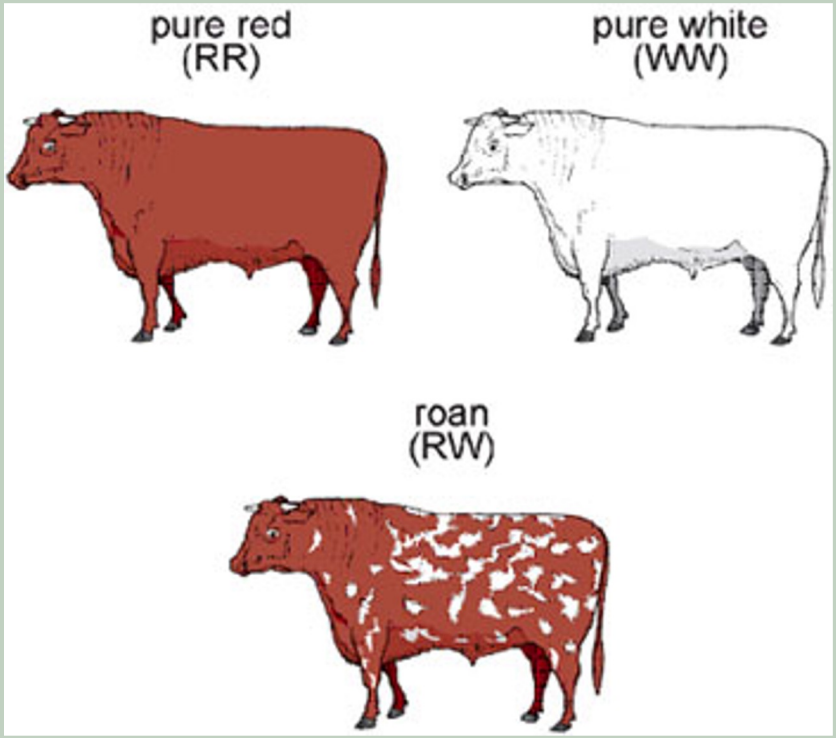
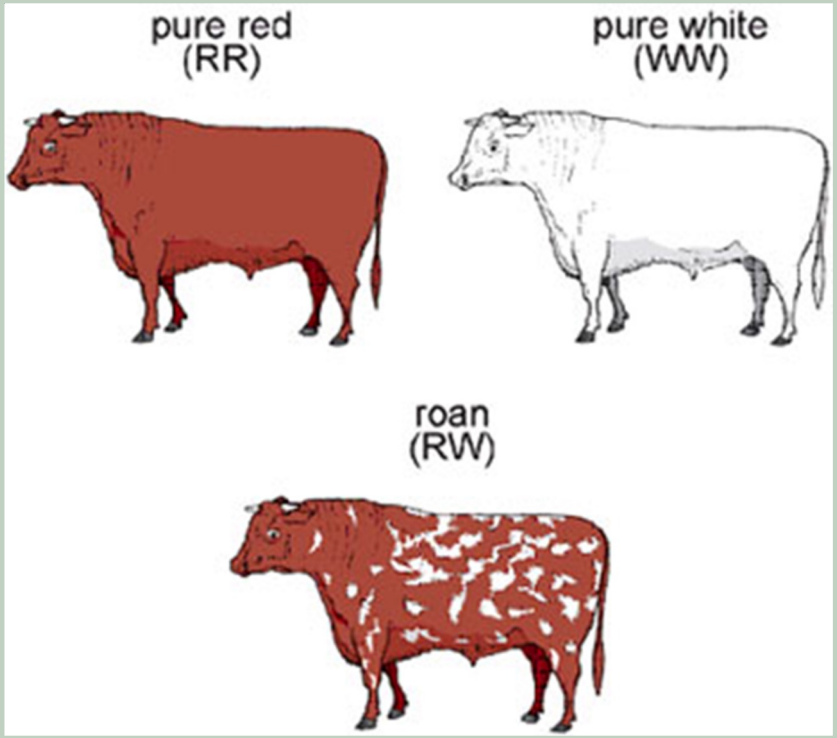
Genetics beyond Mendel

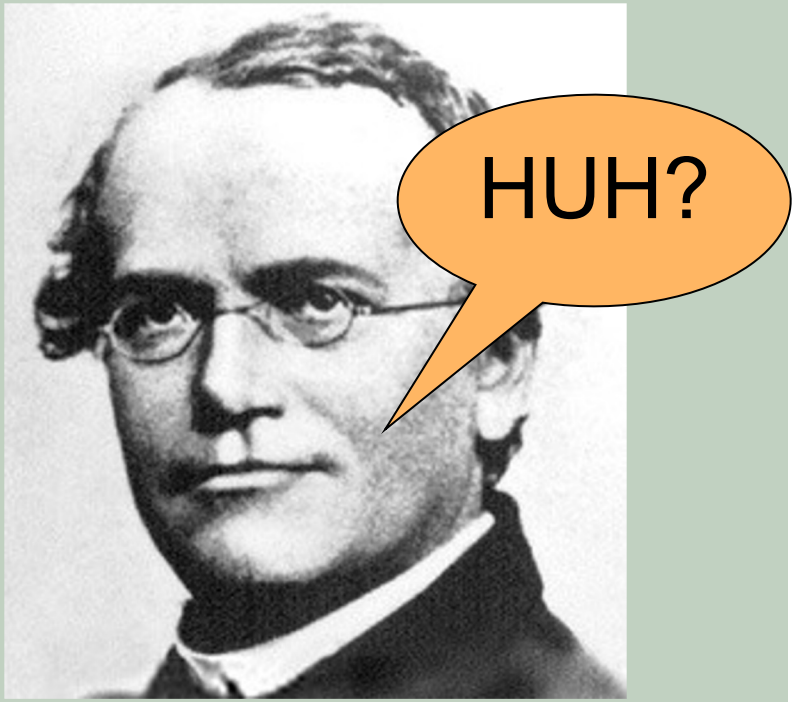


Some exceptions to Mendel's principles:

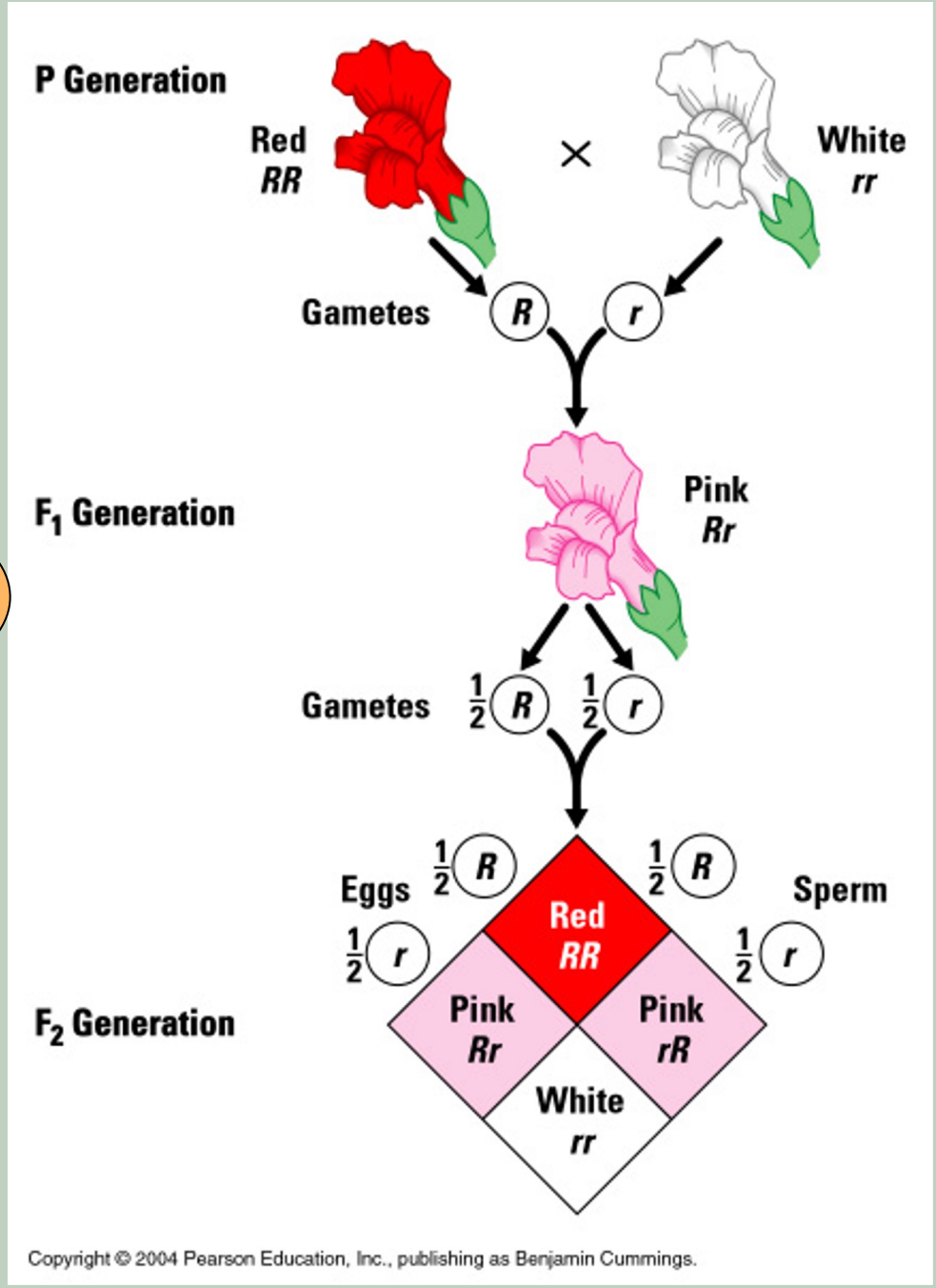


- Some alleles are **<u>neither</u>** dominant nor recessive.
- Many traits are controlled by **<u>more than one gene</u>** (polygenic traits)

- E.g. Snapdragons



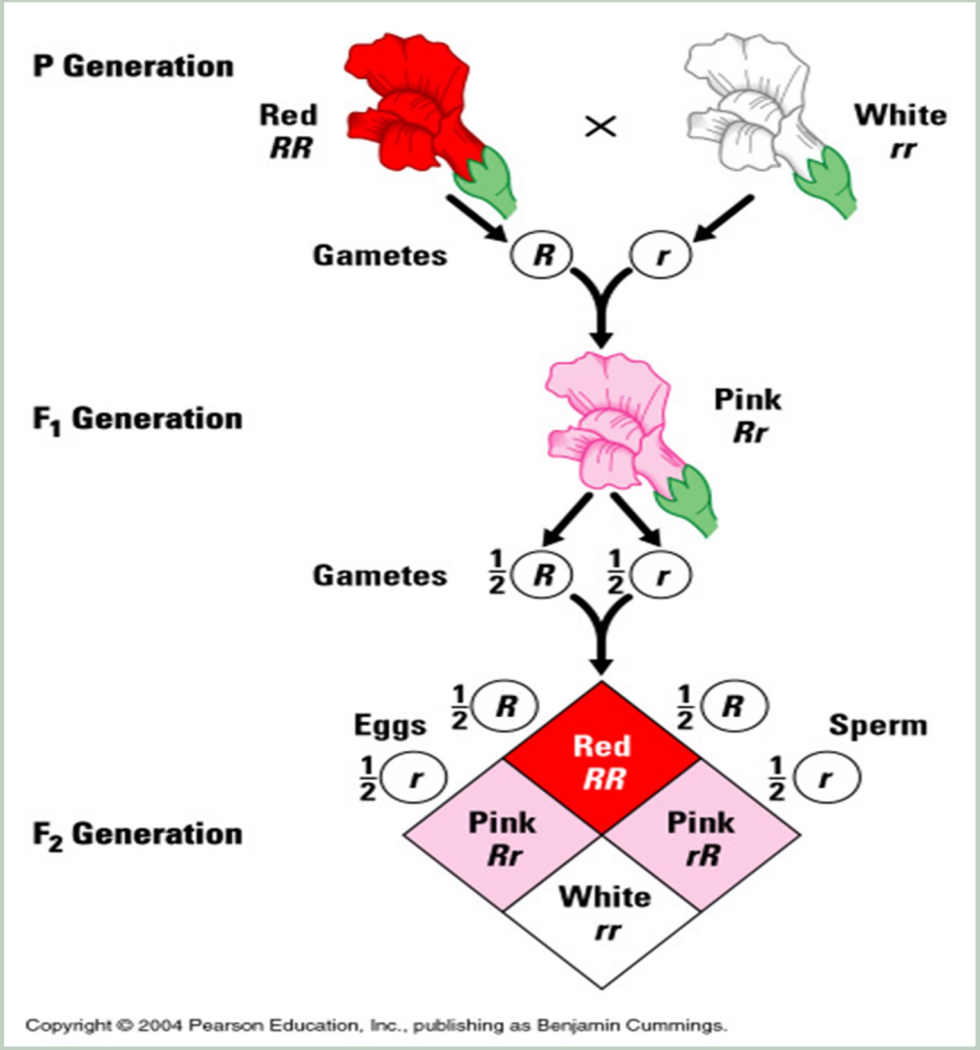
http://www.dobermann-review.com/info/genetics/mendels_genetic_laws/Gregor%20Mendel.jpg



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

Incomplete Dominance

- Neither allele is **DOMINANT**
- When two different alleles are present a new - **intermediate** phenotype which is a mixture **(blending)** of the two (Pink)
- *(remember – an allele is an option in the gene e.g. red or white)*

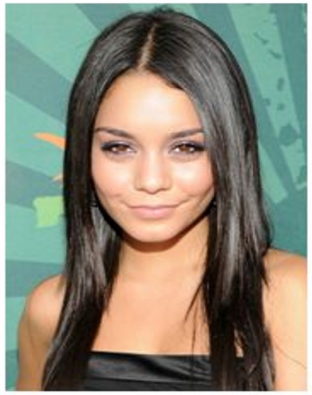


Another example (Straight hair + curly hair wavy hair)

Incomplete Dominance

Curly Hair (CC)

Wavy Hair (Cc)



Straight Hair (cc)

Four-o’ clock flowers

- 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 - so they have **3 phenotypes**

Incomplete Dominance

RR

	R	R
W	RW 	RW 
W	RW 	RW 

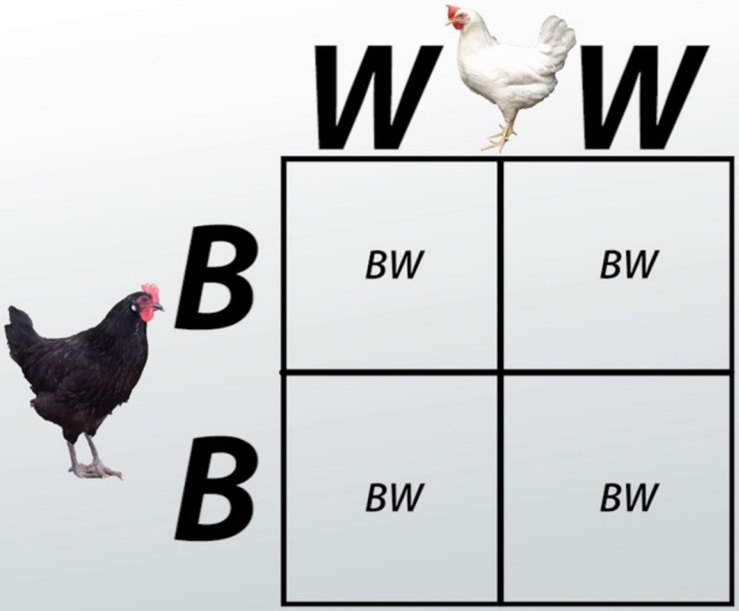
WW

Example – Andalusian Chickens

- 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)

EXAMPLES



			
Phenotype	White	Black	Speckled
Genotype	WW	BB	BW

Codominance

- Two alleles **both are present** in the phenotype
- Usually signified using superscripts.
- example: color of hair coat in cattle.
- $c^r c^r$ = red hairs
- $c^w c^w$ = white hairs
- $c^r c^w$ = roan coat (mixture of both colors)
- **heterozygous phenotype** (e.g. RW) you will see both phenotypes **clearly visible** (will see red and white)

E.g. Shorthorn Cattle

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

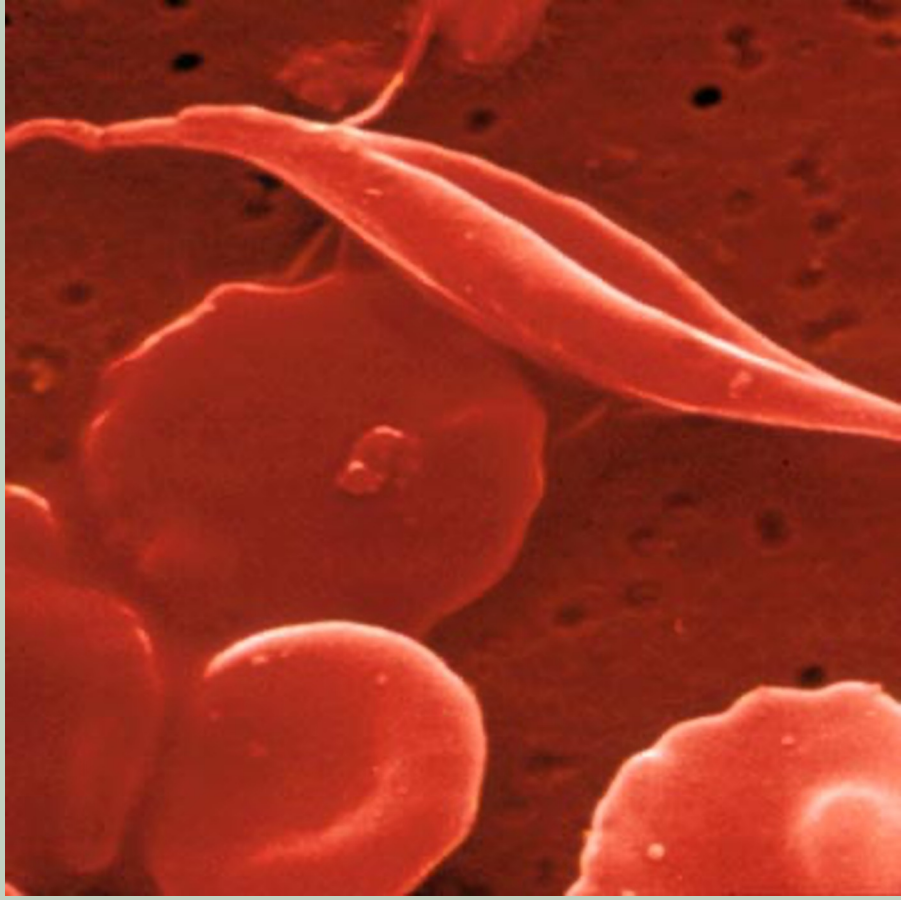
The offspring of will have red hairs and white hairs (RW) (sometimes called Roan)

Roan Horse : Note – both red and white hairs

Codominance in flowers

Note:
Both Pink and white petals can be seen

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

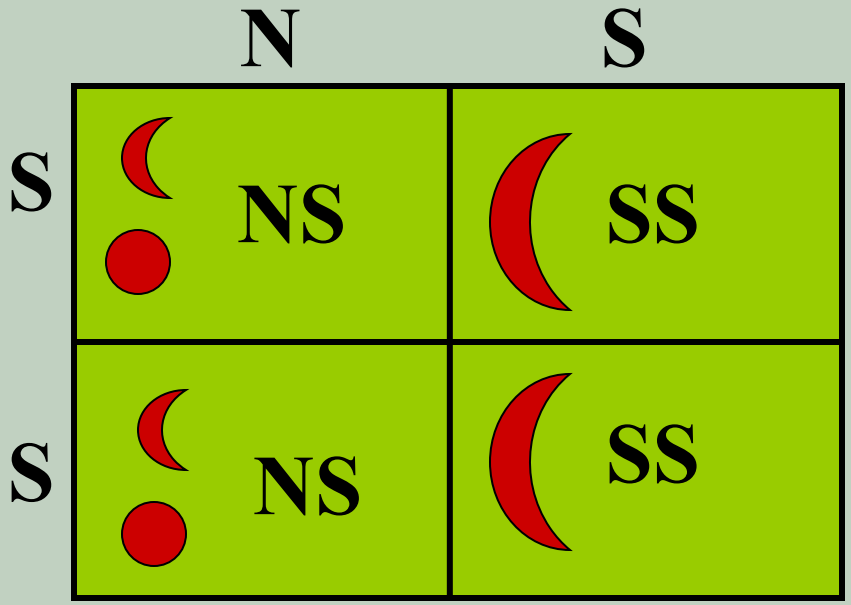
- Show the cross between an individual with sickle-cell anemia and another who is a carrier but not sick.

GENOTYPES:

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

PHENOTYPES:

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



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 incomplete dominance?
    - A. Red
    - B. Blue
    - C. Purple
    - D. Red and Blue patches

    - Answer - purple

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>codominance</u>?
    - A. Red
    - B. Blue
    - C. Purple
    - D. Red and Blue patches
    - **Red and Blue patches**

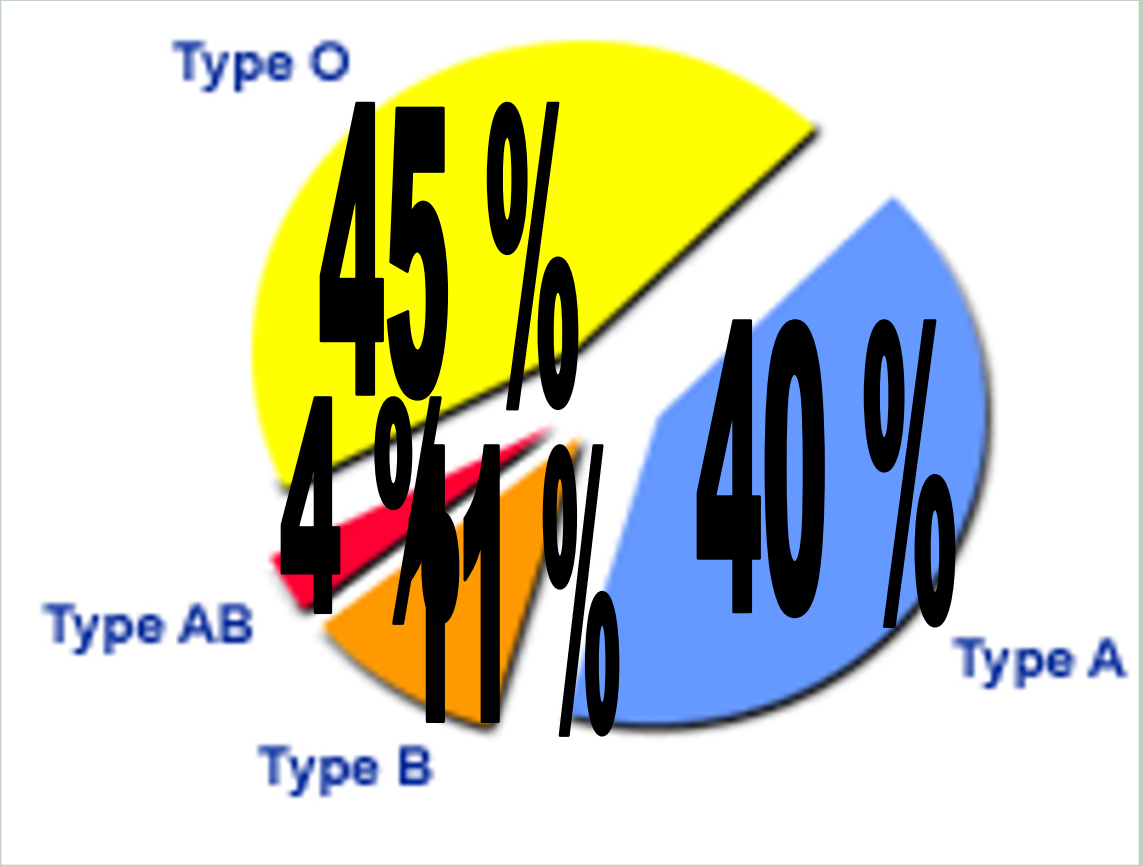
MULTIPLE ALLELISM

- Occurs when there is more than 2 alleles possible for a given gene.
- Allows for a **larger number** of genetic and phenotypic possibilities.
- Human blood types: A,B,O and AB

How common are the different blood types?

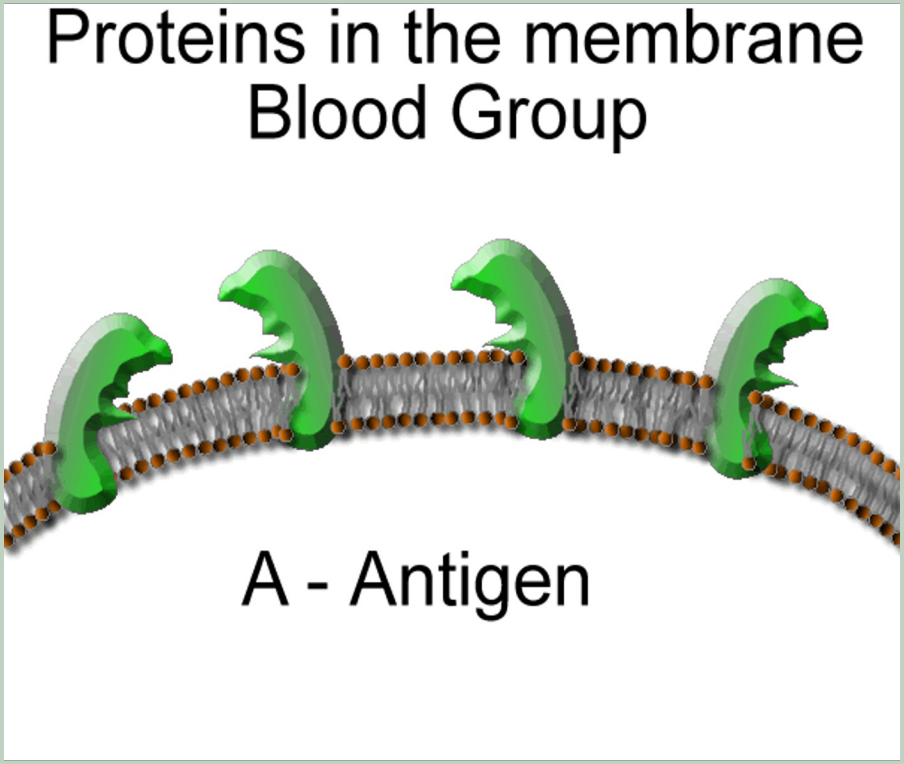
A and B are codominant to each other.

Both A and B are dominant over O.

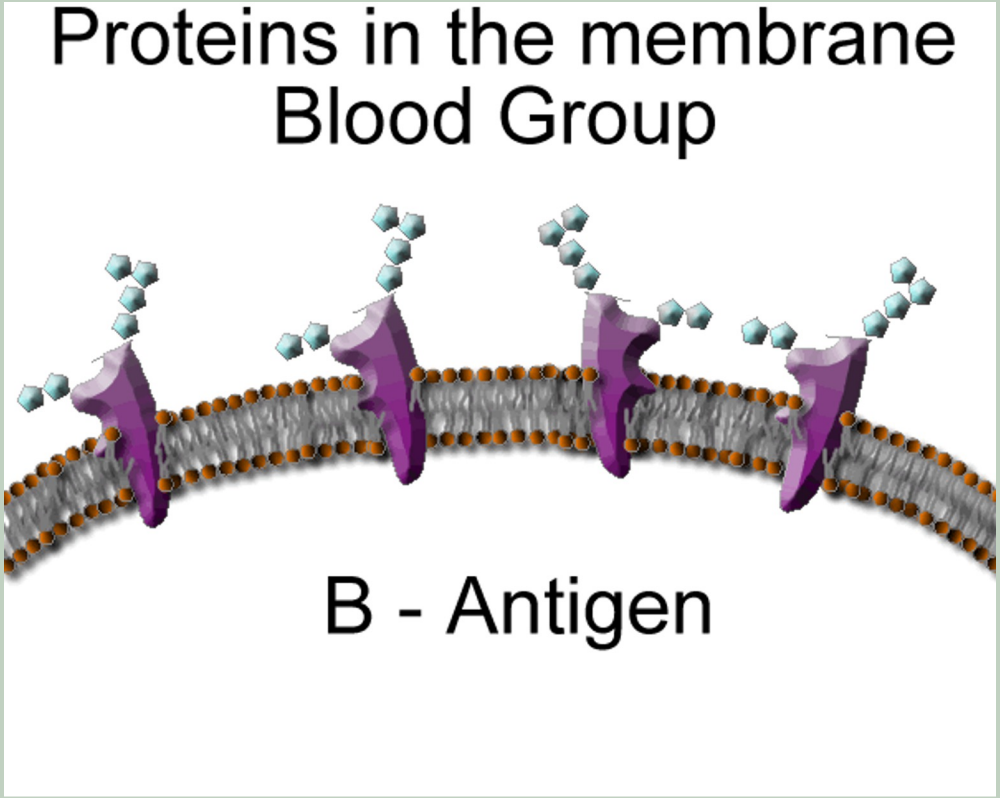


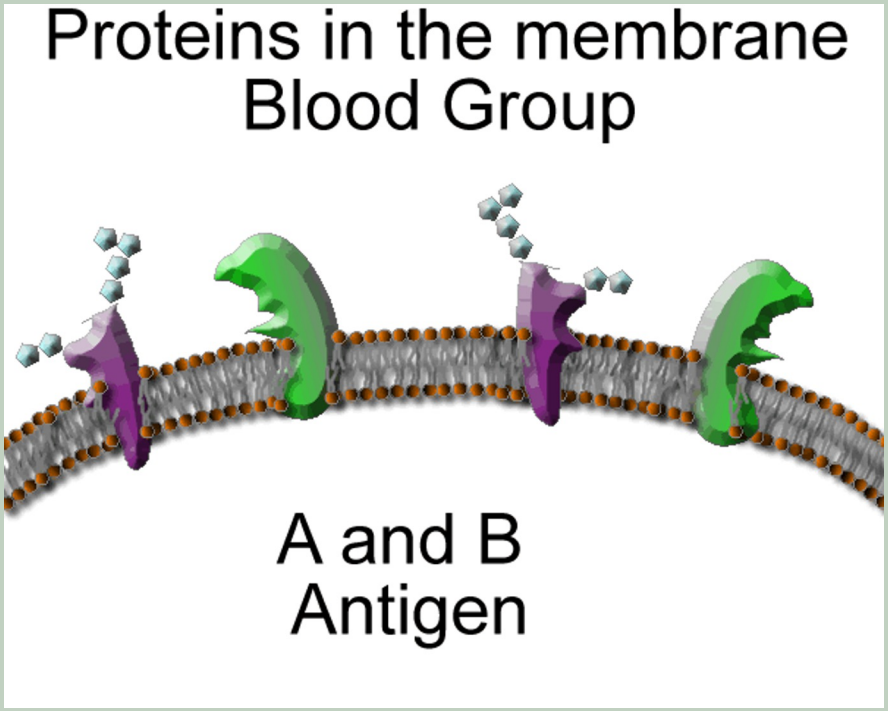
Human Blood types:

- TYPE A
- Allele = I^A
- Red Blood cells have type **<u>A antigens</u>** (proteins) on the surface.

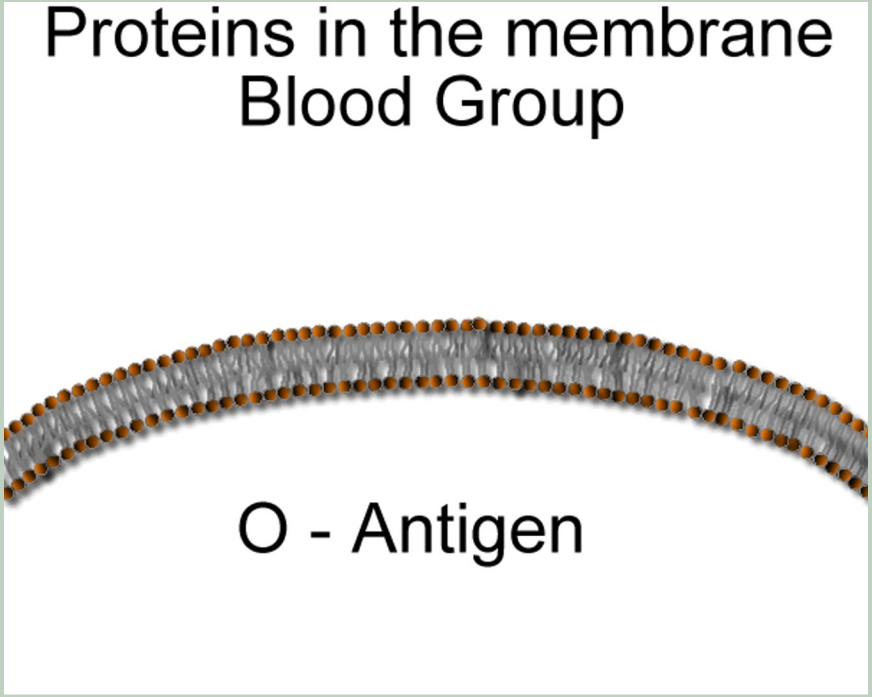


- TYPE B
- Allele = I^B
- Red Blood Cells have type B antigens (proteins) on their surface





- TYPE AB
- genotype = $I^A I^B$
- Blood cells contain both types of antigens (proteins)
- A and B are ….
- Codominant

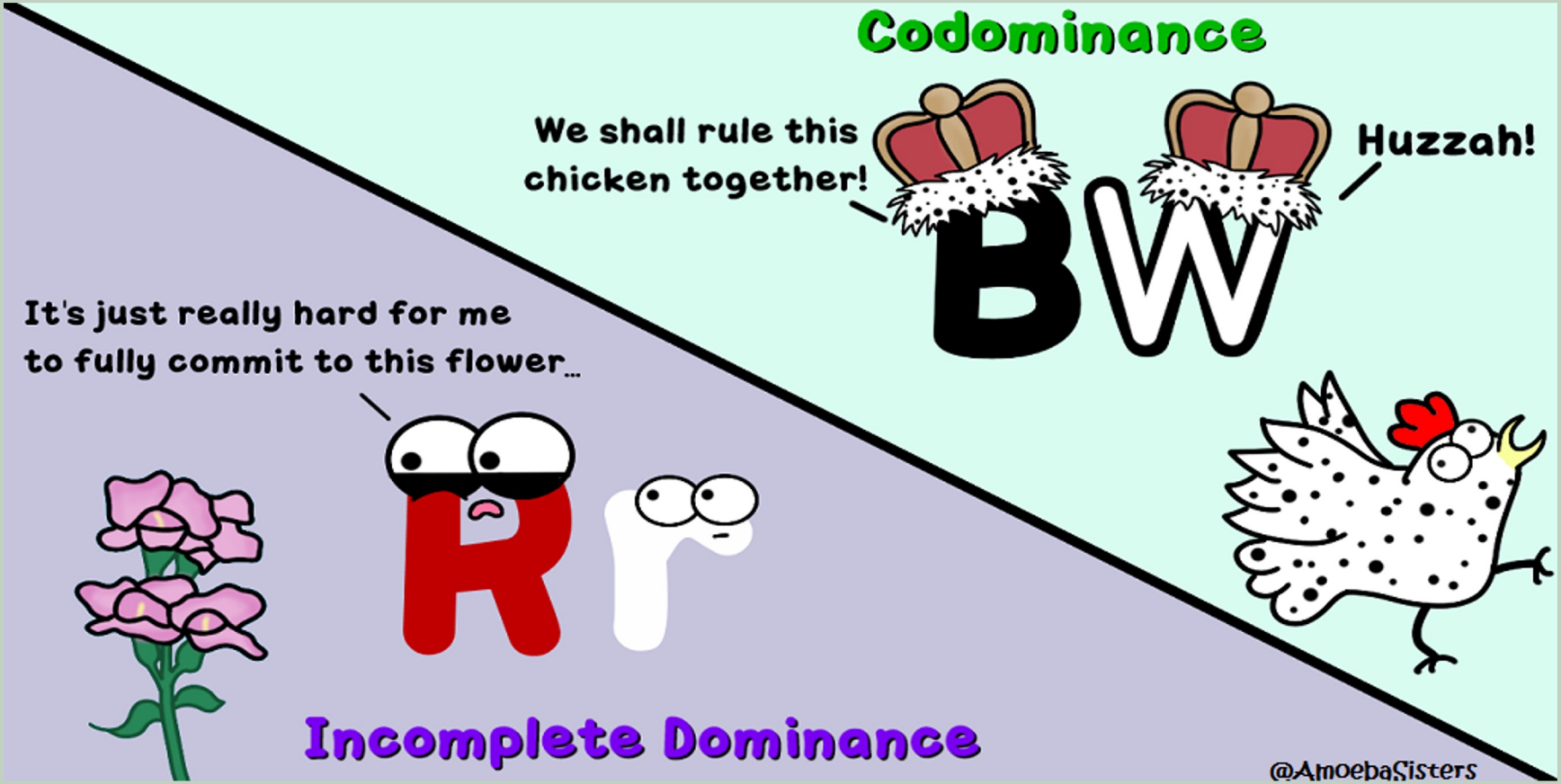


- TYPE O
- Allele = i
- No antigens (proteins) on the surface of the blood cells
- i is recessive to A and B

Which is co-dominance?
Which is incomplete dominance?

both equally present

mixing


Codominance
We shall rule this chicken together!
Huzzah!
B W
It's just really hard for me to fully commit to this flower...
R r
Incomplete Dominance
@AmoebaSisters