More cases of allele interactions (Dominance relationships) and gene interactions (Epistatic interactions).

ABO blood type, how is it inherited?

Isoaggutinogen gene, three alleles

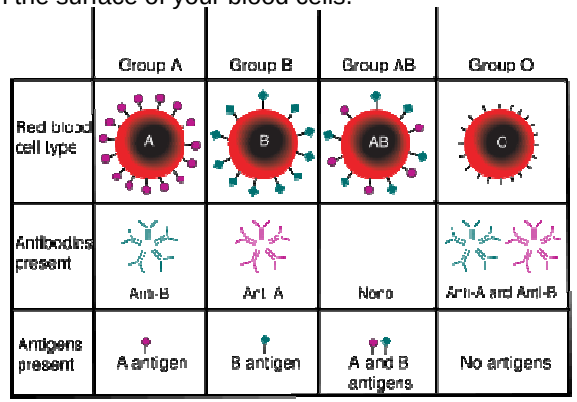
I^A is dominant to I^O (also written as i)

I^B is dominant to I^O

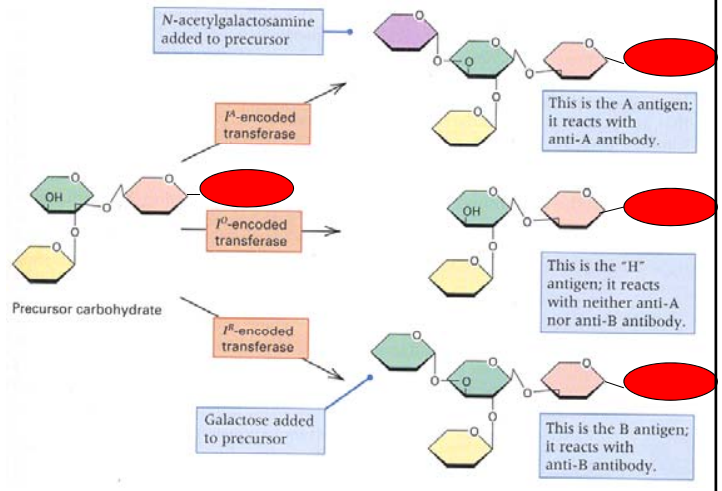
I^A and I^B are co-dominant

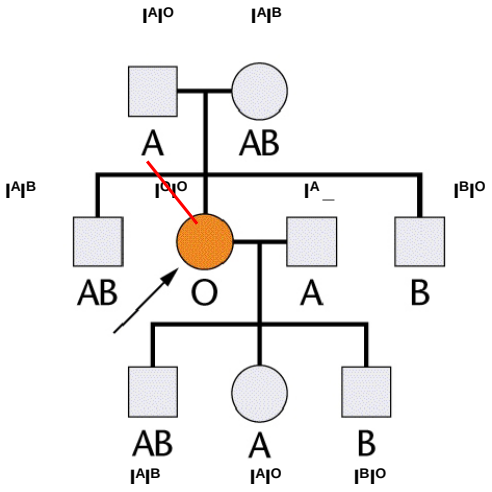
Variation among humans: Blood Groups.

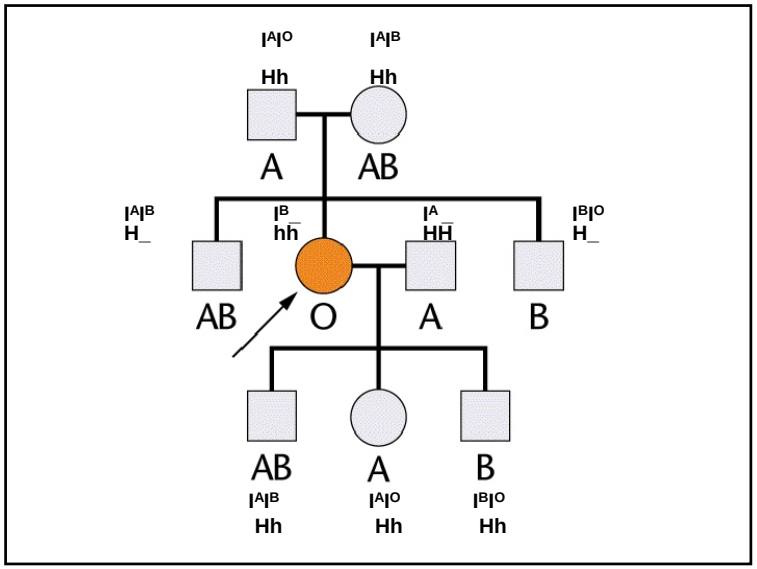
Many different proteins and carbohydrates are placed on the surface of your blood cells.

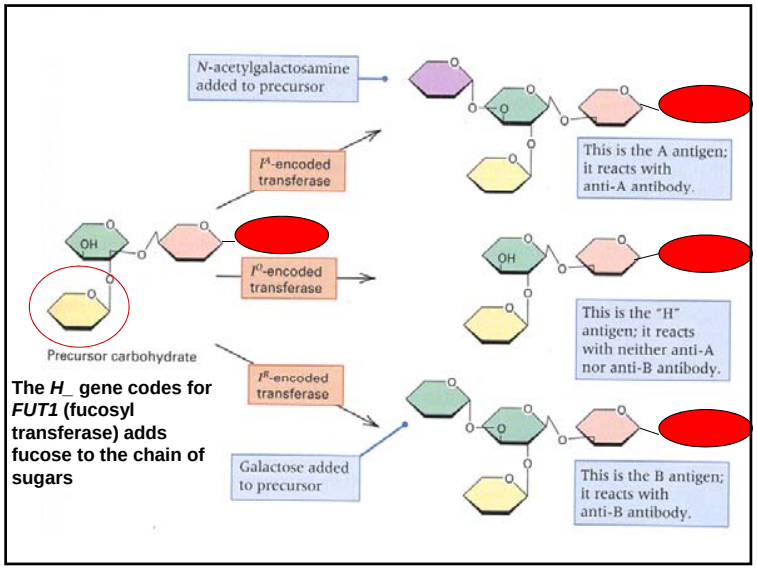


ABO Blood Type Controlled by the Isoagglutinogen "I" gene



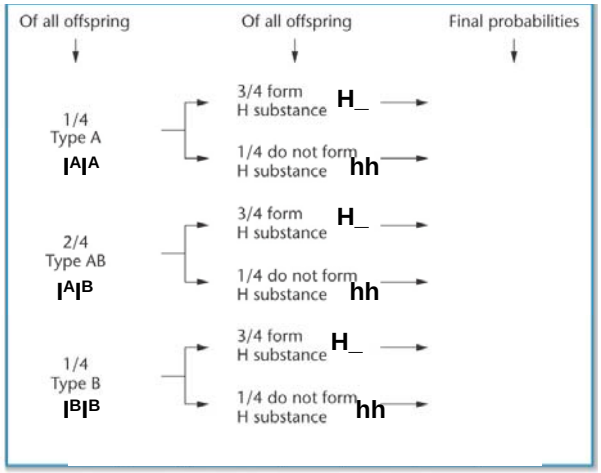




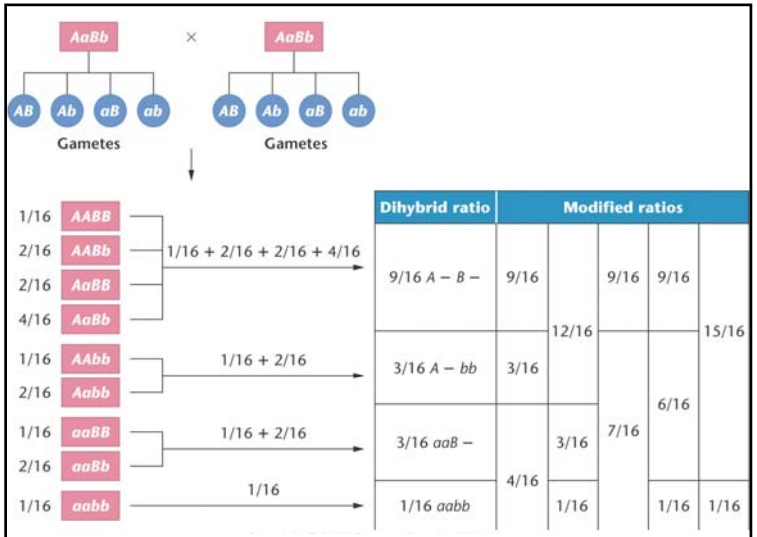


The *H*_ gene codes for *FUT1* (fucosyl transferase) adds fucose to the chain of sugars

Outcome of a hypothetical I^AI^B Hh x I^AI^B Hh mating.



What proportion will look like "O"? A) 1/16, B) All, C) 6/16, D) 1/4, E) None



AaBb x AaBb

Case	Organism	Character	F_2 Phenotypes 9/16	3/16	3/16	1/16	Modified ratio
1	Mouse	Coat color	agouti		albino	black albino	9:3:4
2	Squash	Color	white		yellow	green	12:3:1
3	Pea	Flower color	purple	white			9:7
4	Squash	Fruit shape	disc	sphere		long	9:6:1
5	Chicken	Color	white		colored	white	13:3
6	Mouse	Color	white-spotted	white	colored	white-spotted	10:3:3
7	Shepherd's purse	Seed capsule	triangular			ovoid	15:1
8	Flour beetle	Color	6/16 sooty : 3/16 red	black	jet	black	6:3:3:4

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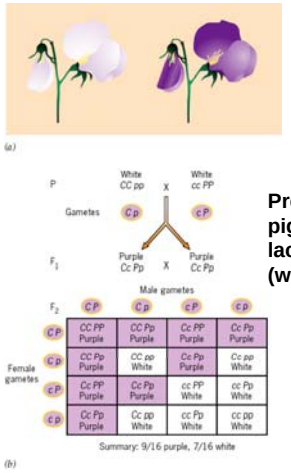


What is happening?

Gene C → **Precursor pigment lacks color (white)**

Gene P → **Intermediate lacks color (white)** → **Purple**

Fig 4.15 White and purple flowers of the sweet pea.

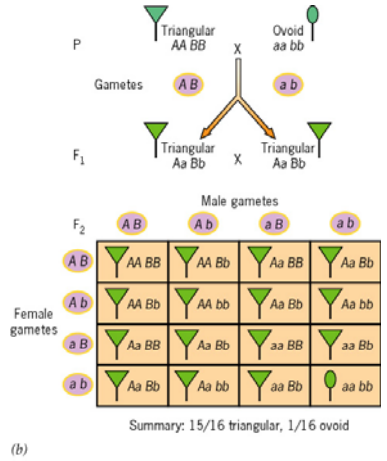
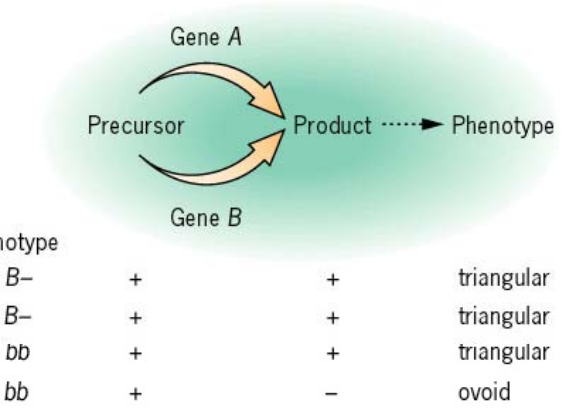
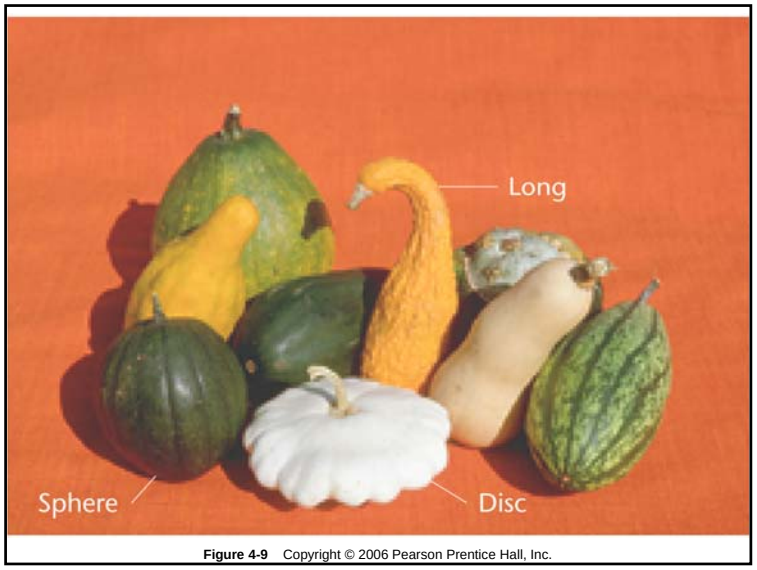


Fig 4.16b Crosses showing duplicate gene control of seed capsule shape in the shepherd's purse.



Genotype			
A– B–	+	+	triangular
aa B–	+	+	triangular
A– bb	+	+	triangular
aa bb	+	–	ovoid

Fig 4.17 Only when both pathways are blocked by homozygous recessive alleles is the triangular phenotype suppressed and an ovoid capsule produced.



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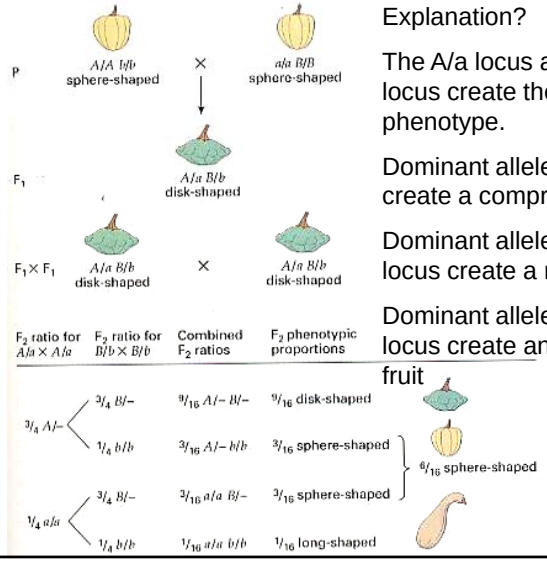


Explanation?

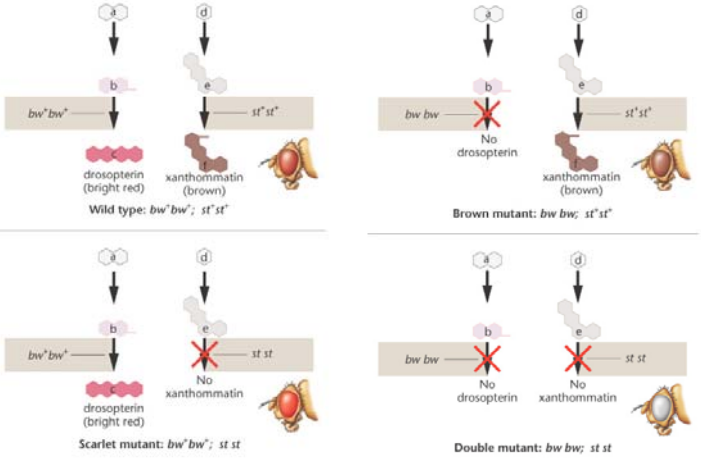
The A/a locus and the B/b locus create the same phenotype.

Dominant alleles at both loc create a compressed fruit.

Dominant alleles at one locus create a round fruit.

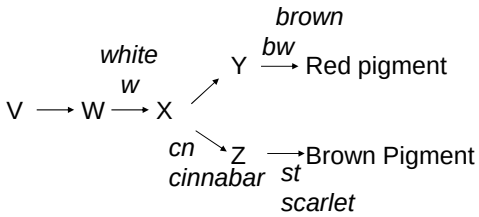
Dominant alleles at neither locus create an elongated fruit

Eye color in Drosophila. The "brick" red color is really 2 pigments (red and brown) combined.



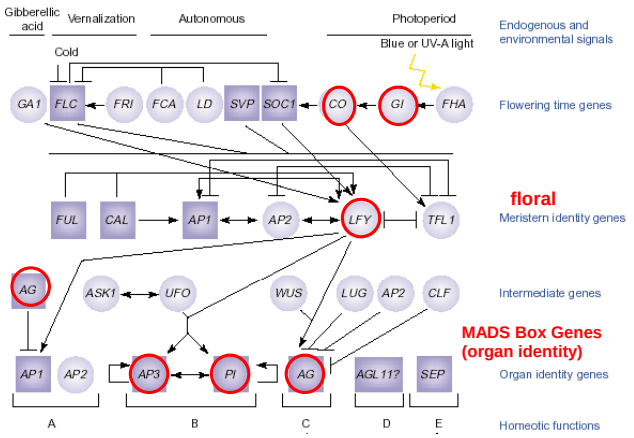
Several ways to get "white eyes" in Drosophila

Likely pathways:

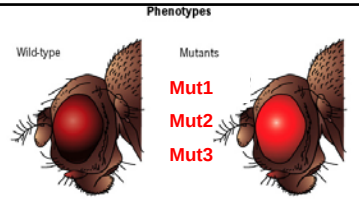


As you can see, changes at multiple genes can affect the same trait and even give you the exact same phenotype!

Many "simple" processes like flowering time involve many interacting genes in networks.



Suppose you find 3 different mutants in Drosophila that all create red instead of brick colored eyes. How do you know if they are alleles at a single gene, or different genes?



Complementation Test

c^1c^1 SS x CC ss

c^2 c^2 x c^1 c^1

c^2 c^2 SS x CC ss

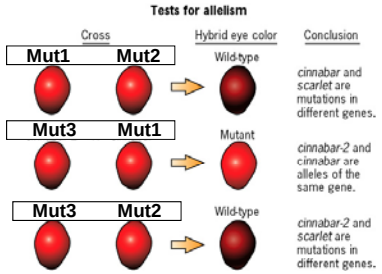


Fig 4.6 A test for allelism involving eye color mutations in *Drosophila*.

"Marriage of two complete albinos with normally pigmented offspring" (Trevor-Roper 1952). How can this be?

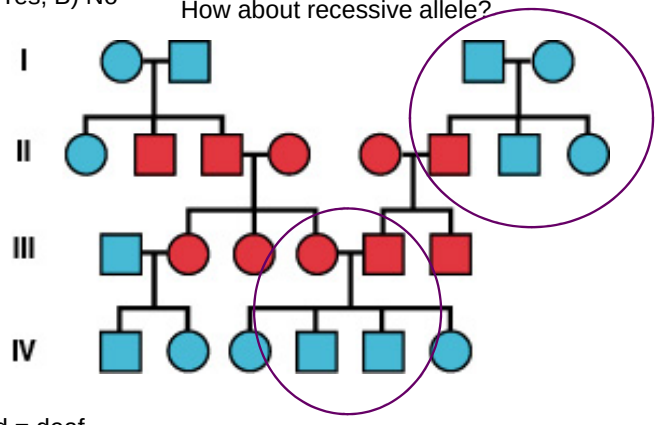
Two different genes that both yield albino. This was a natural complementation test. (a_1a_1 or a_2a_2 both recessive and are albino)

A_1A_1 a_2a_2 x a_1a_1 A_2A_2

A_1a_1 A_2a_2

Can this trait be inherited by a single gene with dominant allele?
A) Yes; B) No

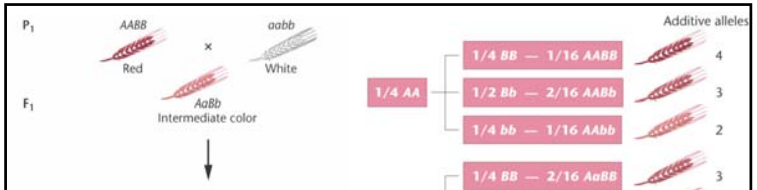
How about recessive allele?



Red = deaf

Blue = hearing

Question 4.11 Congenital deafness in human beings.

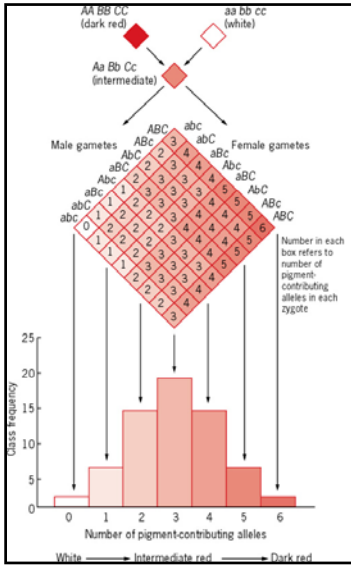


Explanation?

Similar to Snapdragons, no dominance, but 2 loci.

The A and B locus do the same thing, and the more "capital" alleles you have the darker color you get (more pigment produced).

Figure 25.2



Nilsson-Ehle's (1909) experiment with kernel color in wheat.

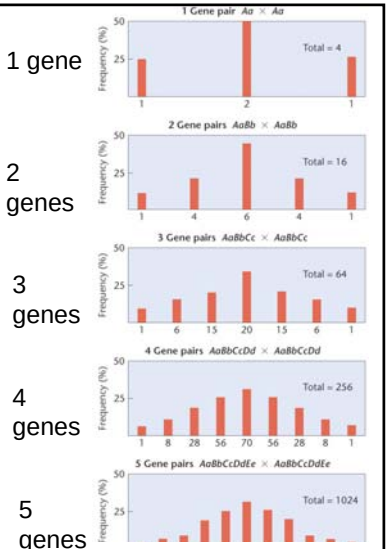
The more genes that contribute to a particular trait, the more the trait has a continuous distribution.

Additive Genetic Variation

All cases are with No Dominance

This provided strong evidence that even traits that did not have discrete phenotypes (yellow vs green or tall vs dwarf…) were "Mendelian" and had a genetic basis!

Figure 25-3



Many traits, such as height, are the product of multiple genes and the environment (like flower color in the last slide).

This "continuous" variation puzzled scientists in the early 1900s. It looked like blending inheritance and not discrete like Mendelian traits!!