Complex Genetics

Sex-linked

- Attached to the X or Y chromosomes (sex chromosomes)
- XX = **Female**
- XY = **Male**
- **Mothers** pass on an affected allele to **son**
- Fathers cannot be carriers!
- Males more affected than females since the Y chromosome is **smaller** and traits are carried on X chromosome

Sex-linked

Hemophilia

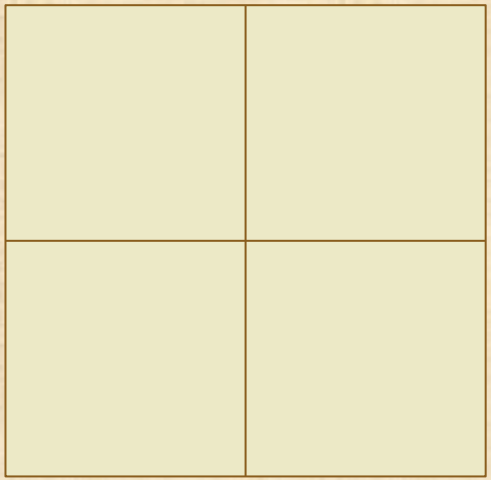
X^HX^H = normal female	X^HY= normal male
X^HX^h = CARRIER female	**No carrier**
X^hX^h = affected female	X^hY = affected male

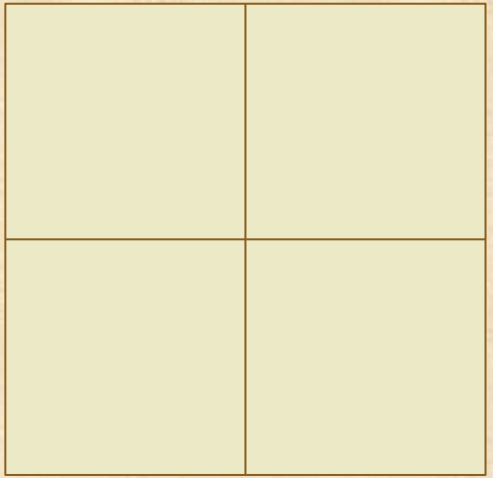
Color-blindness

X^CX^C = normal female	X^CY= normal male
X^CX^c = CARRIER female	**No carrier**
X^cX^c = affected female	X^cY = affected male

Sex-linked

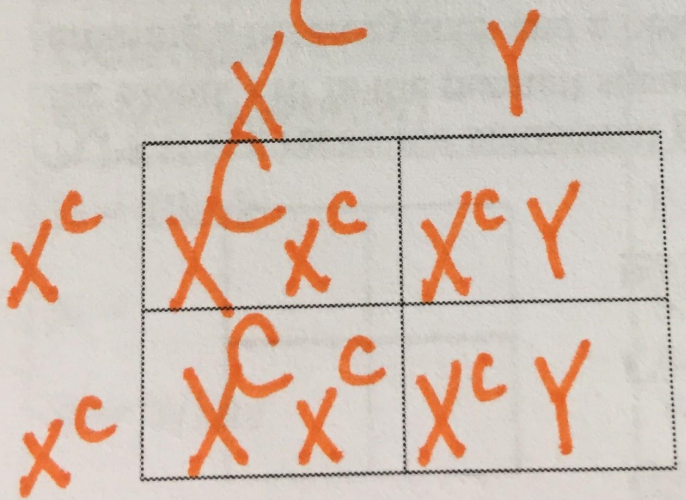
Each box in a Sex-linked Punnett Square is worth 50% to allow for each sex to have 100% possibilities for a total of 200%



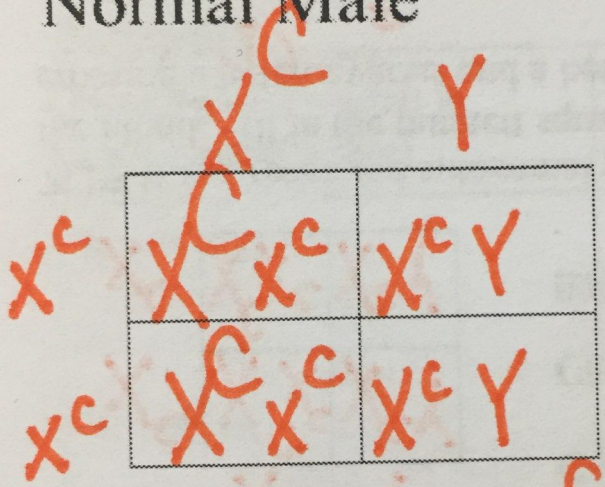


Sex-linked

Colorblind Female x
Normal Male

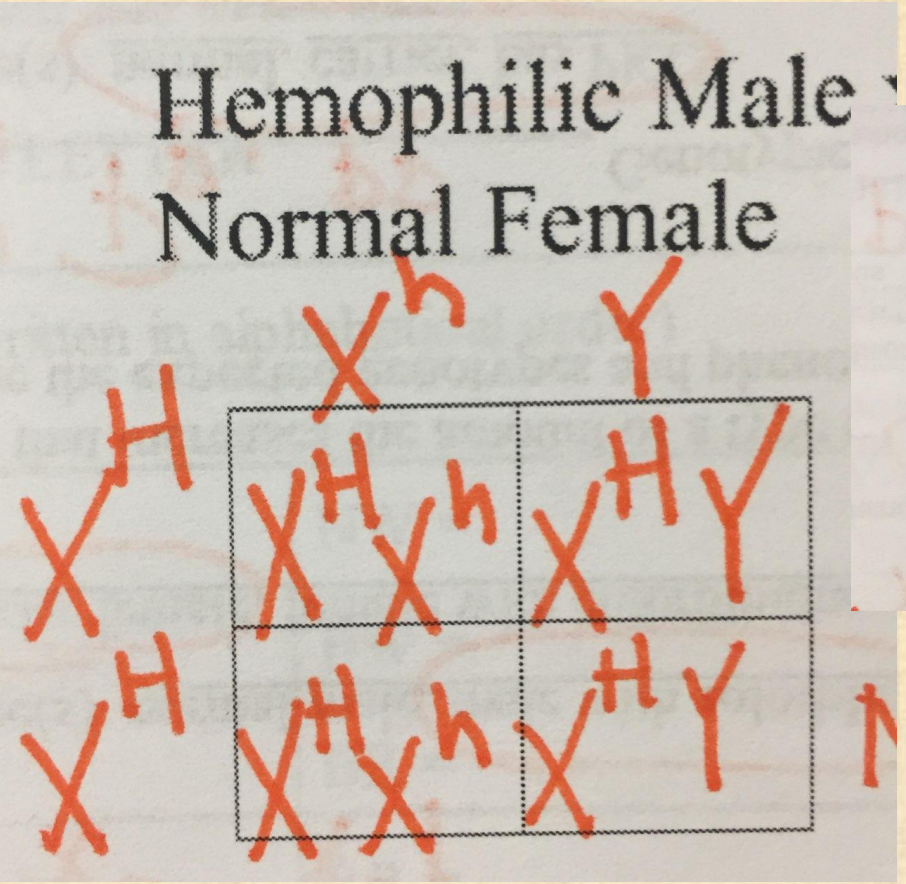


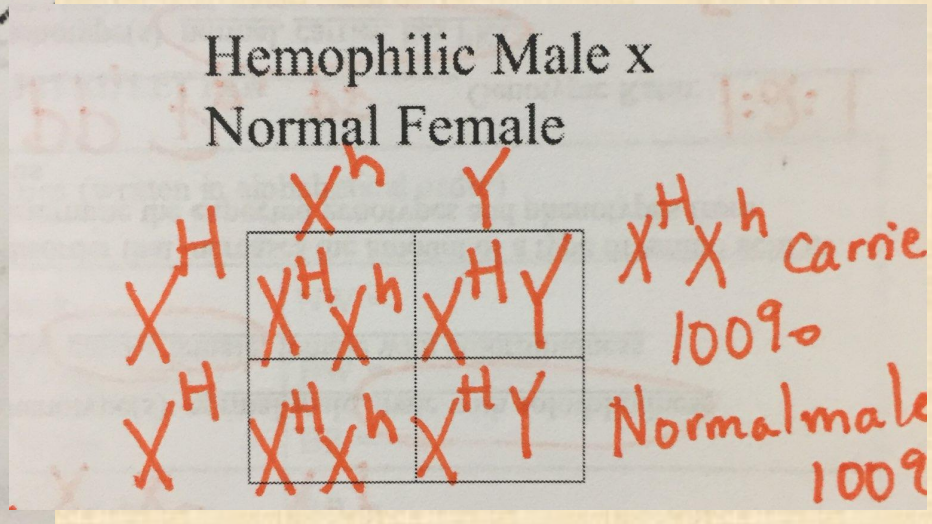
Colorblind Female x
Normal Male



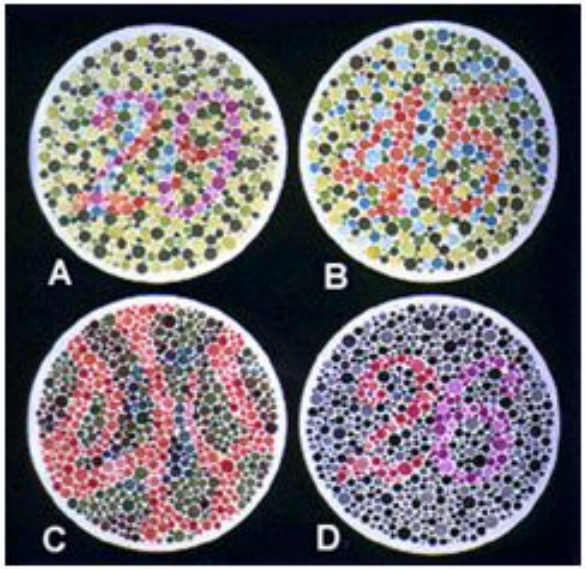
2 x 50% Carrier female
2 x 50% Colorblind male

Sex-linked


Hemophilic Male
Normal Female


Hemophilic Male x
Normal Female
Carrie
100%
Normal male
100%

Are you color blind?



- **4 Sex-Linked Traits:**
-
-
-
-

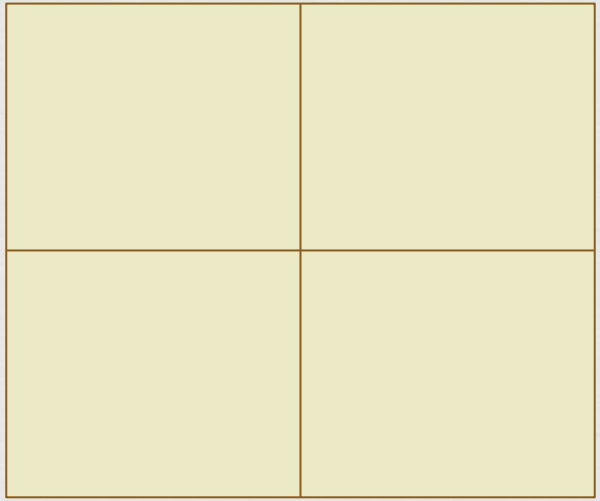
Incomplete Dominance

- When an individual displays a **phenotype** that is the **blending** of the parent's phenotypes
- Genotypes:
  - Traditional Dominant = Capital = RR
  - Traditional Recessive = Capital with apostrophe (R'R')
  - Incomplete Dominant = mixture = RR'

Incomplete Dominance

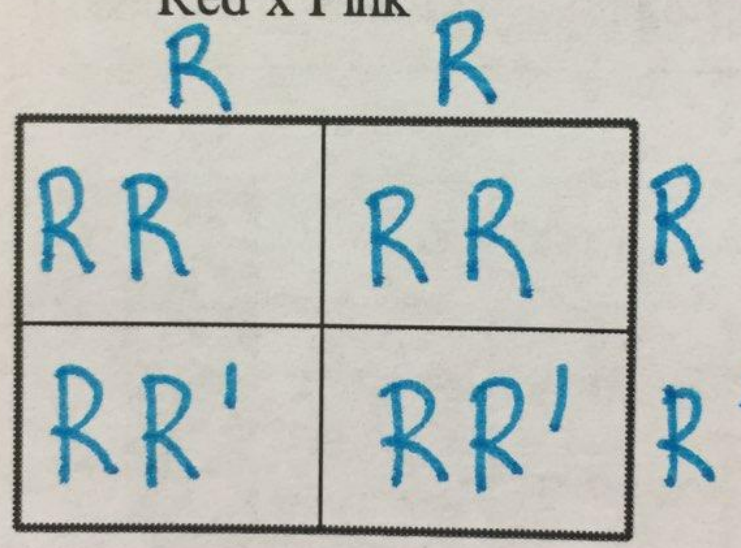
- Flowers: Red & White
  - Blending Result?
    - Pink
- Cows: Brown & White
  - Blending Result?
    - Tan

Red x Pink



Phenotype %:

Red x Pink

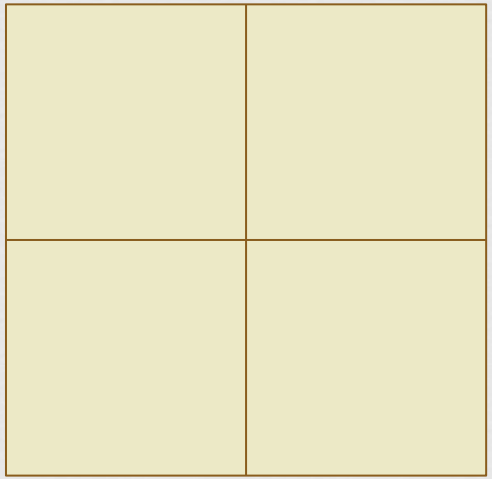


Phenotype %: 50% Red
50% Pink

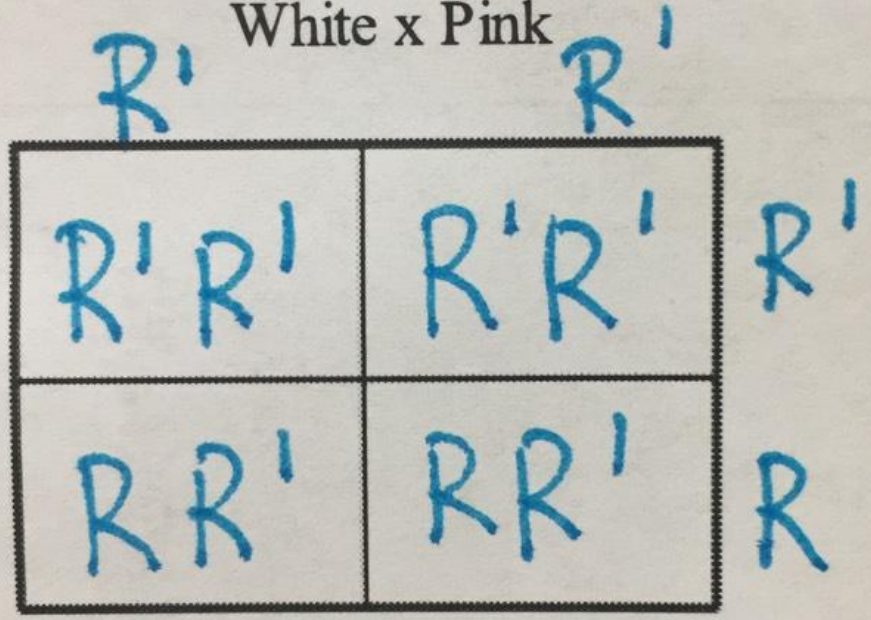
Brown x White

White x Pink

Phenotype %:



White x Pink

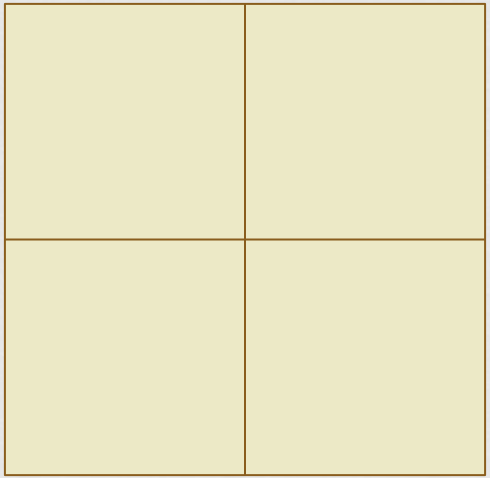


Phenotype %:

50% white

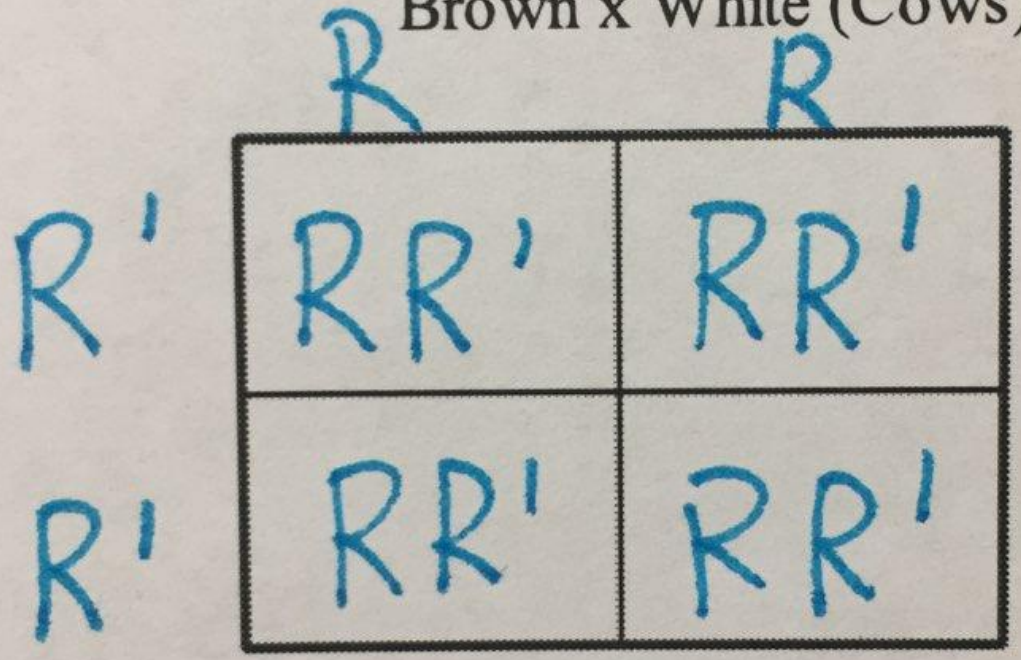
50% Pink

Brown x White (Cows)



Phenotype %:

Brown x White (Cows)

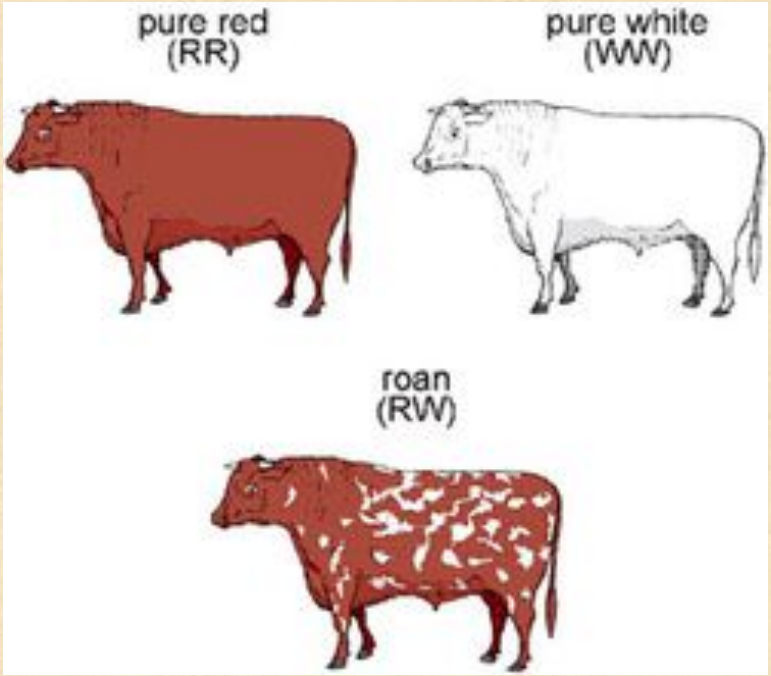


Phenotype % :

100% tan

Codominance

- When a phenotype displays **both traits** equally
- Like co-captains
- Dog with brown and black hairs



Genotypes: Each alleles receives a CAPITAL LETTER

Examples: - TRY THE BLANK ONES

Genotypes (written in alphabetical order)	Phenotypes (written in alphabetical order)	
B = Black	BB = Black	**NW =**
N =	NN = Brown	**BW =**
W= White	WW = White	**BR =**
R=	BN = black & brown	**RR =**

Genotypes: Each alleles receives a CAPITAL LETTER

Examples:

Genotypes (written in alphabetical order)	Phenotypes (written in alphabetical order)	
B = Black	BB = Black	**NW = Black and Brown**
N = BROWN	NN = Brown	**BW = Black and White**
W= White	WW = White	**BR = Black and Red**
R= RED	BN = black & brown	**RR = Red**

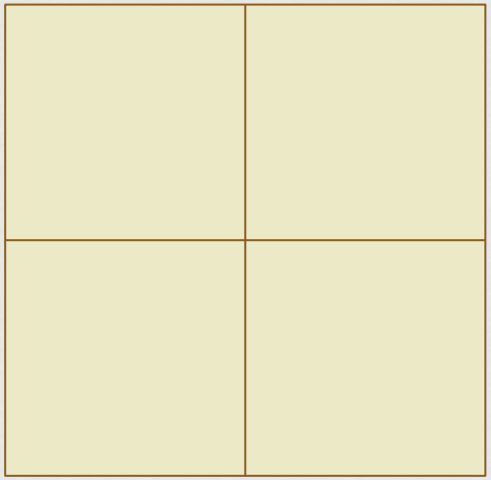
7.4 Human Genetics and Pedigrees

- In incomplete dominance, neither allele is completely dominant nor completely recessive.

Codominant alleles will both be completely expressed.

The flower will show **both** red and white

BW x NN



Phenotype %:

BW x NN

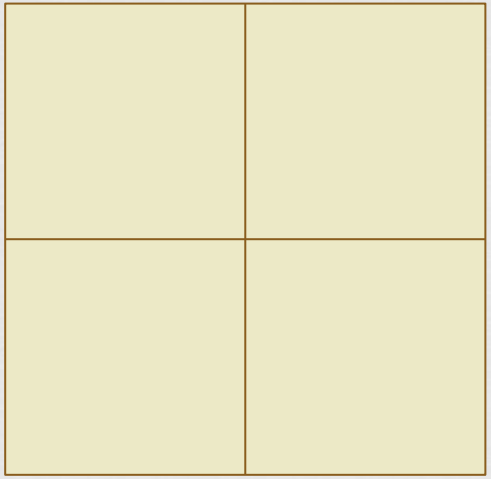
	B	W
N	BN	NW
N	BN	NW

Phenotype %:

50% Black + Brown

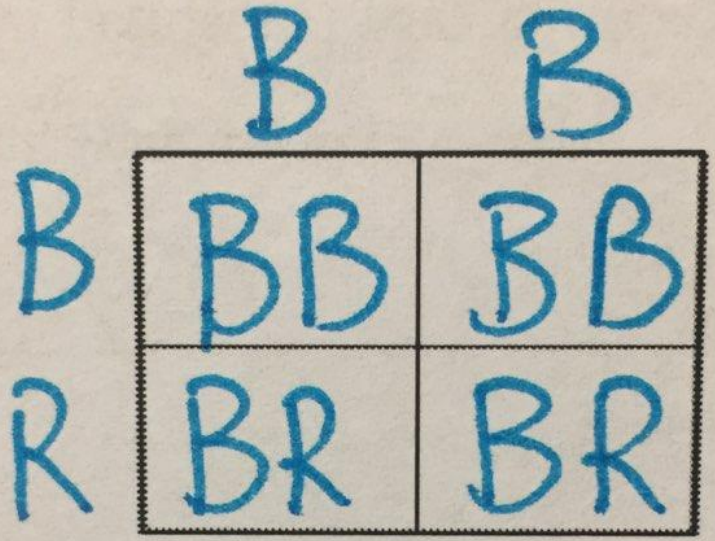
50% Brown + white

BB x BR



Phenotype %:

BB x BR

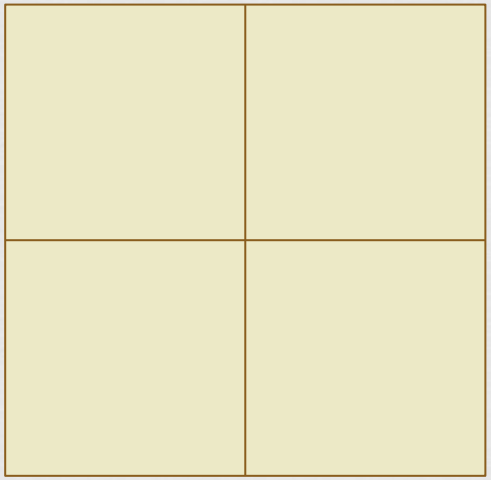


Phenotype % :

50% Black

50% Black + Red

BN x WW



Phenotype %:

BN x WW

	B	N
W	BW	NW
W	BW	NW

Phenotype %:

50% Black + White

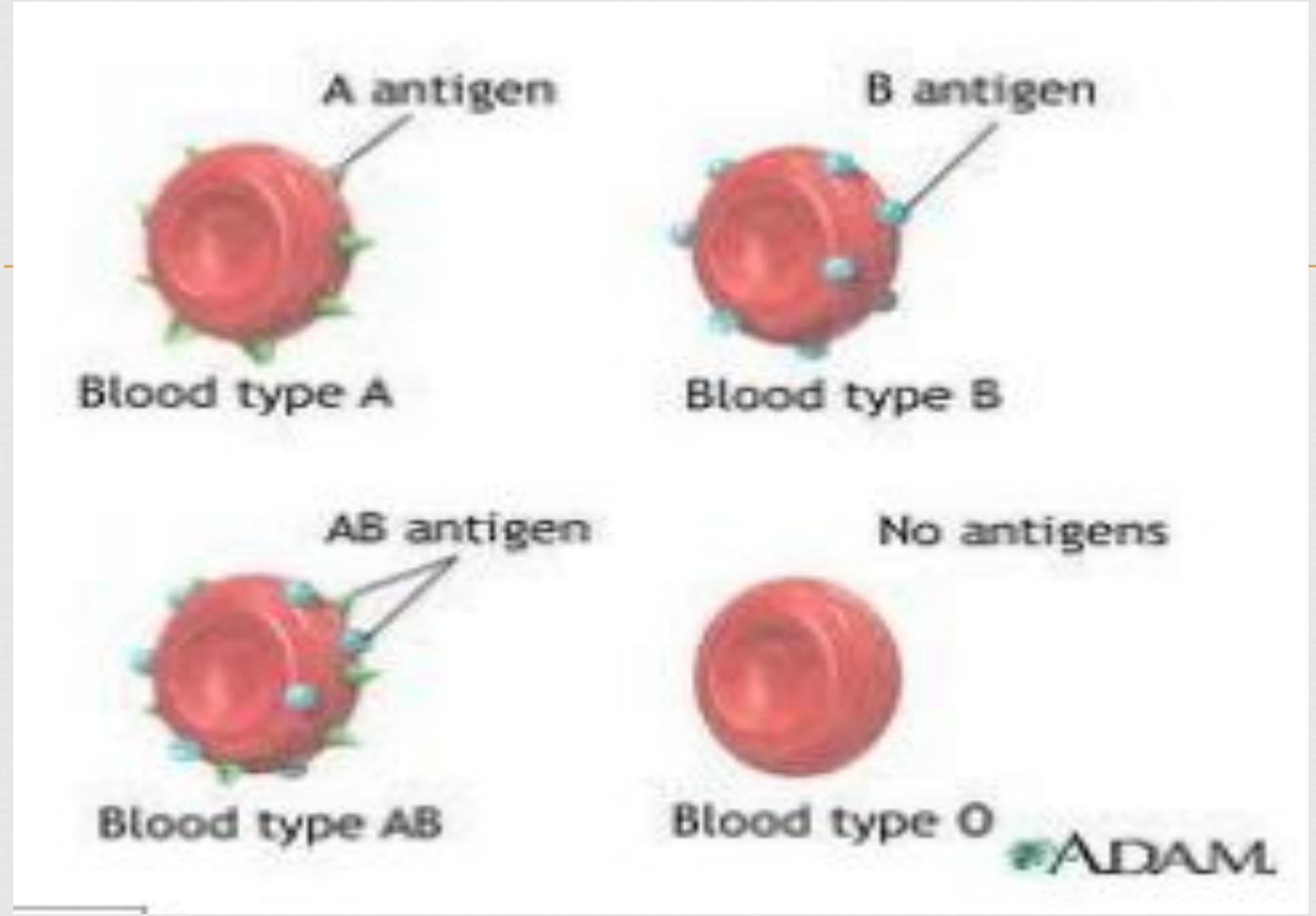
ed 50% Black + Brown

Multiple Alleles

- Genes that have three or more alleles
- Blood Type Gene
  - ABO blood groups
  - Determined by I^A, I^B and *i*

Mother's Blood Type	Father's Blood Type: A	B	AB	O
A	A or O	A, B, AB, or O	A, B, or AB	A or O
B	A, B, AB, or O	B or O	A, B, or AB	B or O
AB	A, B, or AB	A, B, or AB	A, B, or AB	A or B
O	A or O	B or O	A or B	O

Child's Blood Type


A antigen
Blood type A
B antigen
Blood type B
AB antigen
Blood type AB
No antigens
Blood type O
ADAM.

Antigens

Purpose: prevents blood from being infected by foreign objects

Blood Type	Donate Blood To	Receive Blood From
A+	A+ AB+	A+ A- O+ O-
O+	O+ A+ B+ AB+	O+ O-
B+	B+ AB+	B+ B- O+ O-
AB+	AB+	Everyone
A-	A+ A- AB+ AB-	A- O-
O-	Everyone	O-
B-	B+ B- AB+ AB-	B- O-
AB-	AB+ AB-	AB- A- B- O-

Blood Type	Possible Genotypes	Antigens
A	I^AI^A or I^Ai	
B	I^BI^B or I^Bi	
AB	I^AI^B	
O	ii	

Blood Type	Possible Genotypes	Antigens
A	I^AI^A or I^Ai	A
B	I^BI^B or I^Bi	B
AB	I^AI^B	A and B
O	ii	No antigens

Influenced by Several Genes

- Polygenic Influence
  - When **several genes influence a trait**
  - May be located on the **same or different chromosomes** to cause influence
  - Examples:
    - Eye color, height, weight and hair color
    - Think about your permit and what information it provides to remember these

Videos

Incomplete Dominance, Co-dominance & Polygenic Traits

https://www.youtube.com/watch?v=YJHGfbW55l0

Blood Typing

https://www.youtube.com/watch?v=9O5JQqlngFY

Sex-linked Traits

https://www.youtube.com/watch?v=h2xufrHWG3E