
Blood Types & Codominance

Warm-up: Punnett Practice

5 minute
timer

5:00

In dogs, tooth size is controlled by a dominant-recessive gene. Large teeth (T) is dominant to small teeth (t). If a homozygous recessive dog breeds with a heterozygous dog, what are the possible genotypes and phenotypes of their offspring? Use a punnett square to show your work.



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Possible genotypes:

Possible phenotypes:

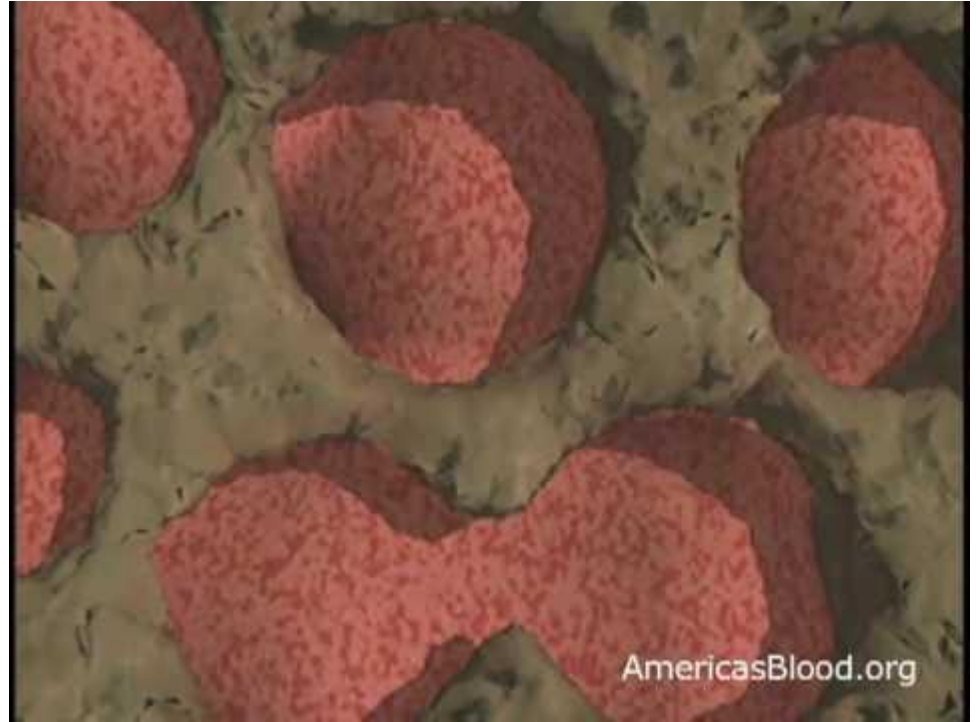
Today's Agenda

1. Warm-up
 2. About blood types
 3. **Notes:** Codominance
 4. Exit Slip
-

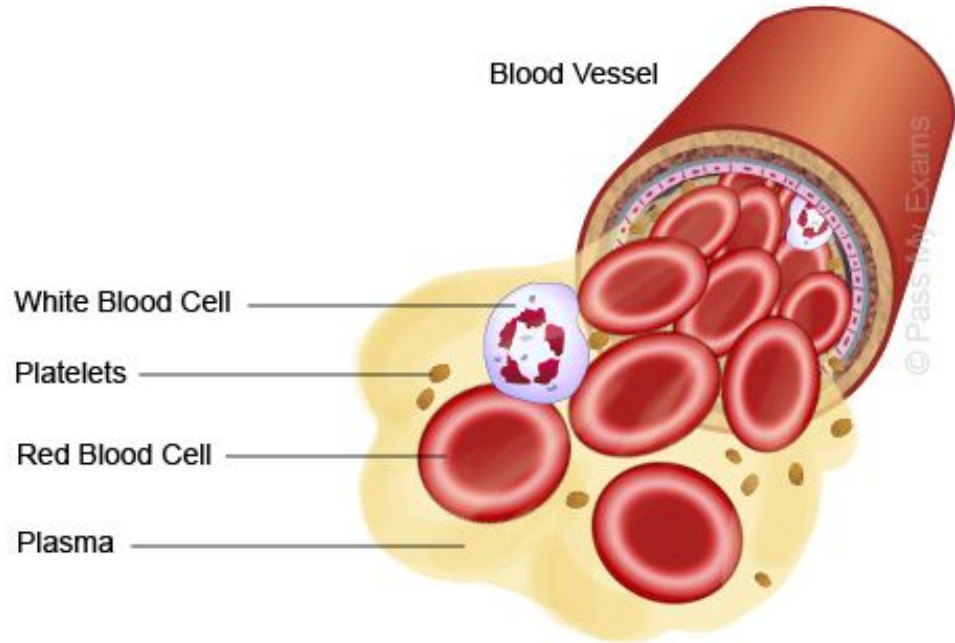
Discussion:

What do you know about blood/blood type?

What is Blood?



What is in “Blood”?



Blood Types

There are 8 different blood types, and a person's blood type is determined by inheritance from parents.

❖	A +	❖	A -
❖	B +	❖	B -
❖	AB +	❖	AB -
❖	O +	❖	O -

We will NOT focus on +
and -

Percentage of Blood Types in the Human Population

- O-positive: 38 percent
 - O-negative: 7 percent
 - A-positive: 34 percent
 - A-negative: 6 percent
 - B-positive: 9 percent
 - B-negative: 2 percent
 - AB-positive: 3 percent
 - AB-negative: 1 percent
-

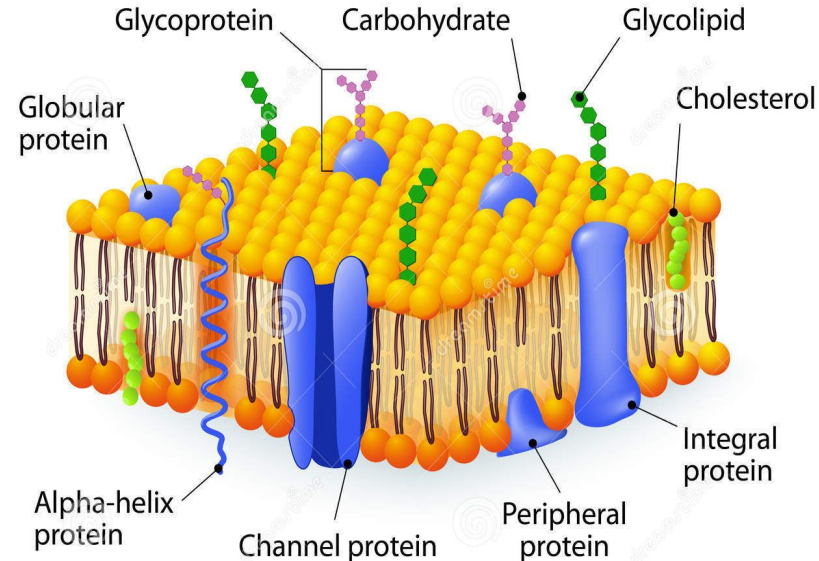
Why Are There Different Blood Types?

Red blood cells can have a carbohydrate chain (glycoprotein) attached to its cell membrane that is called an **antigen**.

Antigens help the body know whether or not something is a foreign substance.

If our immune system encounters an antigen it has not seen before, it will attack that foreign substance.

CELL MEMBRANE



The ABO Blood System

Blood Type (genotype)	Type A (AA, AO)	Type B (BB, BO)	Type AB (AB)	Type O (OO)
Red Blood Cell Surface Proteins (phenotype)	 A diagram of a red blood cell with five blue circular antigens, each containing a white letter 'A', attached to its surface by red lines.	 A diagram of a red blood cell with five blue circular antigens, each containing a white letter 'B', attached to its surface by red lines.	 A diagram of a red blood cell with five blue circular antigens on its surface: two contain the letter 'A' and three contain the letter 'B'.	 A diagram of a red blood cell with no antigens on its surface.

GLYCOPROTEINS ON SURFACE OF CELLS
DETERMINE BLOOD TYPE

Why Are There Different Blood Types?

There are two types of antigens that can be on red blood cells: type A and type B.

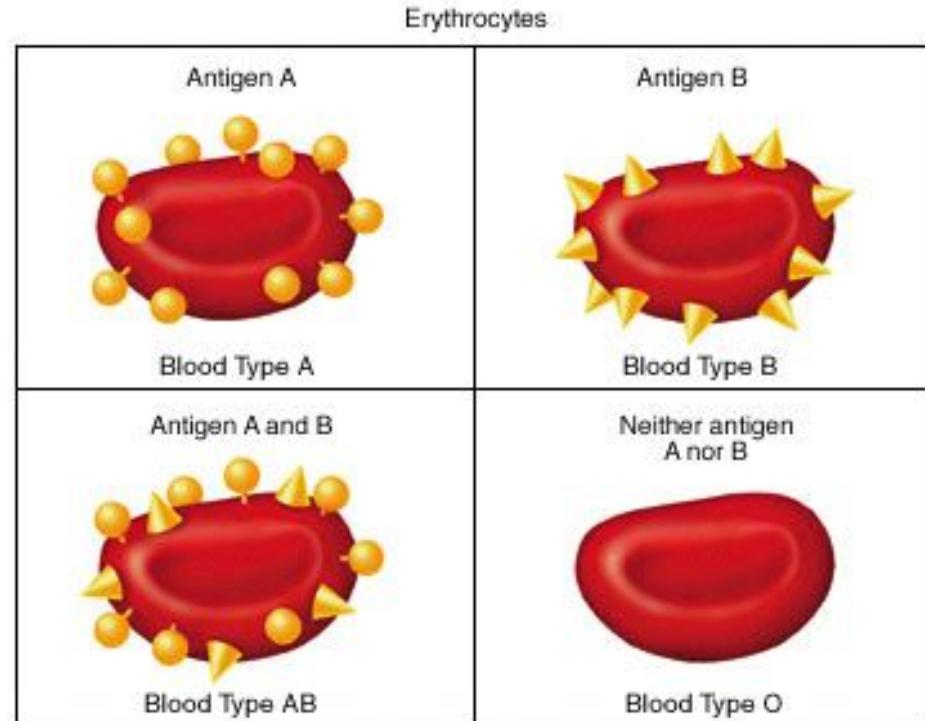
Blood Types:

Type A → has A antigens

Type B → has B antigens

Type AB → has A and B antigens

Type O → has no antigens

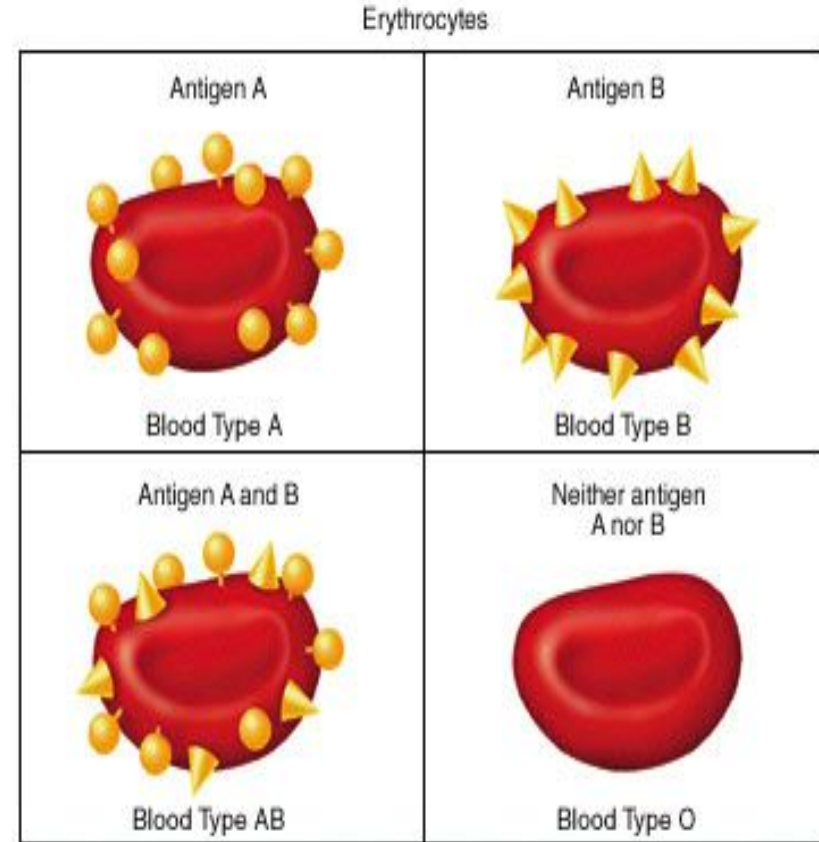


Why is this important?

This determines whether you can receive blood donations from another person.

The immune system will attack any red blood cell with an antigen it does not recognize.

If have blood type A, your immune system will attack donated red blood cells with B antigens, but not donated red blood cells with A antigens.



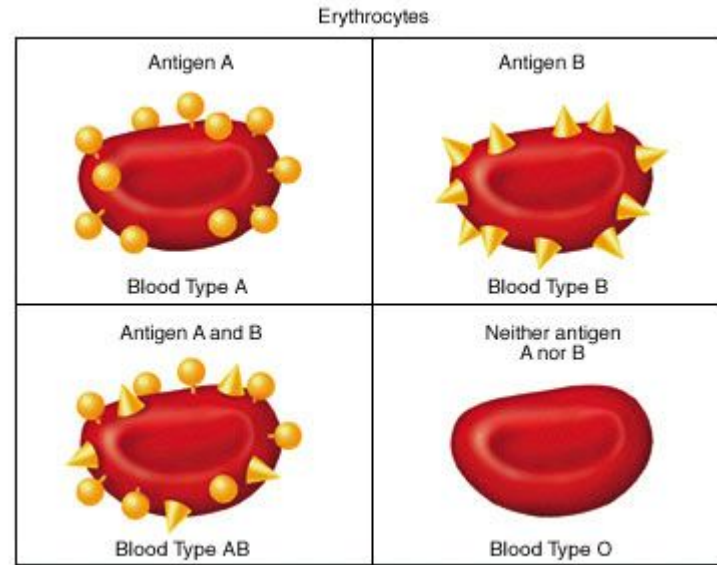
Group Activity

Blood Donation

Because of the antigens we just learned about, only certain blood types can receive donations from certain other blood types.

Your group's goal is to correctly draw arrows from the donors to all recipients on the next slide..

HINT: Some blood types can donate to more than one blood type.



DONOR

O 

A 

B 

AB 

RECIPIENT

 **O**

 **A**

 **B**

 **AB**

Group O can donate red blood cells to anybody. It's the universal donor.

Group A can donate red blood cells to A's and AB's.

Group B can donate red blood cells to B's and AB's.

Group AB can donate to other AB's, but can receive from all others.

DONOR

O



A



B



AB



RECIPIENT

O



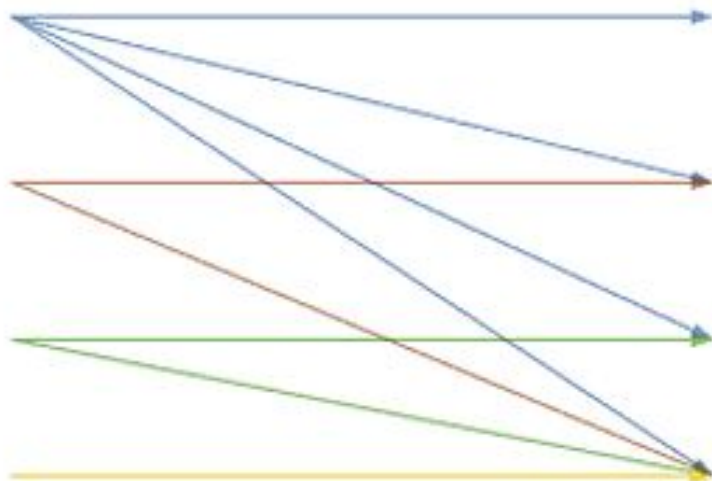
A



B



AB



TERMINOLOGY

UNIVERSAL DONOR: Which blood type was able to donate blood to every other group?

UNIVERSAL RECEIVER: Which blood type was able to receive blood from every other group?



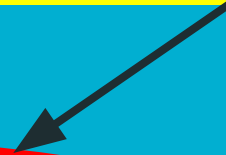
Codominance

The three types of inheritance

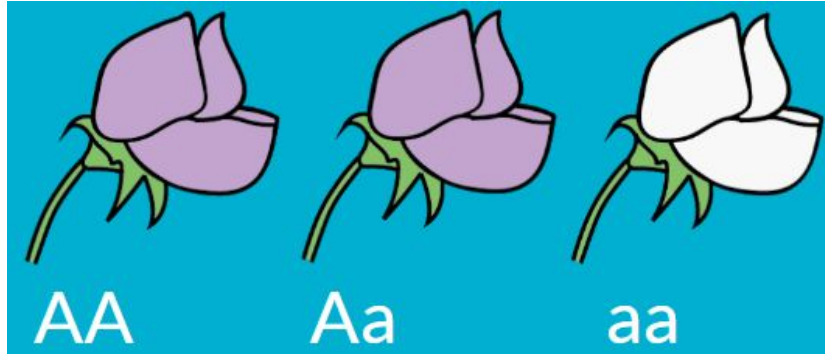
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1. Simple dominant-recessive
2. Incomplete dominance
3. Codominance (*we will learn about this later*)

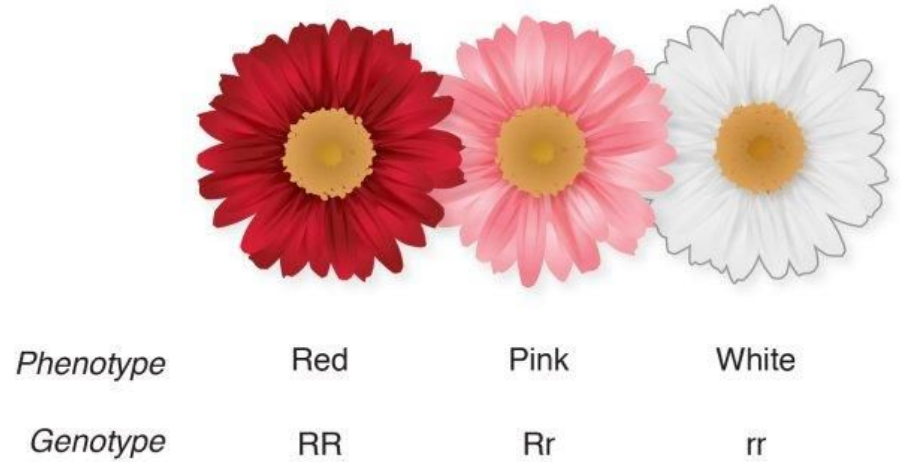
Remember this?



Simple Dominant-Recessive

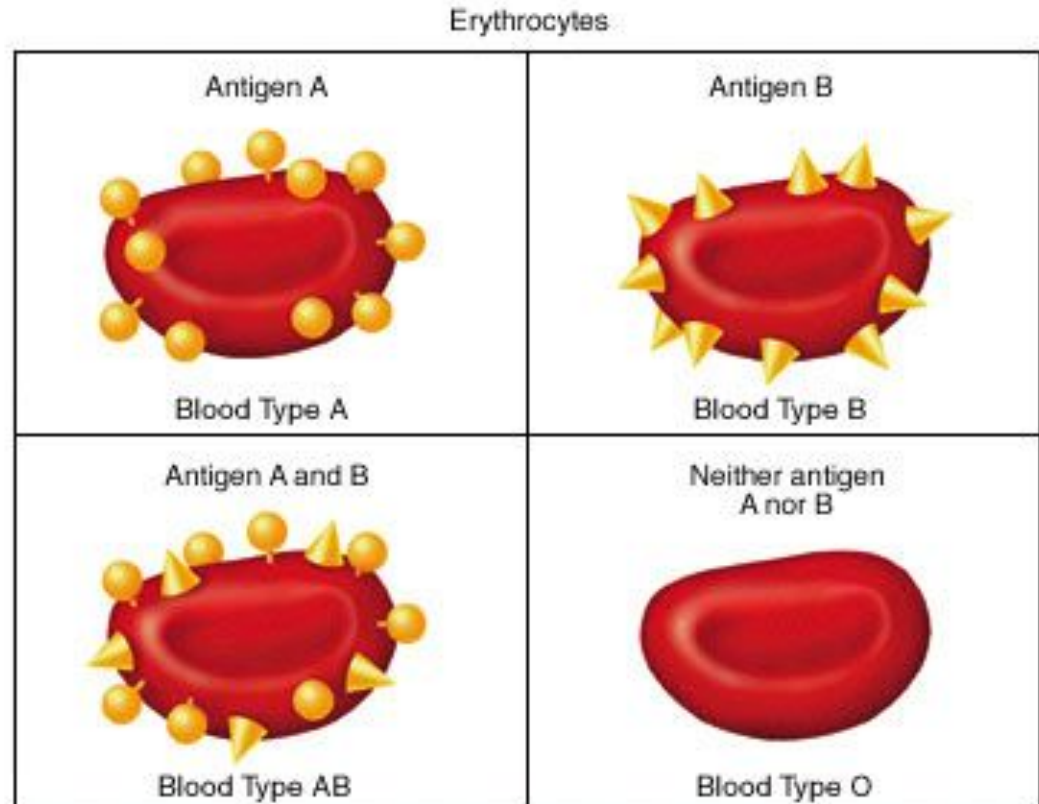


Incomplete Dominance



*Notice that in **AB** Blood, **BOTH** dominant traits are expressed! (The blood cells have **both antigens**.)

*This is why blood type in humans is considered a codominant trait.



Codominance AND Multiple Alleles

The antigen genes for blood type are **codominant**.

This means that there are **TWO** dominant alleles that are **BOTH** expressed

A → dominant (I^A) AND B → dominant (I^B)

But there is also an allele for not having an antigen, which is recessive.

O → recessive (i)

This means that there are a total of **THREE** alleles!

The alleles:

A → dominant (I^A)

B → dominant (I^B)

O → recessive (i)

***What is the genotype for someone who is homozygous for type A blood?**

***What is the genotype for someone who is heterozygous for type B blood?**

Allele I^A produces antigen **A**

Allele I^B produces antigen **B**

Allele i produces **no** antigen.

Genotypes	Phenotypes (blood types)
$I^A I^A$	A
$I^A I^B$	AB
$I^A i$	A
$I^B I^B$	B
$I^B i$	B
ii	O

Punnett Squares & Blood Type

We can use punnett squares to find possible blood types that an offspring will have

- *What is the mother's blood type?
- *What is the father's blood type?
- *What blood types can their children have?

		Mother	
		i	i
Father	I ^A	I ^A i	I ^A i
	I ^B	I ^B i	I ^B i

Quick Practice

Draw a punnett square to show the cross between a mother with **heterozygous A blood** and a father with **homozygous B blood**.

Quick Practice

Draw a punnett square to show the cross between a mother with heterozygous A blood and a father with homozygous B blood.

	I^A	i
I^B	$I^A I^B$	$I^B i$
I^B	$I^A I^B$	$I^B i$

Possible blood
types for child:

AB and B

Quick Practice

Draw a punnett square to show the cross between a mother with **heterozygous B blood** and a father with **homozygous O blood**.

Quick Practice

Draw a punnett square to show the cross between a mother with heterozygous B blood and a father with homozygous O blood.

	I^B	i
i	$I^B i$	ii
i	$I^B i$	ii

Possible blood types for child:

B and O

Quick Practice

Draw a punnett square to show the cross between a mother with **AB blood** and a father with **O blood**.

Quick Practice

Draw a punnett square to show the cross between a mother with AB blood and a father with homozygous O blood.

	I^A	I^B
i	$I^A i$	$I^B i$
i	$I^A i$	$I^B i$

possible blood
types for child:

A or B

Exit Question:

A child has a blood type of O. You know that the mother's blood type is O. The person that believes he is the father of this child has a blood type of B.

Could this person be the child's father? Can you be absolutely sure? Show punnett squares (more than one if needed) to explain your answer.
