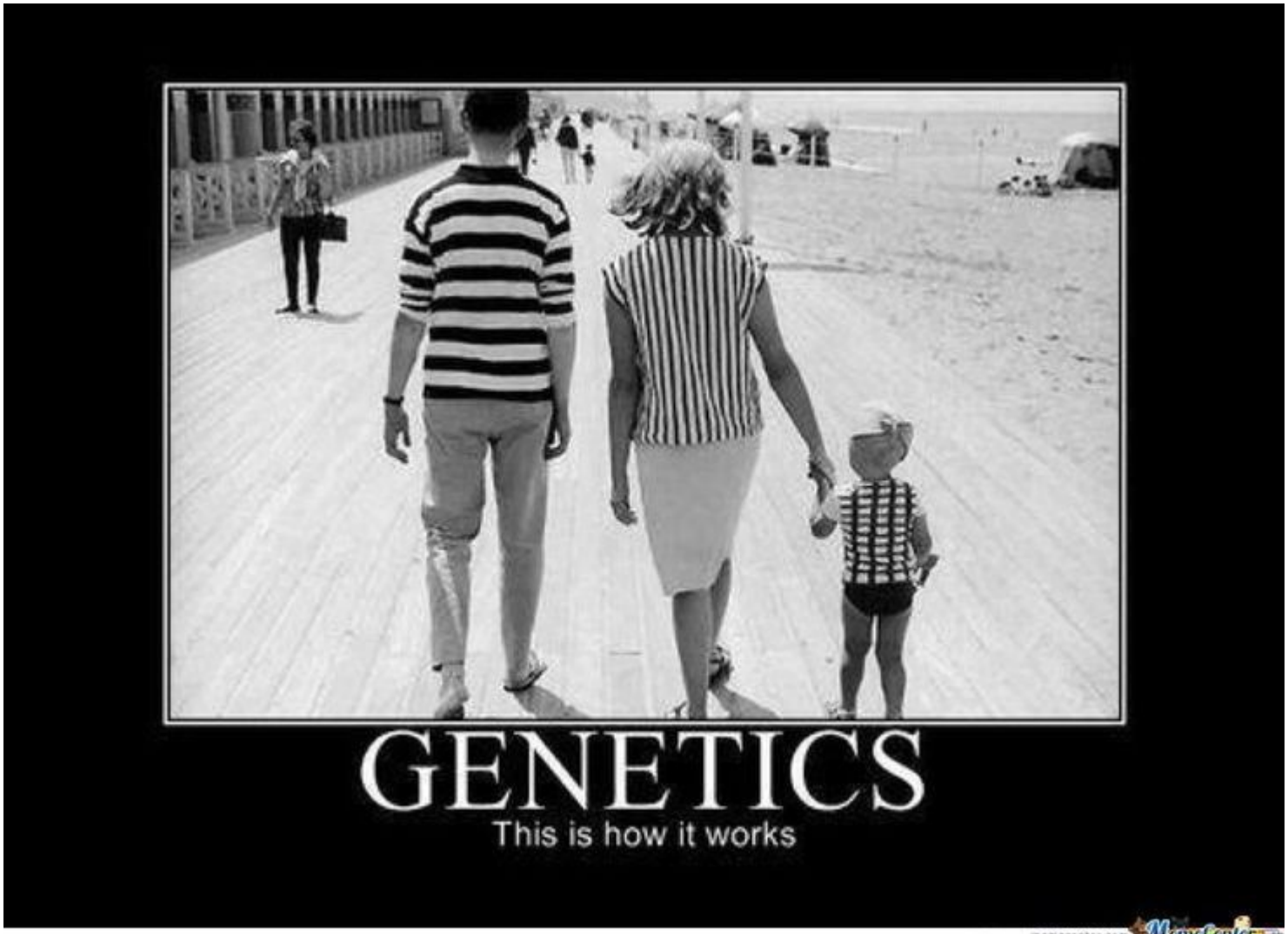
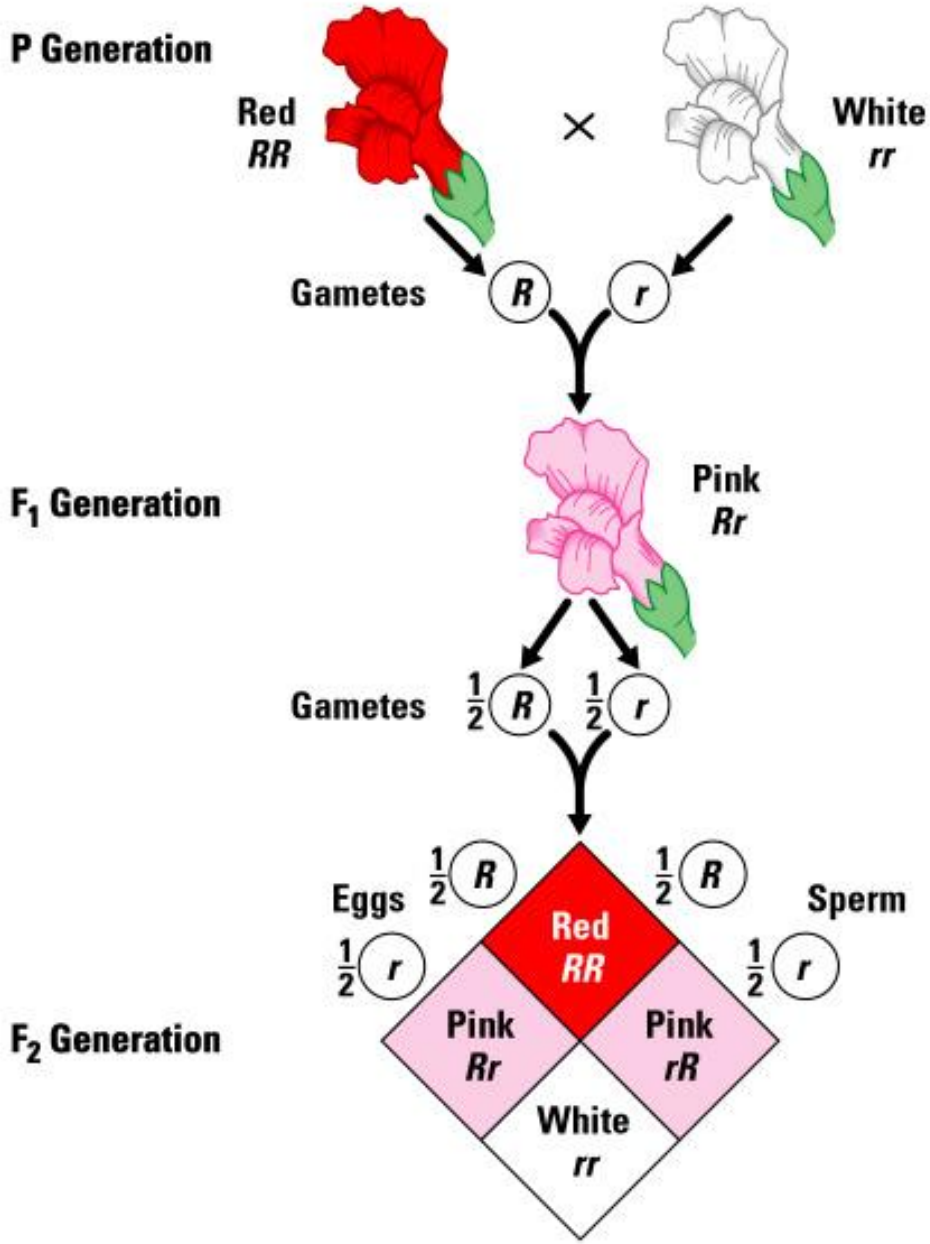
Incomplete Dominance and Codominance




This is my mom and dad.

- Snapdragons

http://www.dobermann-review.com/info/genetics/mendels_genetic_laws/Gregor%20Mendel.jpg



http://faculty.pnc.edu/pwilkin/incompdominance.jpg

Today's Goal:

Explain the difference:

incomplete dominance	co-dominance

Incomplete Dominance

- Neither allele is completely dominant over the other allele.
- A heterozygous phenotype
  - A mixture or blending of the two

Four-o’ clock flowers

- Incomplete dominance
- Neither Red (R)
- or White (W) is dominant

When a homozygous red flower (RR)

Mix with a homozygous white flower (WW), the alleles blend in the hybrid (RW) to produce pink flowers

Andalusian Chickens

- Incomplete dominance
- Neither Black (B) or

White (W) are dominant

The offspring of a black feathered chicken (BB) and a white feathered chicken (WW) are blue (BW) – BLUE HEN!!

Codominance

- Two equally dominant alleles are expressed at the same time.

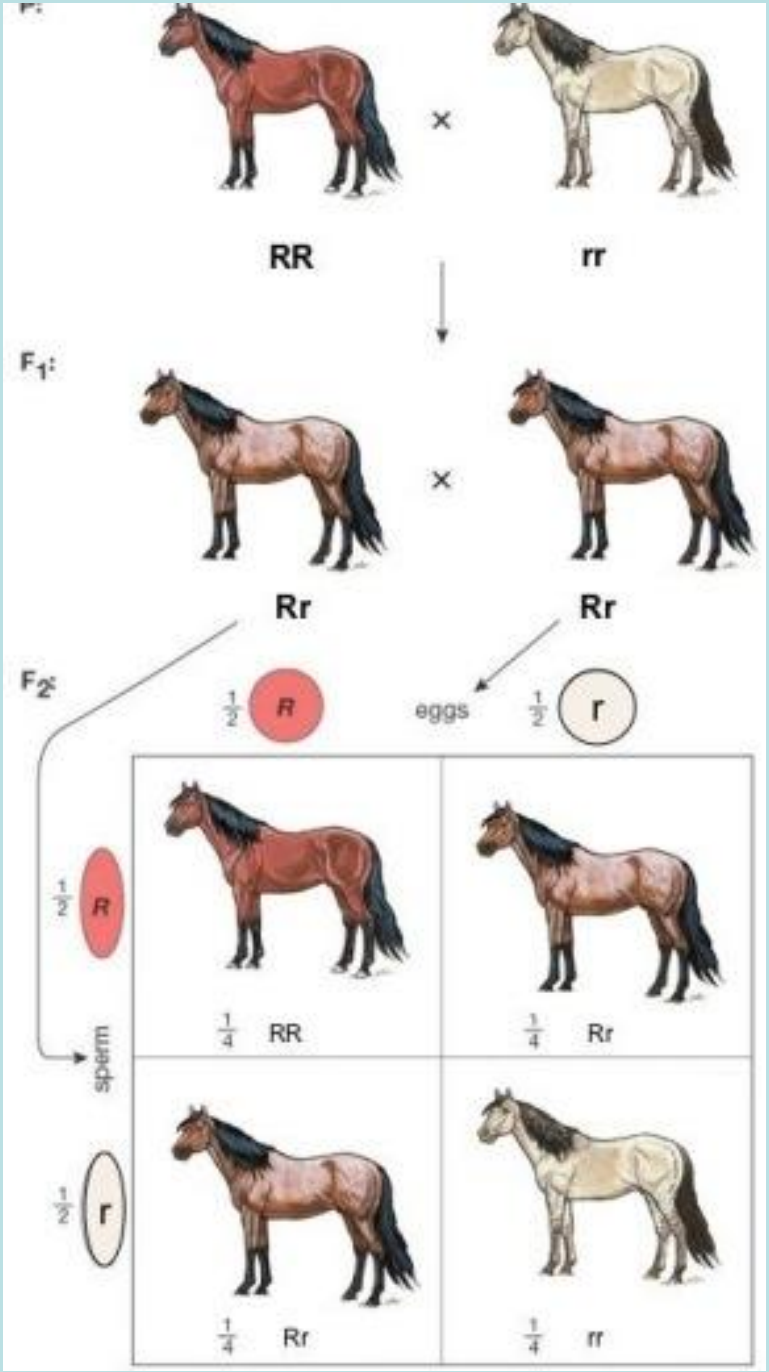
- Heterozygous phenotype will have both phenotypes visible

Shorthorn Cattle

- Co- dominance
- Homozygous red (RR)
- Homozygous white (WW)

The offspring of will have both red and white hairs (RW)

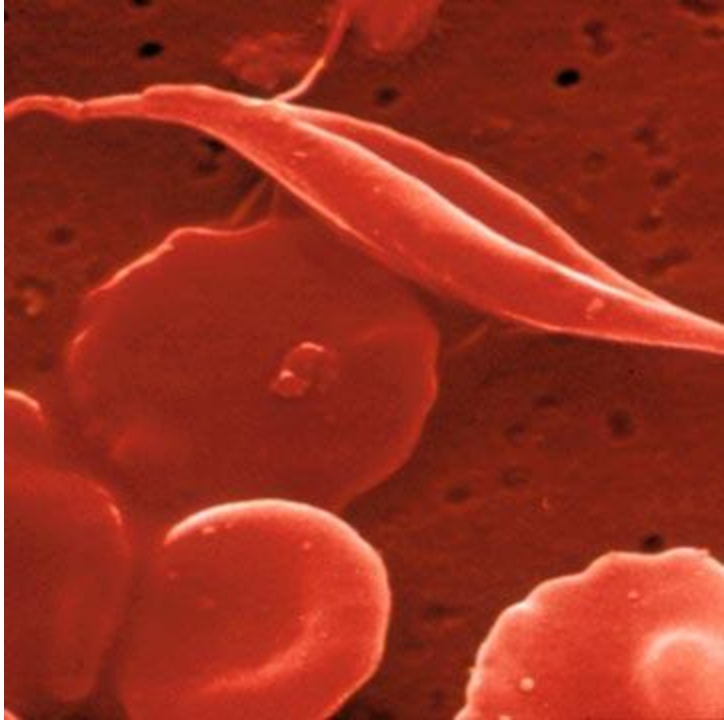
The offspring are heterozygous and called “roan”



Roan Horse

http://search.vadlo.com/b/q?rel=2&keys=Dominance+Incomplete+Dominance+Codominance+PPT

Sickle- Cell Anemia



- Co-dominance
- Caused by an abnormal

Hemoglobin, the protein that red blood cells use to carry oxygen

Normal hemoglobin is (RR)

Sickle Cell shaped blood cells (SS)

People who are carriers (heterozygous) for the disease there is a mixture of both normal and sickle cell (RS)

Problem: Codominance

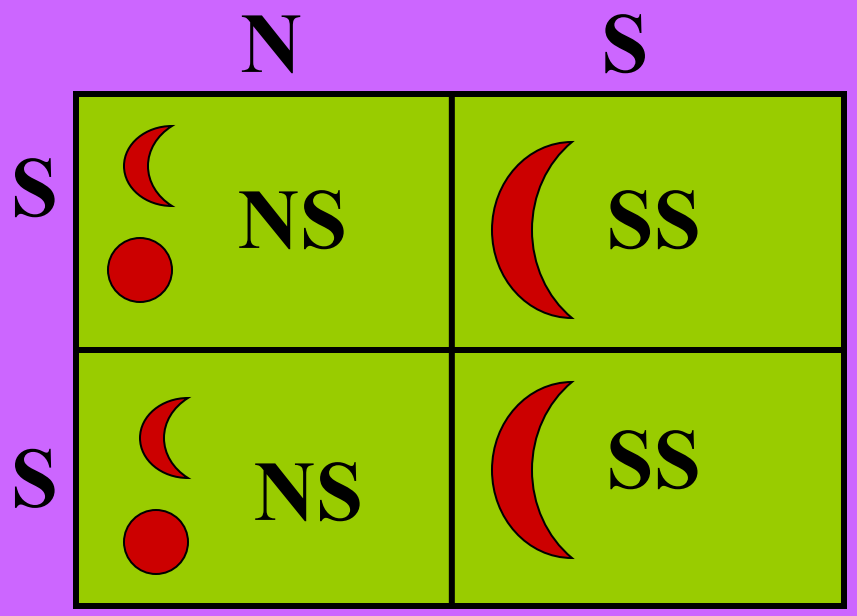
- Show the cross between an individual with sickle-cell anemia and another who is a carrier but not sick.

GENOTYPES:

- NS (2) SS (2)
- ratio 1:1

PHENOTYPES:

- carrier (2); sick (2)
- ratio 1:1



both equally present

mixing

Let's Stop and Think…

- Let's say there are two alleles for the hair color trait- red and blue
  - What would be the resulting phenotype of a heterozygous pair if the alleles showed <u>incomplete dominance</u>?
    - Draw the punnett square on the left hand page

Let’s Stop and Think…

- Let’s say there are two alleles for the hair color trait- red and blue
  - What would be the resulting phenotype of a heterozygous pair if the alleles showed codominance?
    - Draw the punnett square on the left page.

MULTIPLE ALLELISM

- When there is more than 2 alleles possible for a given gene.

- Allows for a larger number of genetic and phenotypic possibilities.

BLOOD TYPING

- Blood types are A, B, O, and AB.
- AB blood is a co-dominant trait.
- Both the A blood and the B blood need to be dominant in order to make a combination of co-dominant blood types, which is AB.
-

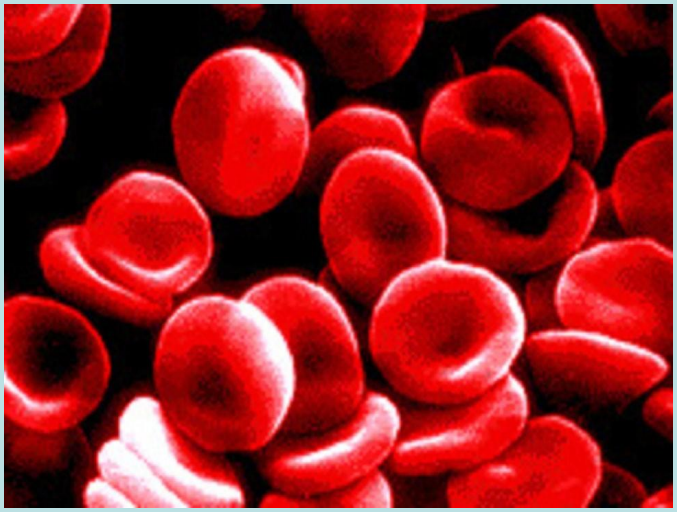
Blood Type	Genotype		Can Receive Blood From:
A	$i^A i$ $i^A i^A$	AA AO	A or O
B	$i^B i$ $i^B i^B$	BB BO	B or O
AB	$i^A i^B$	AB	A, B, AB, O
O	$i\,i$	OO	O

	IA	IA
IB	IA IB	IA IB
IB	IA IB	IA IB

	IA	i
IB	IA IB	IB i
i	IA i	ii

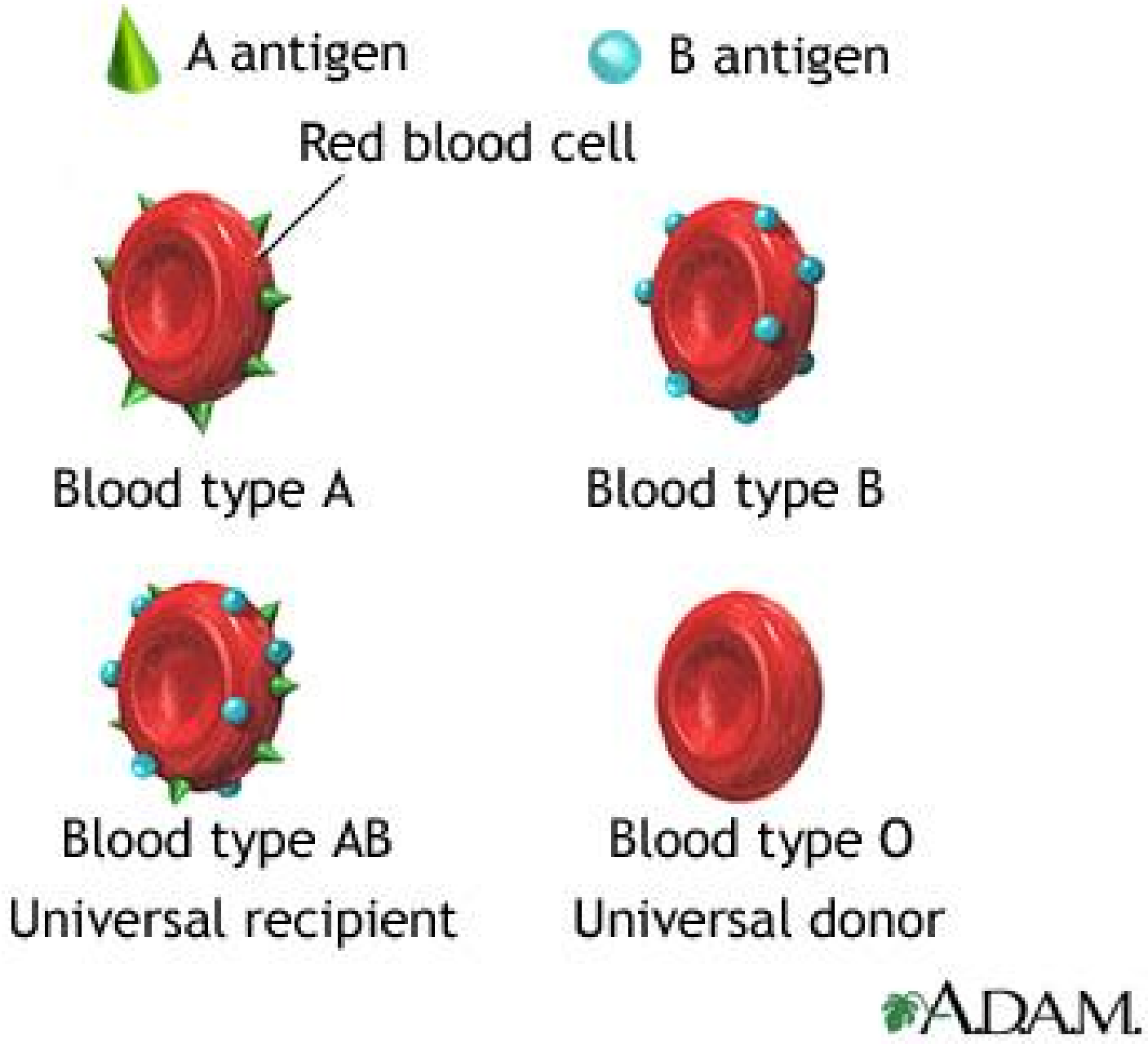
BLOOD TYPES

- 4 ABO blood types
- 3 alleles of the I gene
  - I^A = A antigen on RBC
  - I^B = B antigen on RBC
  - **i** = neither A nor B antigen



http://sydfish.files.wordpress.com/2008/02/bloodcells.jpg

Genotype	Blood type	Antibody
I^AI^A or I^Ai	A	Anti – B
I^BI^B or I^Bi	B	Anti – A
I^AI^B	AB	None
ii	O	Anti – A, Anti – B

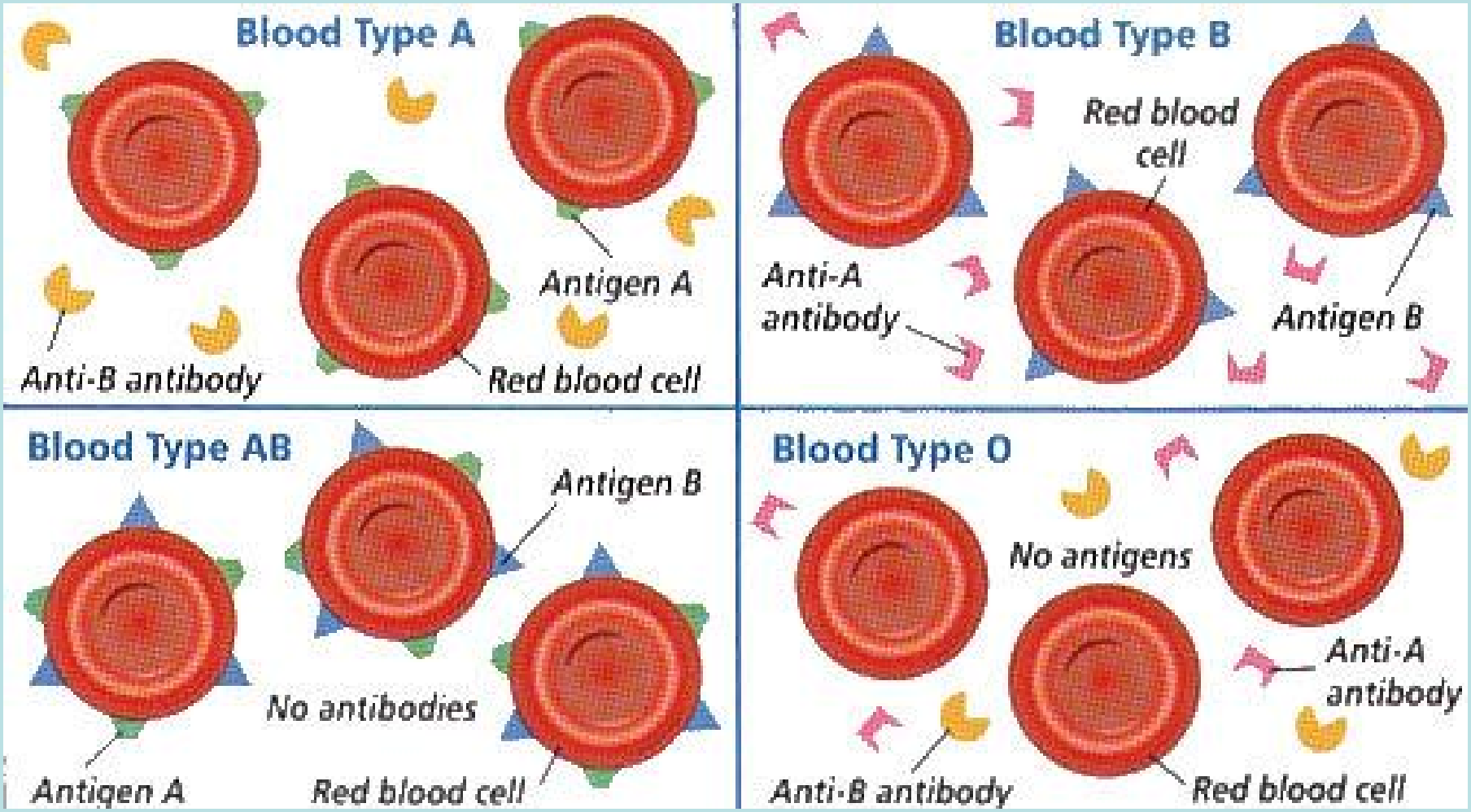


http://www.pennmedicine.org/health_info/images/19450.jpg

The ABO Blood System

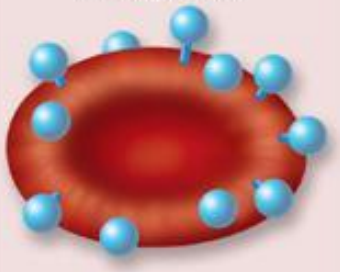
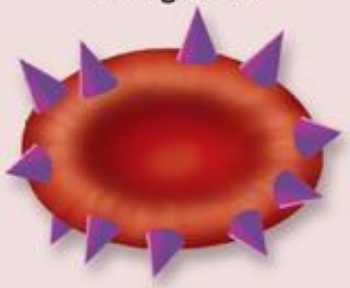
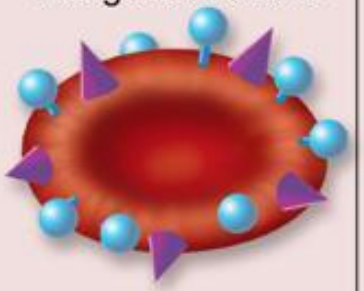
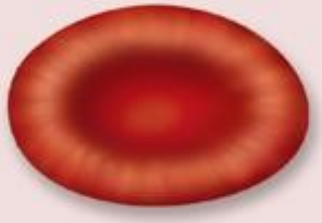
Blood Type (genotype)	Type A (AA, AO)	Type B (BB, BO)	Type AB (AB)	Type O (OO)
Red Blood Cell Surface Proteins (phenotype)	 A agglutinogens only	 B agglutinogens only	 A and B agglutinogens	 No agglutinogens
Plasma Antibodies (phenotype)	 b agglutinin only	 a agglutinin only	NONE. No agglutinin	 a and b agglutinin

http://duongchan.files.wordpress.com/2007/05/abobloodsystem.jpg



http://image.wistatutor.com/content/feed/tvcs/blood_type5B15D.jpg

ABO Blood Types

Erythrocytes	Antigen A 	Antigen B 	Antigens A and B 	Neither antigen A nor B 
Plasma	Anti-B antibodies 	Anti-A antibodies 	Neither anti-A nor anti-B antibodies	Both anti-A and anti-B antibodies 
Blood type	**Type A** Erythrocytes with type A surface antigens and plasma with anti-B antibodies	**Type B** Erythrocytes with type B surface antigens and plasma with anti-A antibodies	**Type AB** Erythrocytes with both type A and type B surface antigens, and plasma with neither anti-A nor anti-B antibodies	**Type O** Erythrocytes with neither type A nor type B surface antigens, but plasma with both anti-A and anti-B antibodies

http://www.biologycorner.com/anatomy/blood/images/bloodtypes.jpg

Codominance & Multiple Alleles

BLOOD TYPE	GENOTYPE	CAN RECIVE BLOOD FROM
A	I^AI^A , I^Ai	A, O
B	I^BI^B , I^Bi	B, O
AB	I^AI^B	A, B, AB, O
O	ii	O

- Human blood type is an example of both codominance and a trait with multiple alleles.
- AB = universal acceptor
- O = universal donor

PRACTICE QUESTIONS

1. In a certain case a woman's blood type was tested to be AB. She married and her husbands blood type was type A. Their children have blood types A, AB, and B. What are the genotypes of the parents? What are the genotypic ratios of the children?

Rhesus Factor

- The **Rhesus** factor, also known as the Rh factor, gets its name from experiments conducted in 1937 by scientists Karl Landsteiner and Alexander S. Weiner.

- Involved Rabbits which when injected with the Rhesus monkey's red blood cells, produced an antigen present in the red blood cells of many humans

http://content9.clipmarks.com/blog_cache/latimesblogs.latimes.com/img/E0C83714-56E5-4757-B9F1-604FCE5643C3

Rhesus Factor

- The Rhesus factor is an antigen, or more specifically a protein, that exists on the surface of red blood cells.

- If a person has either two (+) genes for Rh or one (+) and one (-) Rh gene, they will test Rh(+). A person will be negative only if they have 2 (-).

Relevance of Rh Factor & ABO Typing?

- It is very important in terms of babies:
  E.g. an Rh(-) mother may make antibody against an Rh(+) fetus if the baby gets a (+) gene from its father (Obstetricians screen pregnant women for this problem with blood tests).

- The ABO and RH genes are only two of many blood antigens that are present on human red cells and must be matched up for successful blood transfusions.

Multifactorial

- Referring to control of the expression of a trait by several genes and environmental factors.

- Many multifactorial traits show continuous distribution.

Multifactorial

- E.g. Human height → usually between 120cm and 200cm, however these genes cannot be fully expressed without all the necessary nutrients from a healthy diet

http://www.babble.com/CS/blogs/droolicious/menace-height.jpg

2. Practice: In a certain breed of cow the gene for red fur, ***R***, is **codominant** with that of white fur, ***W***. What would be the phenotypic & genotypic ratios of the offspring if you breed a red cow and a white bull? What would they be if you breed a red & white cow with a red & white bull?

3. Practice: A rooster with grey feathers is mated with a hen of the same phenotype. Among their offspring 15 chicks are grey, 6 are black and 8 are white.

a. What is the simplest explanation for the inheritance of these colors in chickens?

b. What offspring would you expect from the mating of a grey rooster and a black hen?