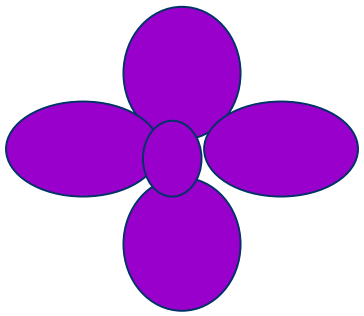
Beyond Mendel's Laws

Incomplete Dominance
Co-dominance and
Multiple Alleles

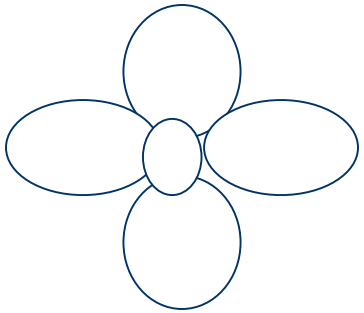
Review: Dominant/Recessive

- One allele is dominant over the other (capable of masking the recessive allele)

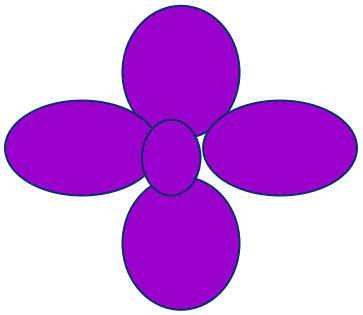
PP = purple



pp = white



Pp = purple

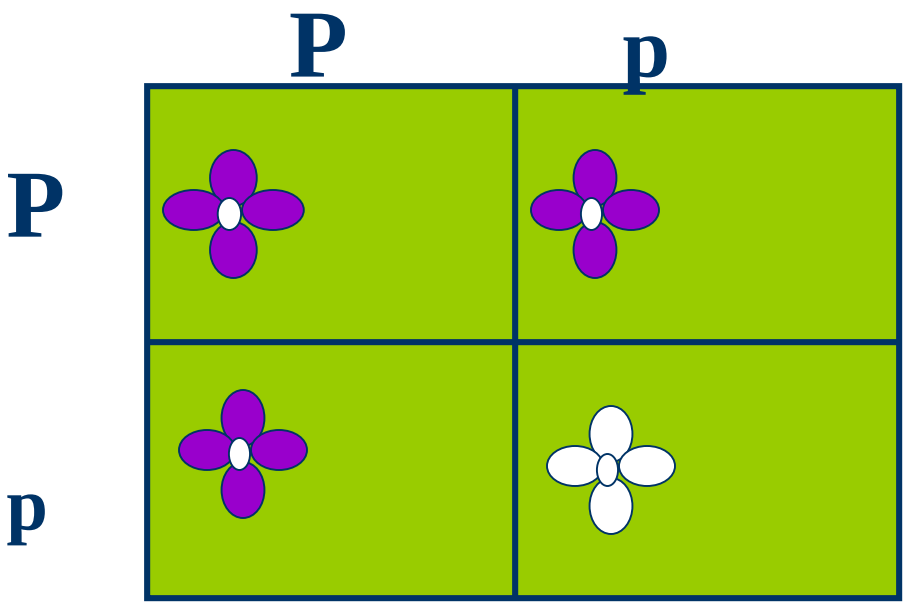


Review Problem: Dominant/Recessive

- In pea plants, purple flowers (P) are dominant over white flowers (p) show the cross between two heterozygous plants.

GENOTYPES:

PHENOTYPES:



Are there always dominants and recessives?

- Not all traits are purely dominant or purely recessive
- In some cases, neither are dominant
- When this happens it is known as Incomplete dominance

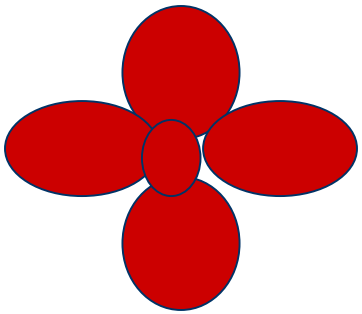
Blending of the Traits

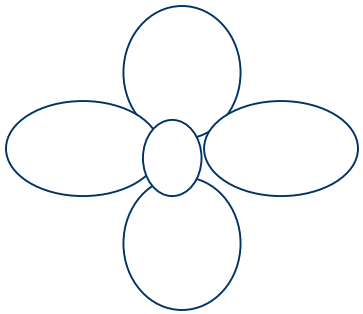
- The blending gives intermediate expression
  - New phenotypes that are shown when incomplete dominance of genes occurs
- Only in the Heterozygous individuals

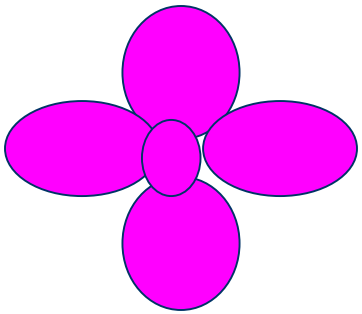
Incomplete Dominance

- A third (new) phenotype appears in the heterozygous condition

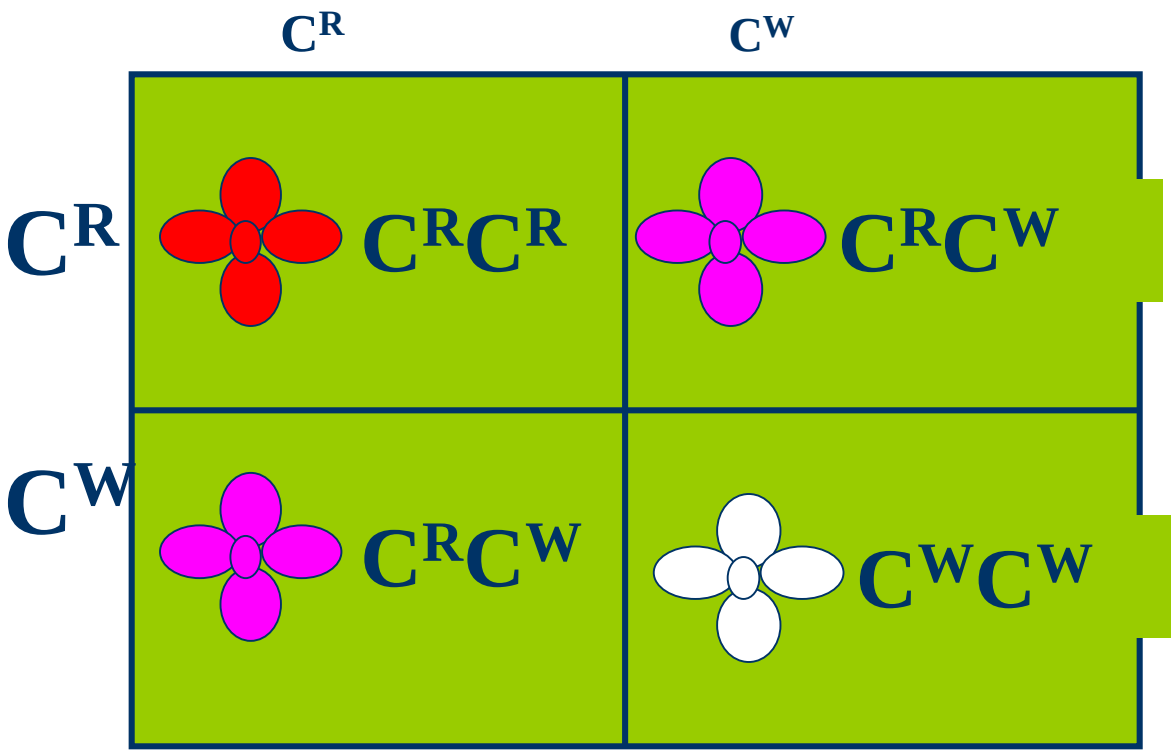
C^RC^R = red **C^WC^W = white** **C^RC^W = pink**







Example Cross



Real Life Examples

Snapdragon

Roses

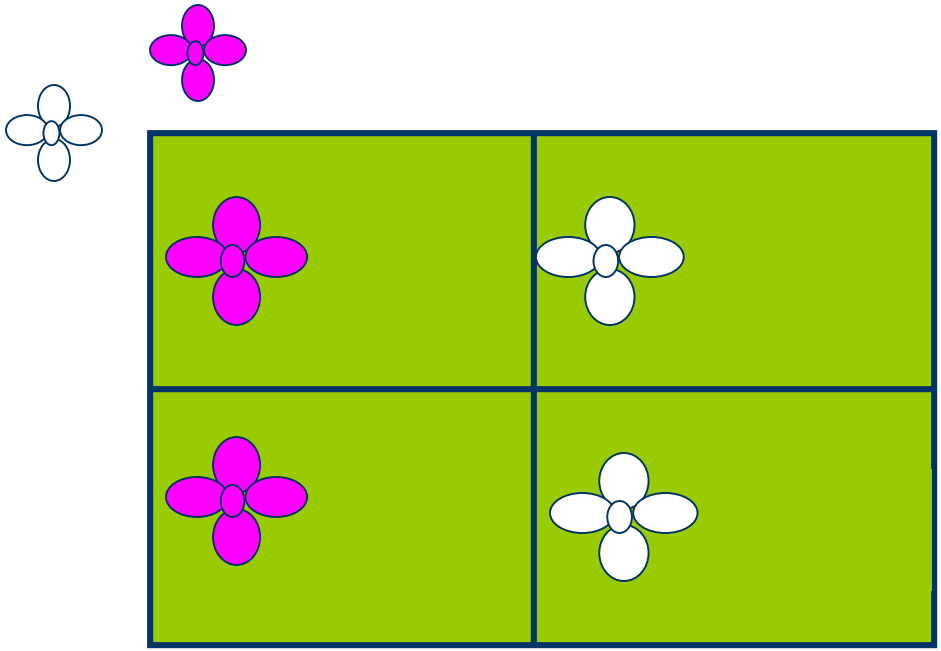
Carnation

Problem: Incomplete Dominance

- Show the cross between a pink and a white flower.

GENOTYPES:

PHENOTYPES:



Why does it happen?

- Individuals with a single C^R (ie., C^RC^W) allele are unable to make enough red pigment to produce the red flowers

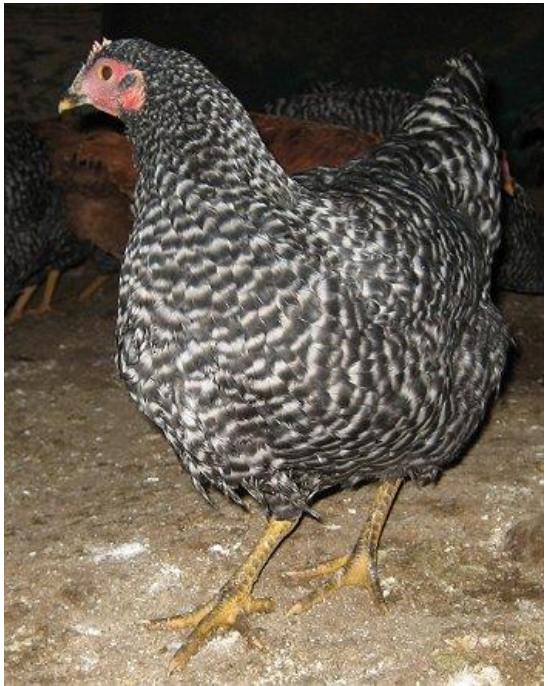
- Individuals that are white produce no red pigment

Co-Dominant

- When we have two alleles that are both dominant we actually get expression of both

- We will use the example of chickens
  - Some chickens are black
  - Some chickens are white

Expression

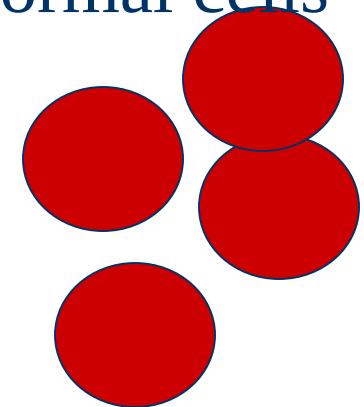


Example

Co-dominance in Humans

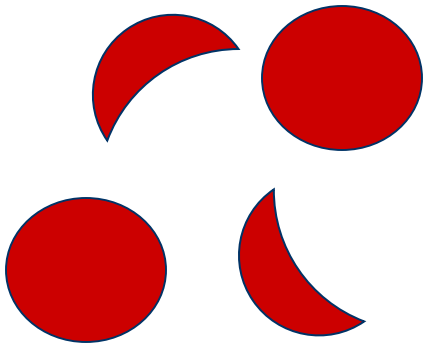
- The heterozygous condition when **both** alleles are expressed
- Ex. Sickle Cell Anemia in Humans

Hb^AHb^A =
normal cells



Hb^SHb^S=
sickle cells

Hb^AHb^S =
some of each



Human Example – Electron Micrograph

- Individuals with Hb^AHb^S are also called carriers
- This means that they carry the gene for sickle cell anemia, but it is not expressed to its fullest extent

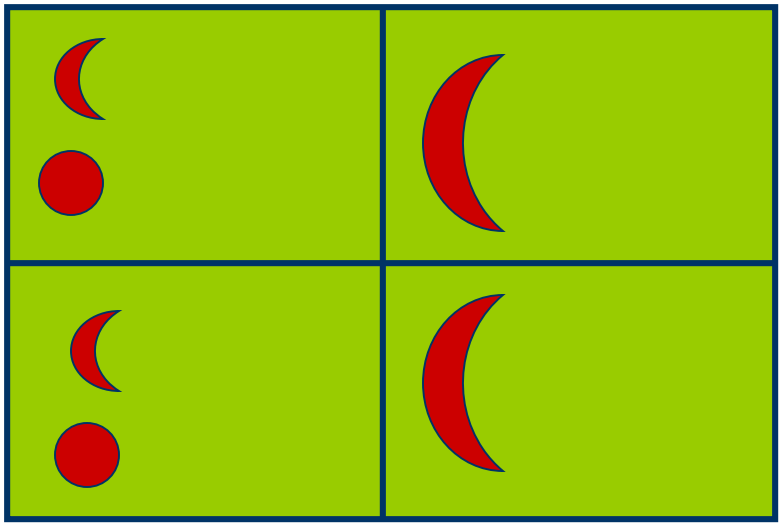
Problem: Co-dominance

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

GENOTYPES:

-

PHENOTYPES:



Multiple Alleles

What does that mean?

- Many genes that control specific traits have more than 2 alleles
- This means that there are far more possibilities for different phenotypes

MORE VARIABILITY

Multiple Alleles Example: Human Blood types

- A and B are co-dominant
  - AA = A blood type
  - BB = B blood type
  - AB = AB blood type
- A and B are dominant over O
  - AO = A blood type
  - BO =B blood type
  - OO = O blood type

Co-dominance

- Co-dominance?
  - It was when there was more than one allele present that was dominant and both were expressed
- Dominance
  - When one allele is more dominant than another and will be expressed over another

How does this account for bloods alleles?

- A, B, and O are the alleles
- If A and B are co-dominant, then when they are both present they will be represented with A and B giving us blood type AB

- When A and O and B and O are present you get AO and BO but because A and B are dominant over O, you get blood type A and blood type B

What these code for

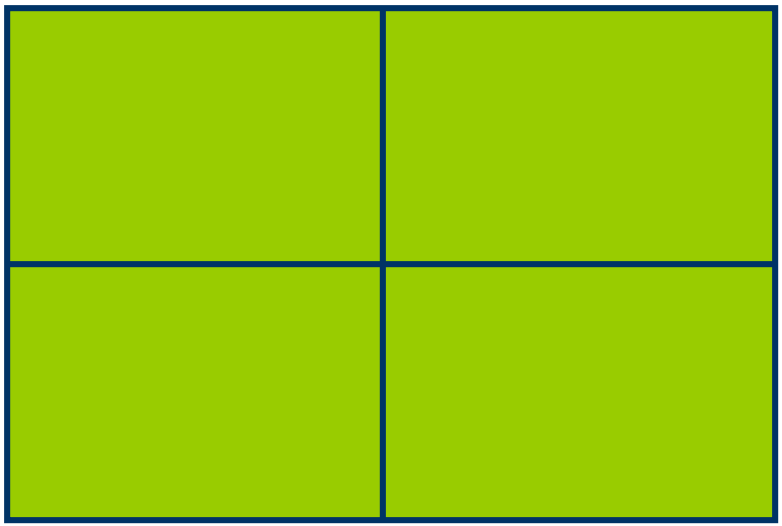
- The genes determine what kind of glycoprotein your blood cell has on the surface
  - Blood Type A – only A glycoproteins
  - Blood Type B – only B glycoproteins
  - Blood Type AB – has both
  - Blood Type O – has neither

Problem: Multiple Alleles

- Show the cross between a mother who has type O blood and a father who has type AB blood.

GENOTYPES:

PHENOTYPES:



Problem: Multiple Alleles

- Show the cross between a mother who is heterozygous for type B blood and a father who is heterozygous for type A blood.

GENOTYPES:

PHENOTYPES: