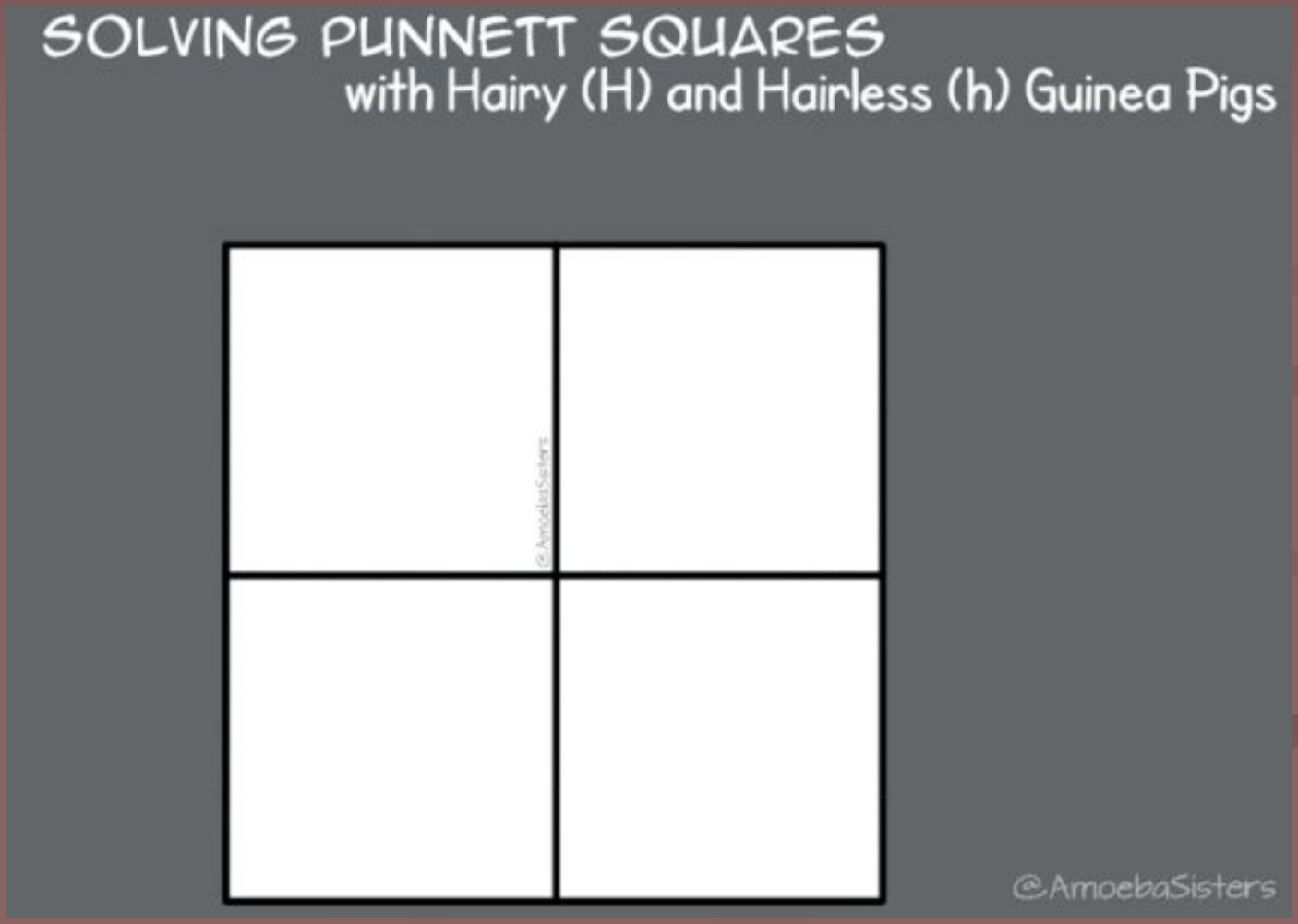
These are OUT of order BE CAREFUL

		Dominant	Recessive
1	FLOWER COLOR	 Purple	 White
6	FLOWER POSITION	 Axial	 Terminal
2	SEED COLOR	 Yellow	 Green
3	SEED SHAPE	 Round	 Wrinkled
5	POD SHAPE	 Inflated	 Constricted
4	POD COLOR	 Green	 Yellow
7	STEM LENGTH	 Tall	 Dwarf

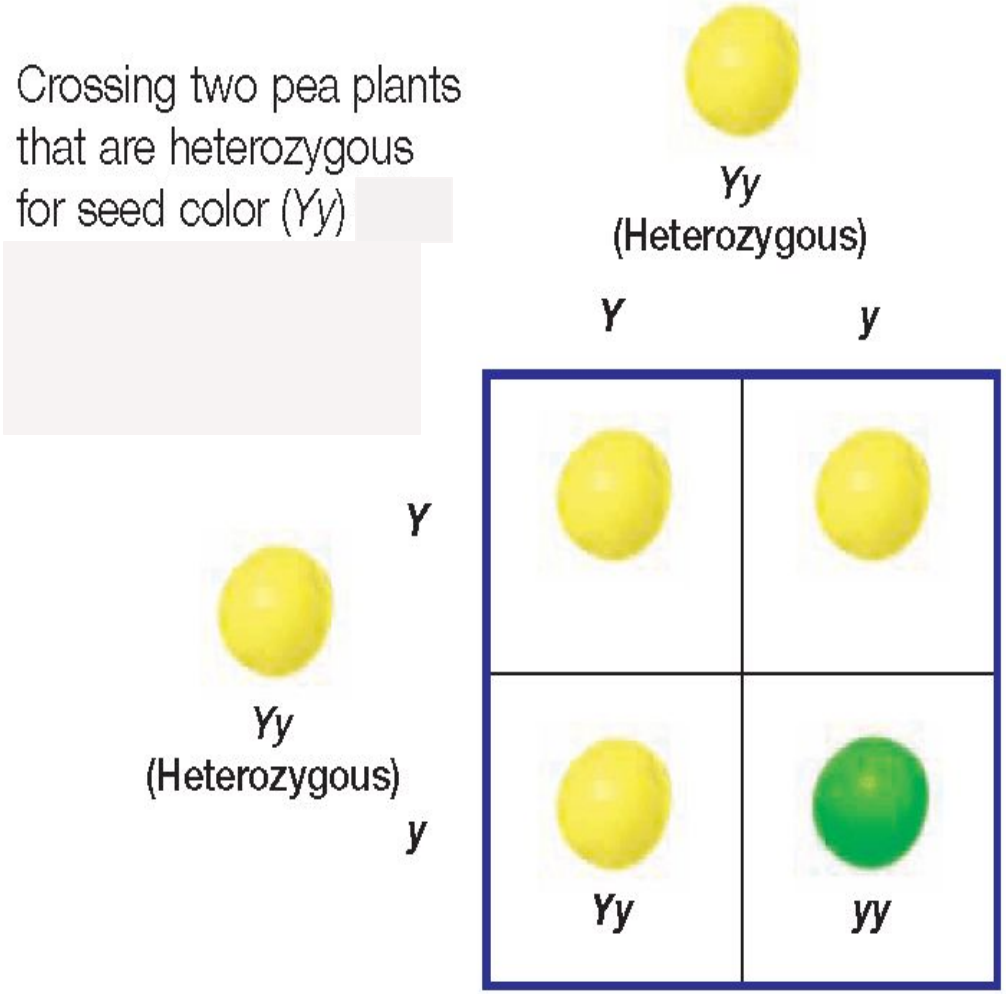
How to do a Monohybrid cross?

- Follow along on your worksheet
- Be precise
- Do ALL steps
- Show all work
- Don't be lazy--- points will be deducted
- Be sure to do the G's, P's, D's and R's for all types even if it is a zero!!!!!!!!

How to do a genetic cross instruction sheet



Monohybrid Cross



- Remember all of the:
  - Genotype
  - Phenotype
  - Dominant amounts
  - Recessive amounts

PRACTICE
Page 100

PRACTICE
Page 100

Practice: Monohybrid Cross

- Cross a homozygous dominant Round seed pea with a heterozygous round pea

- Cross a two heterozygous yellow seeds

Homework Time ☺

- Complete Punnett Square Practice Worksheet
  - Must be complete before you leave

- Homework
  - Monohybrid Cross

(has guinea pigs on it)

Dihybrid Cross

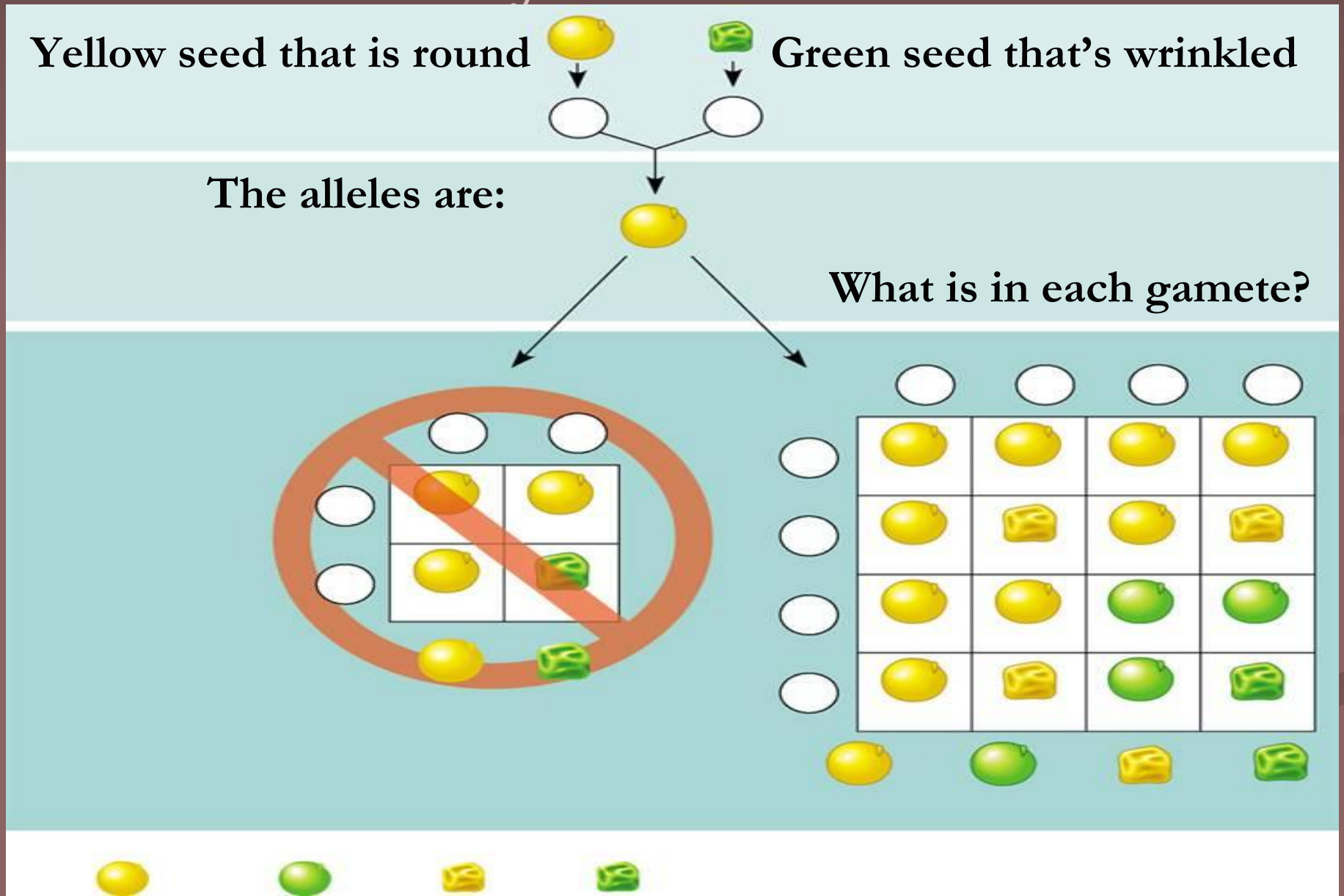
Insert this info on bottom of page 3 of notes or back blank page

- We are crossing 2 traits at the same time
- Want to find out if BOTH of these will show up at the SAME time

- Remember there are now **4 phenotypes**
- Dominant/dominant
  - 1st 2nd
- Dominant/recessive
  - 1st 2nd
- Recessive/dominant
  - 1st 2nd
- Recessive/recessive
  - 1st 2nd

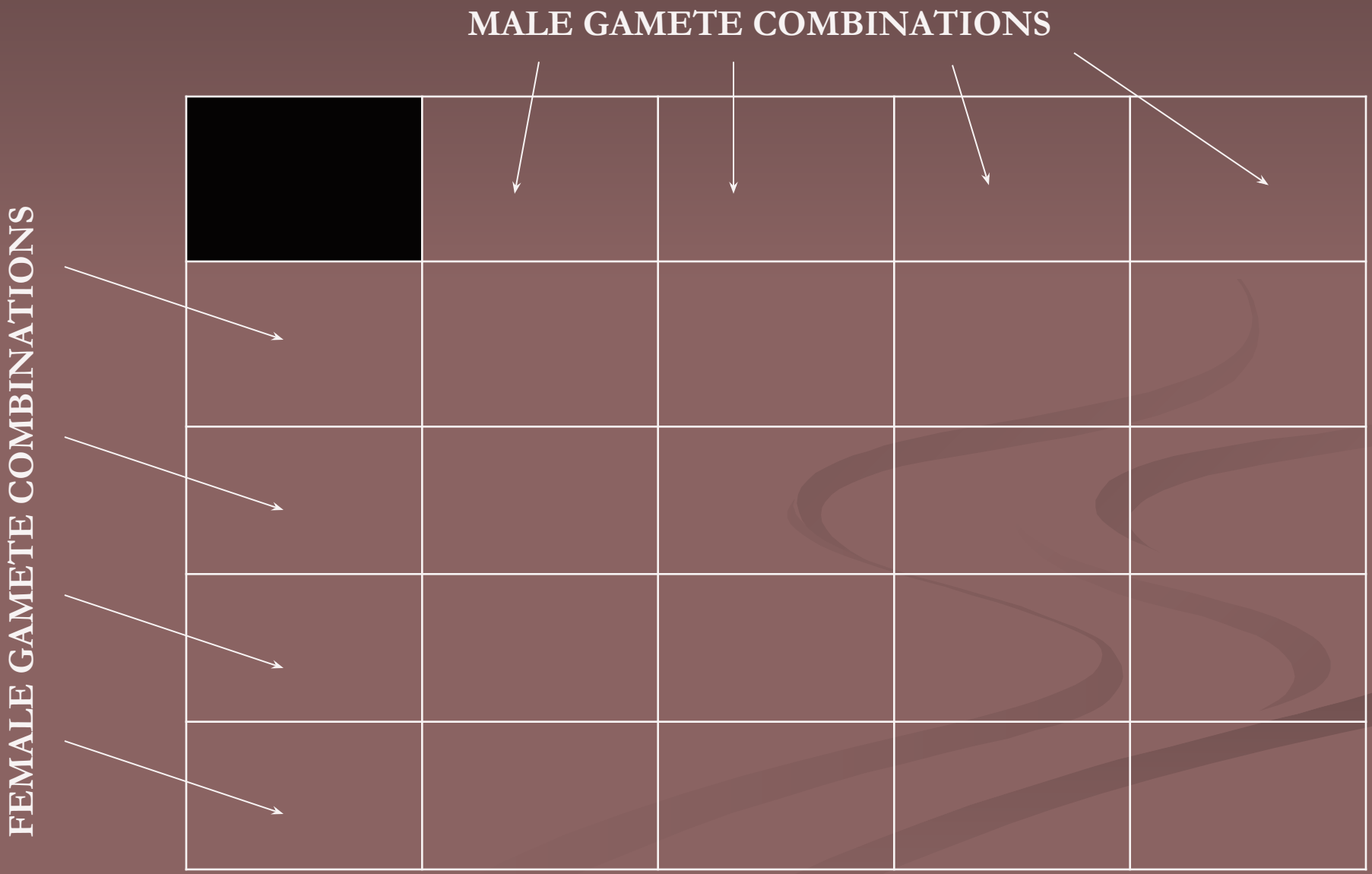
Practice
101/102

Dihybrid Cross



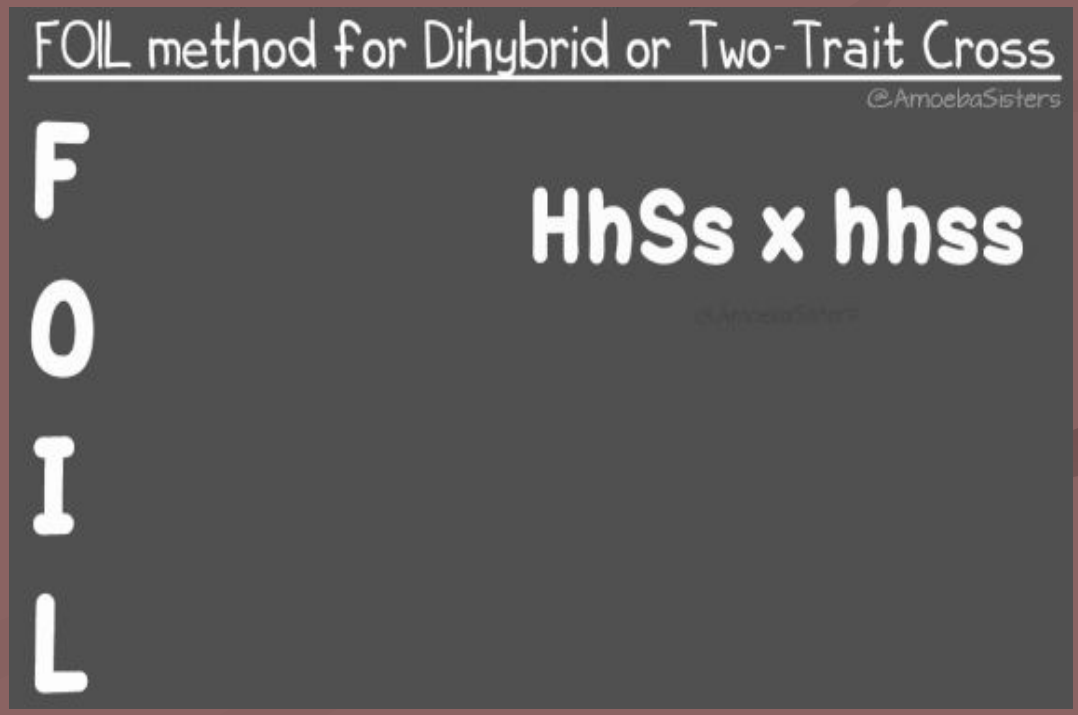
How to do a Dihybrid Cross

Practice 101/102



Dihybrid

- Since we are crossing 2 traits
  - Each gamete will have a combo of 2 alleles
  - We need to FOIL to do this
  - If the organism has the following
  - RrYy
    - First =
    - Outer=
    - Inner=
    - Last=



How to do a Dihybrid Cross

You must **FOIL** the GAMETES

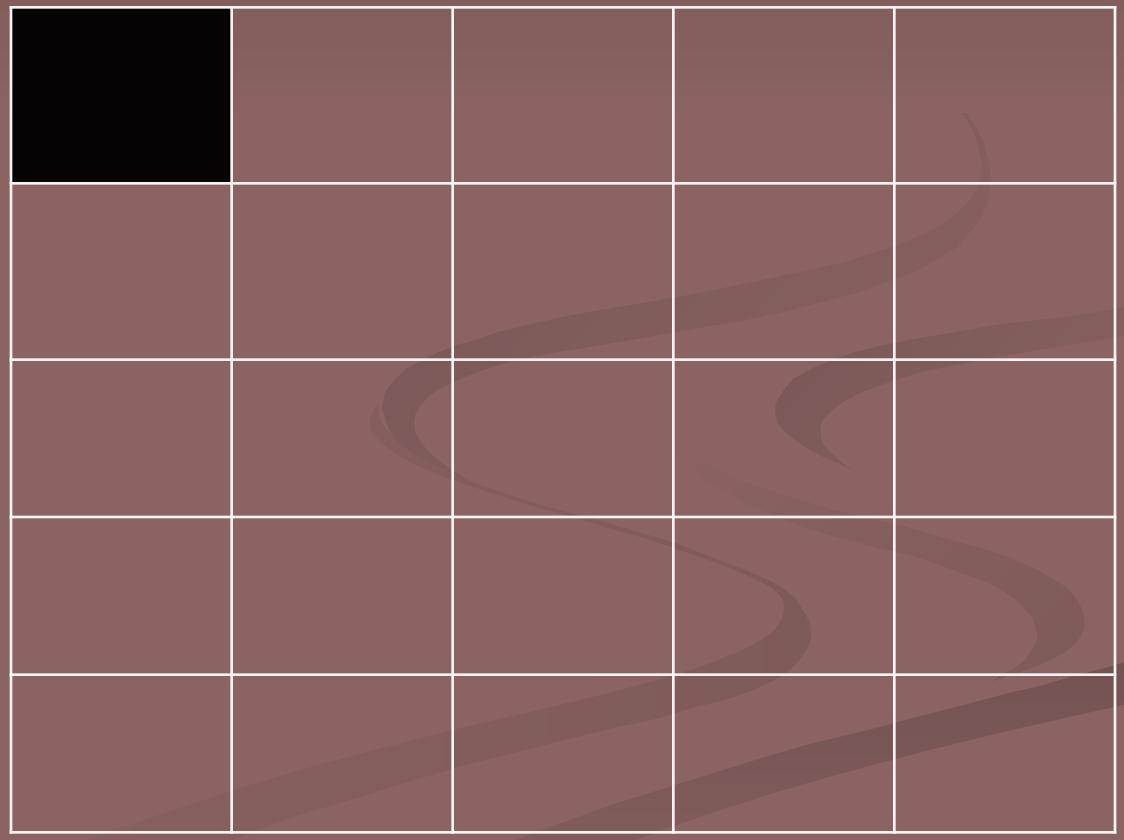
- **First**
- **Outer**
- **Inner**
- **Last**

MALE GAMETE COMBINATIONS

RrYy

FEMALE GAMETE COMBINATIONS

rryy



How to do a Dihybrid Cross

Practice 101/102

MALE GAMETE COMBINATIONS

FEMALE GAMETE COMBINATIONS

	RY	Ry	Ry	ry
ry	RrYy	Rryy	rrYy	rryy
ry	RrYy	Rryy	rrYy	rryy
ry	RrYy	Rryy	rrYy	rryy
ry	RrYy	Rryy	rrYy	rryy

PHENOTYPES (4)

GENOTYPES (4)

Practice - Dihybrid Cross

You must **FOIL** the GAMETES

Practice pg 101/102

MALE GAMETE COMBINATIONS

FEMALE GAMETE COMBINATIONS

Practice - Dihybrid Cross

You must **FOIL** the GAMETES

PHENOTYPES:

D/D=Black/short

D/R= Black/long

R/D= White/short

R/R= White/long

Guinea Pig Cross #1

	B L	B l	b L	b l
b L	BbLL	BbLl	bbLL	bbLl
b L	BbLL	BbLl	bbLL	bbLl
b l	BbLl	Bbll	bbLl	bbll
b l	BbLl	Bbll	bbLl	bbll

Practice - Dihybrid Cross

You must **FOIL** the GAMETES

PHENOTYPES:

D/D=Black/short

D/R= Black/long

R/D= White/short

R/R= White/long

Guinea Pig Cross #2

	bL	bL	bL	bL
B l	BbLl	BbLl	BbLl	BbLl
B l	BbLl	BbLl	BbLl	BbLl
b l	bbLl	bbLl	bbLl	bbLl
b l	bbLl	bbLl	bbLl	bbLl

Essential Questions

- What is the significance of Mendel's experiments to the study of genetics?
- What is the law of segregation? Law of independent assortment?
- How do you set up a monohybrid cross? Dihybrid cross?
- How many genotypes in a monohybrid cross? Dihybrid?
- How many phenotypes in a monohybrid cross? Dihybrid cross?
- Are they dominants/recessive amounts in a monohybrid cross? Dihybrid cross?
- *Vocabulary: genetics, allele, dominant, recessive, homozygous, heterozygous, genotype, phenotype, law of segregation, independent assortment, hybrid*

Are you **INCOMPLETELY** dominant?

Page 98

Test	Traits	Traits (middle)	Traits
Hair Texture	*Curly* CC	*Wavy* CS	*Straight* SS
Inter-eye distance	*Close distance* CC	CF *Medium distance*	*Far distance* FF
Lip protrusion	*Protruding* PP	PN *Slightly protrudes*	*No protrusion* NN

Incomplete Dominance

- Situation where 1 allele is NOT completely dominant over another
- Both alleles are expressed in the heterozygous individual
- The heterozygous phenotype is a mix of the 2 allele
- Example: snapdragon flower
  - C^RC^R = red
  - C^WC^W= white
  - C^RC^W= pink
  - Other examples: Hair texture, Lip protrusion and Inter-eye distance

Incomplete dominance

Exam

- CC = Curly SS = S
- Punnett square problem: 2 Wavy haired people marry

	C	S
C	CC	CS
S	CS	SS

25% Curly
50% Wavy
25% Straight

Oompa Loompa Genetics

- Oompahs can have red, blue, or purple hair. The allele that controls this trait is incompletely dominant, where purple hair is caused by the heterogeneous condition. Make a key for the genotypes and phenotypes of hair color.
  - Blue Hair =
  - Red Hair=
  - Purple Hair=

Practice

1. Orville Oompha has purple hair and is married to Opal Oompah who brags that she has the bluest hair in the valley. How many of Opal's children will be able to brag about their blue hair?

2. Olivia Oompha is married to Odo Oompha. Both of them have purple hair. They have 100 children. What is the hair color of their children's hair?

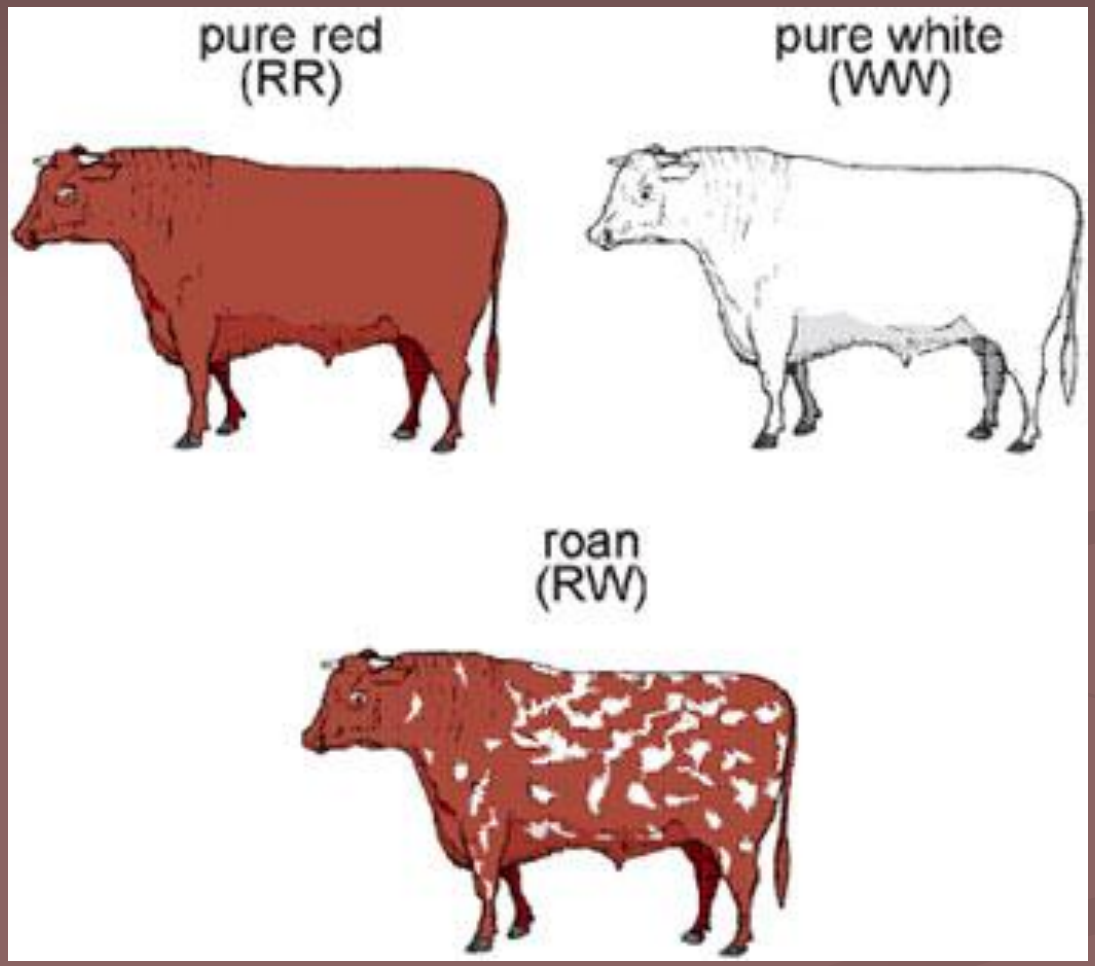
More practice

- Ophelia Oompah is not married but she wants children. She goes to a fertility clinic where she is fertilized by an anonymous sperm donor. Ophelia has red hair. 5 months later, a litter of 8 Oompah's is born, 4 who have red hair and 4 with all purple hair. What was the father's hair color?

CODOMINANCE

- Situation where the phenotype of the heterozygote shows both dominant alleles at the **SAME** time
- The <u>heterozygous</u> phenotype shows **<u>BOTH</u>** alleles
  - Example: roan coat in horses/cattle
    - C^RC^R= red
    - C^WC^W= white
      C^RC^W = roan (red and white together)
    - Other examples: chickens (black, white, white with black spots)

Roan Color



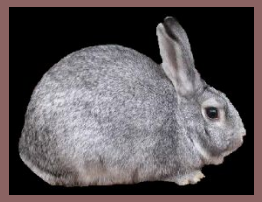
Practice – Finding the Heterozygote??

- **Any curly kids if:**
  - a curly haired husband marries a straight haired woman
  - A wavy haired man and woman marry
  - What type of trait is this?
- **Any Roan Cows if:**
  - 1 red bull and 1 white cow mate
  - 1 roan bull and 1 red cow mate
  - What type of trait is this?
- **Any pink flowers if:**
  - 1 white flower and 1 red flower cross pollinate
  - 1 pink flower and 1 white flower cross pollinate
  - What type of trait is this?

Multiple Alleles

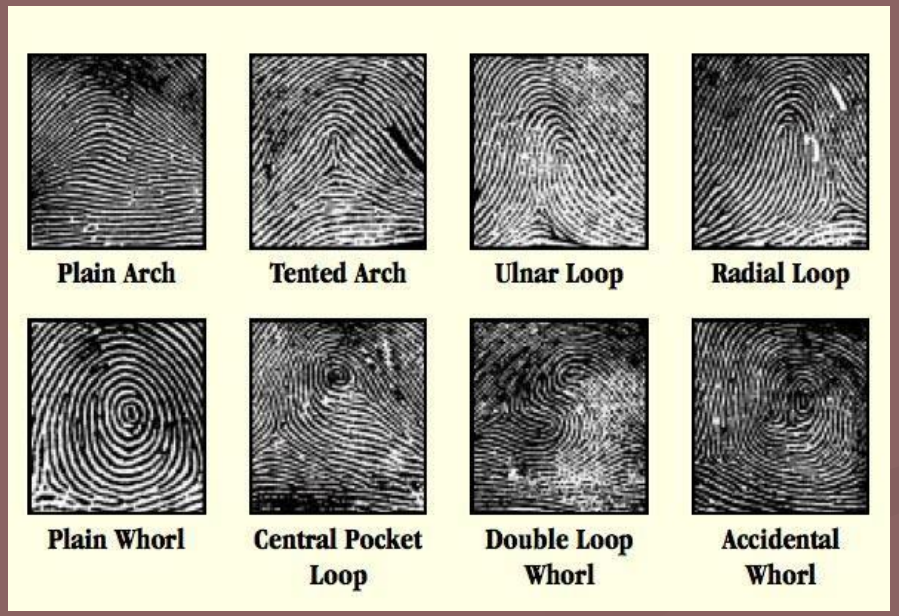
- A gene determined by more than 2 alleles
  - Example **Blood types**
    - Type A
    - Type B
    - Type AB
    - Type O
  - **Rabbit coat color**
    - Full color = C
    - Albino color= c
    - Chinchilla = ch
    - Himalayan=h

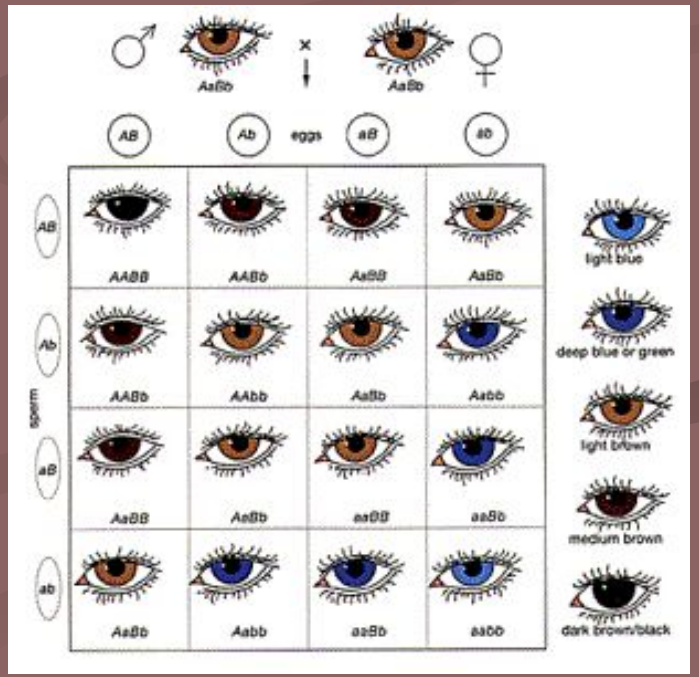
Blood Type	Genotype		Can Receive Blood From:
A	$i^A i$ $i^A i^A$	AA AO	A or O
B	$i^B i$ $i^B i^B$	BB BO	B or O
AB	$i^A i^B$	AB	A, B, AB, O
O	$i\,i$	OO	O



Polygenic Trait

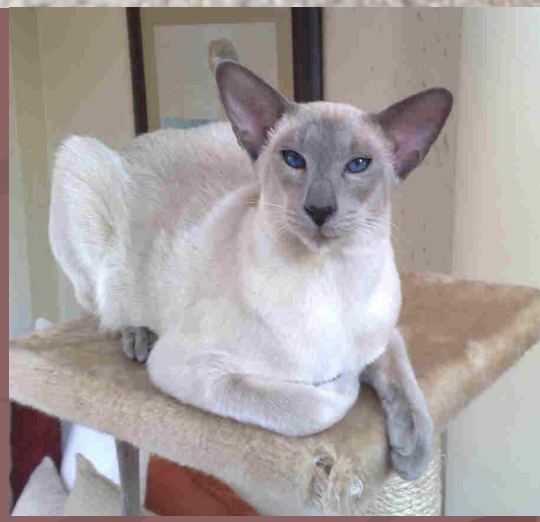
- When traits are controlled by the interaction of 2 or more genes
  - Examples: skin color, height, eye color, fingerprint pattern





Environmental Influences

- Environmental conditions can affect gene expression and influence genetically determined traits
- Butterfly, flowers, Siamese cats
  - Ears, tail, feet, nose = darkened in cool temps
  - Ears, tail, feet, nose = lighter in warm temps



Page 106/107

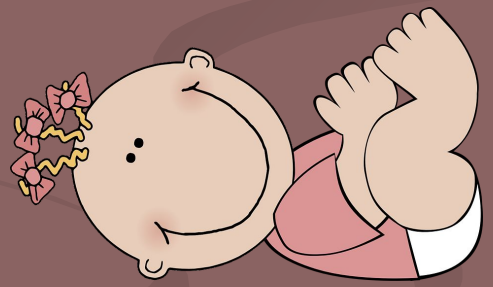
Baby Blunder

- Complete into your journal books

Blood Type	Allele Option	Allele Option
Type A	AA	AO
Type AB	AB	
Type B	BB	BO
Type O	OO	

Baby Blunder

- There was a mix up at the hospital with some of babies wristbands
- Try and figure out which baby belongs to which family.
- Complete each families Punnett Square.
- The Lincohs' are Type O and AB
- the Franklins' are Type AB and B
- The Darwins' are Type O and O
- The Mendels' are Type O and A



Baby Blunder

- Baby #1= Type AB
- Baby #2= Type B
- Baby #3= Type A
- Baby #4= Type O

Lincoln's = (O/AB)

	O	O
A	AO	
B	BO	

Franklin's = (AB/B)

	A	B
B	AB	BB
B	AB	BB

	A	B
B	AB	BB
O	AO	BO

Mendel's (O/A)

	O	O
A	AO	AO
A	AO	AO

	O	O
A	AO	AO
O	OO	OO

Darwin's = (O/O)

	O	O
O	OO	OO
O	OO	OO

Page 105

Vocabulary Check

1. Codominant alleles
2. Incomplete dominance
3. Multiple Alleles
4. Sex Chromosomes
5. Sex-linked traits
6. Polygenic inheritance
7. Autosomes

A). traits controlled by genes located on the sex chromosomes

B). Blood type is an example of this

C). First 22 pairs of homologous chromosomes

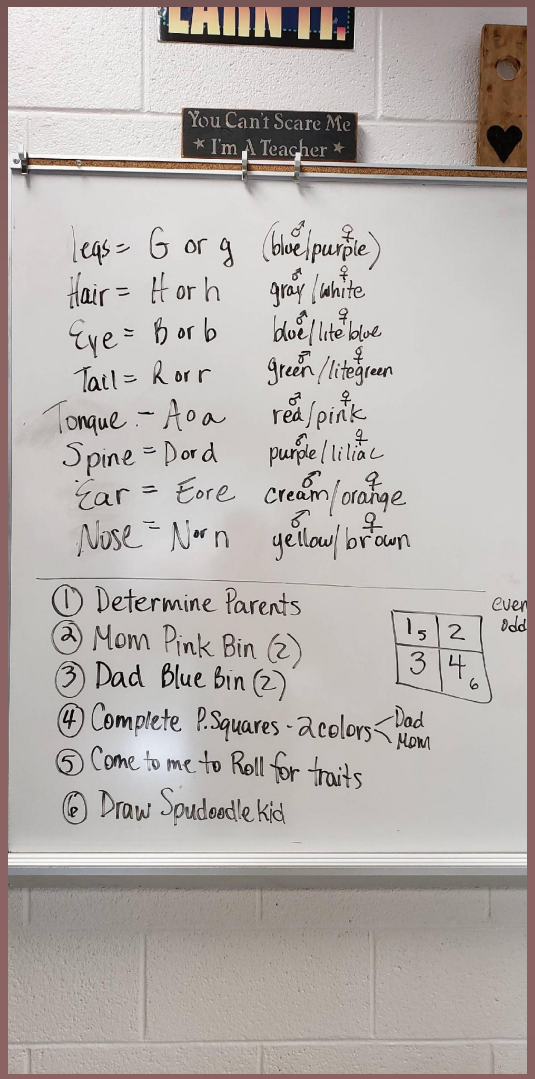
D). When neither allele of the parent is completely dominant, offspring shows mixed phenotype

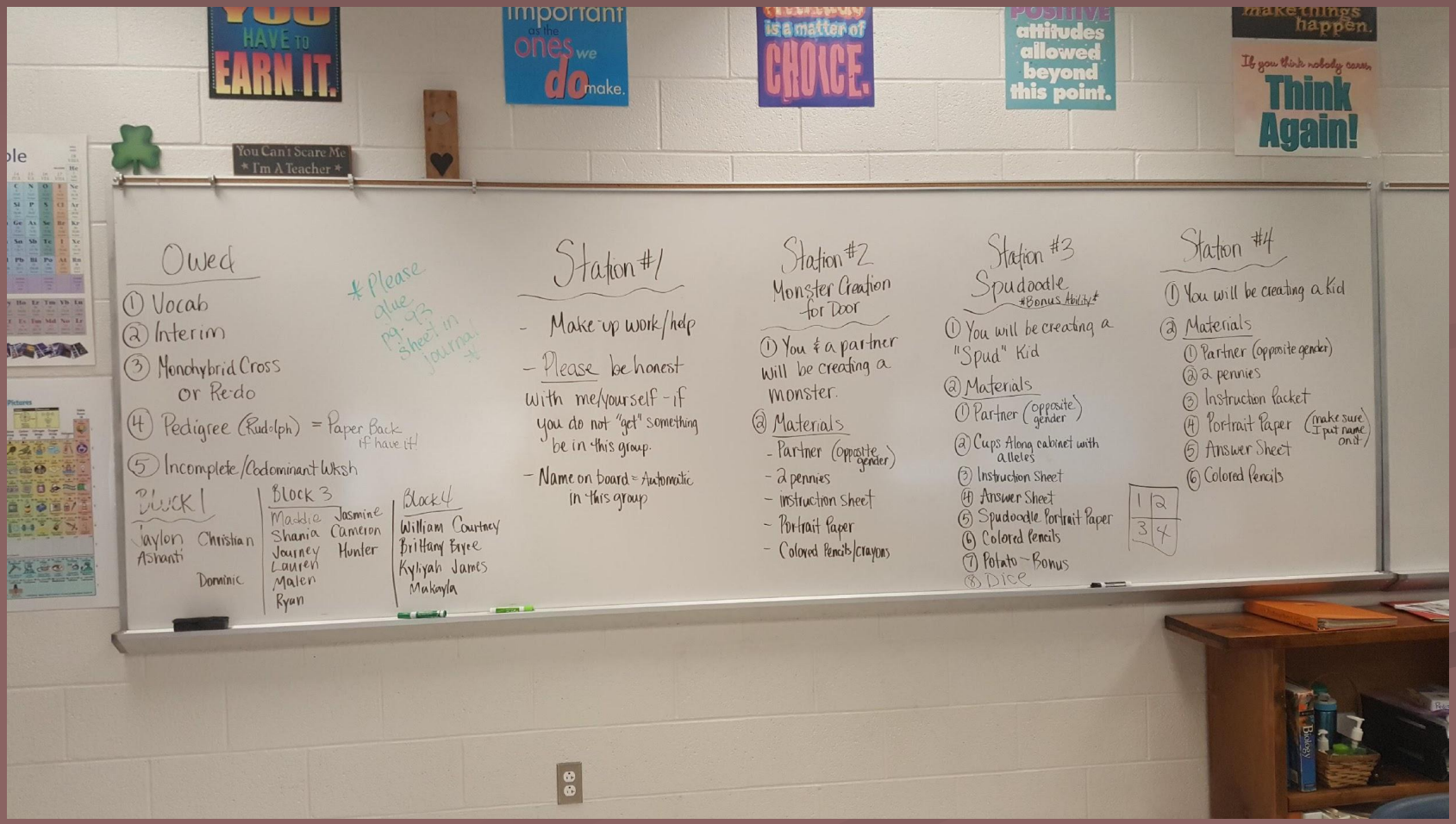
E). Having more than 2 alleles for a genetic trait

F). 23rd pair of chromosomes in humans

G). Inheritance pattern of a trait that is controlled by 2 or more genes

Spudoodle Directions




HAVE TO
EARN IT.
ones we do make.
is a matter of
CHOICE.
attitudes allowed beyond this point.
Think Again!
You Can't Scare Me
* I'm A Teacher *
Owed
① Vocab
② Interim
③ Monohybrid Cross or Re-do
④ Pedigree (Rudolph) = Paper Back if have it!
⑤ Incomplete/Codominant Wksh
* Please glue pg. 93 sheet in journal *
Block 1
Jaylon Christian
Ashanti
Dominic
Block 3
Maddie Jasmine
Shania Cameron
Journey Hunter
Lauren
Maten
Ryan
Block 4
William Courtney
Brittany Bryce
Kyliyah James
Makayla
Station #1
- Make up work/help
- Please be honest with me/yourself - if you do not "get" something be in this group.
- Name on board = Automatic in this group
Station #2
Monster Creation for Door
① You & a partner will be creating a monster.
② Materials
- Partner (opposite gender)
- 2 pennies
- Instruction sheet
- Portrait Paper
- Colored Pencils/crayons
Station #3
Spudoodle
Bonus Ability
① You will be creating a "Spud" Kid
② Materials
① Partner (opposite gender)
② Cups Along cabinet with alleles
③ Instruction Sheet
④ Answer Sheet
⑤ Spudoodle Portrait Paper
⑥ Colored Pencils
⑦ Potato - Bonus
⑧ Dice
1 2
3 4
Station #4
① You will be creating a Kid
② Materials
① Partner (opposite gender)
② 2 pennies
③ Instruction Packet
④ Portrait Paper (make sure I put name on it)
⑤ Answer Sheet
⑥ Colored Pencils