



Extensions of Mendelian Genetics



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Outline of course

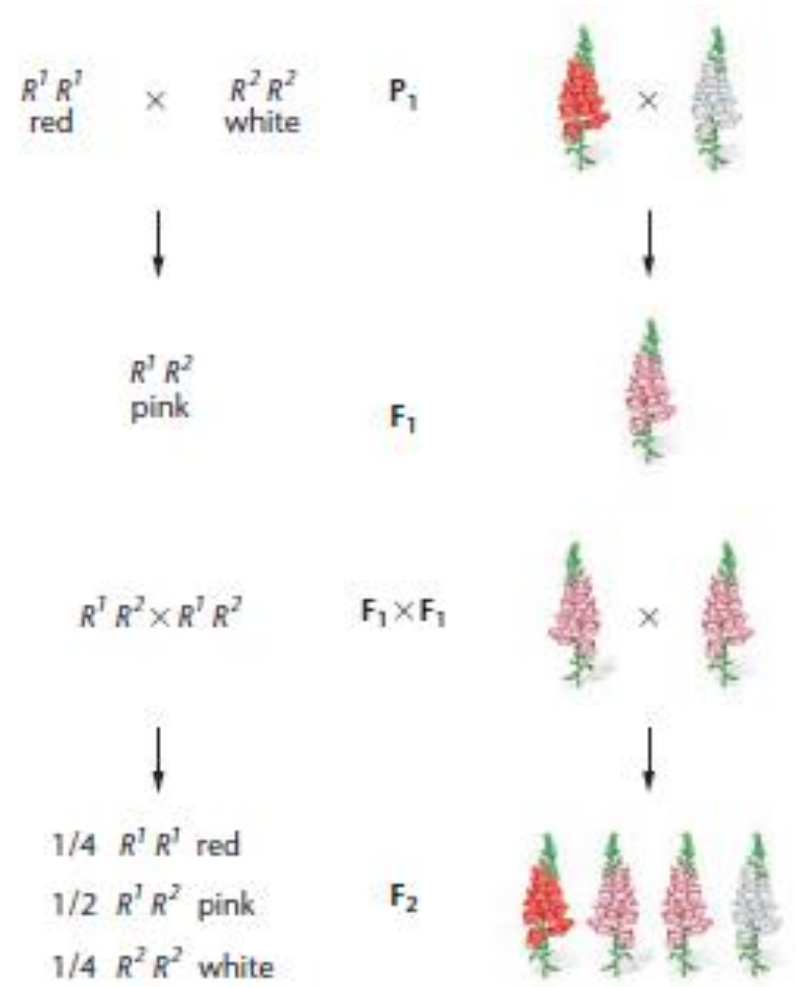
- While alleles are transmitted from parent to offspring according to Mendelian principles, they often do not display the clear-cut dominant /recessive relationship observed by Mendel.
- In many cases, in a departure from Mendelian genetics, two or more genes are known to influence the phenotype of a single characteristic.
- Still another exception to Mendelian inheritance occurs when genes are located on the X chromosome, because one of the sexes receives only one copy of that chromosome, eliminating the possibility of heterozygosity.



Outline of course

- The result of the various exceptions to Mendelian principles is the occurrence of phenotypic ratios that differ from those produced by standard monohybrid, dihybrid, and trihybrid crosses.
- Phenotypes are often the combined result of genetics and the environment within which genes are expressed.

Neither Allele Is Dominant in Incomplete, or Partial, Dominance





In Codominance, the Influence of Both Alleles in a Heterozygote Is Clearly Evident

Genotype	Phenotype
$L^M L^M$	M
$L^M L^N$	MN
$L^N L^N$	N

$$L^M L^N \times L^M L^N$$



$$1/4 L^M L^M$$

$$1/2 L^M L^N$$

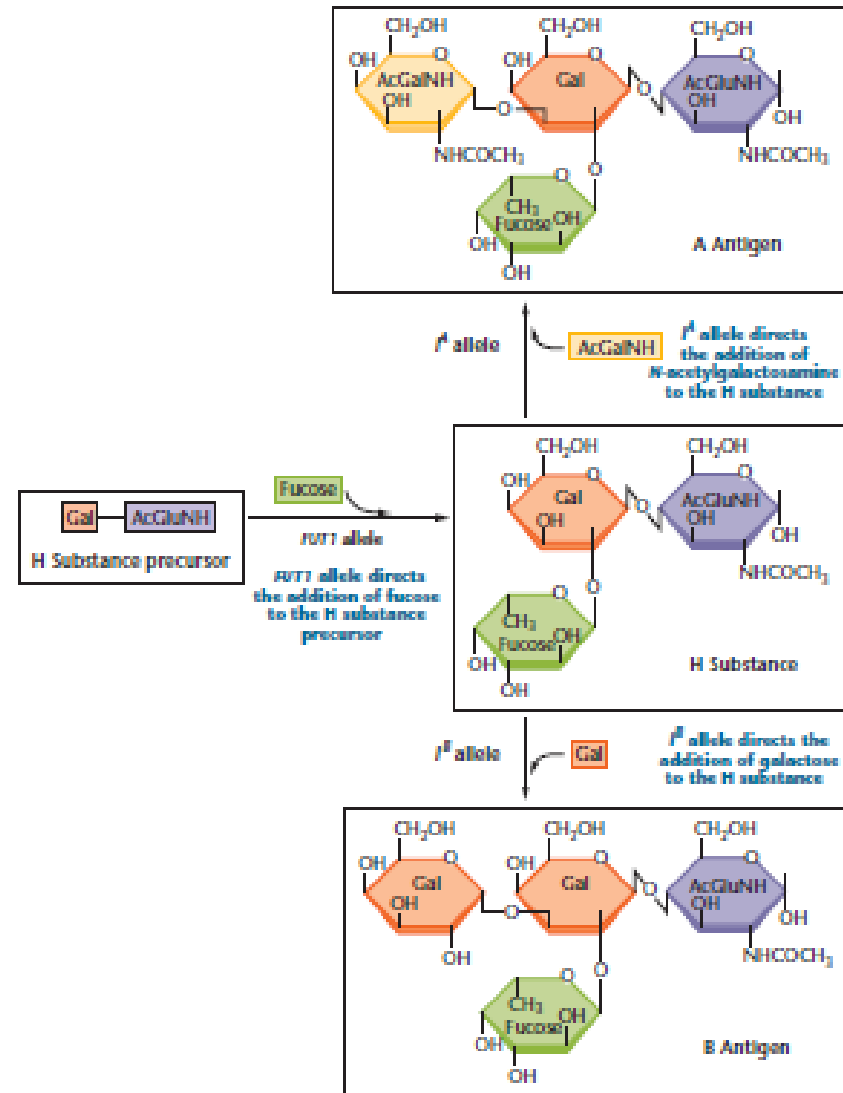
$$1/4 L^N L^N$$



Multiple Alleles of a Gene May Exist in a Population

Genotype	Antigen	Phenotype
$I^A I^A$	A } A }	A
$I^A i$	A }	
$I^B I^B$	B } B }	B
$I^B i$	B }	
$I^A I^B$	A, B	AB
ii	Neither	O

Multiple Alleles of a Gene May Exist in a Population



The Bombay Phenotype

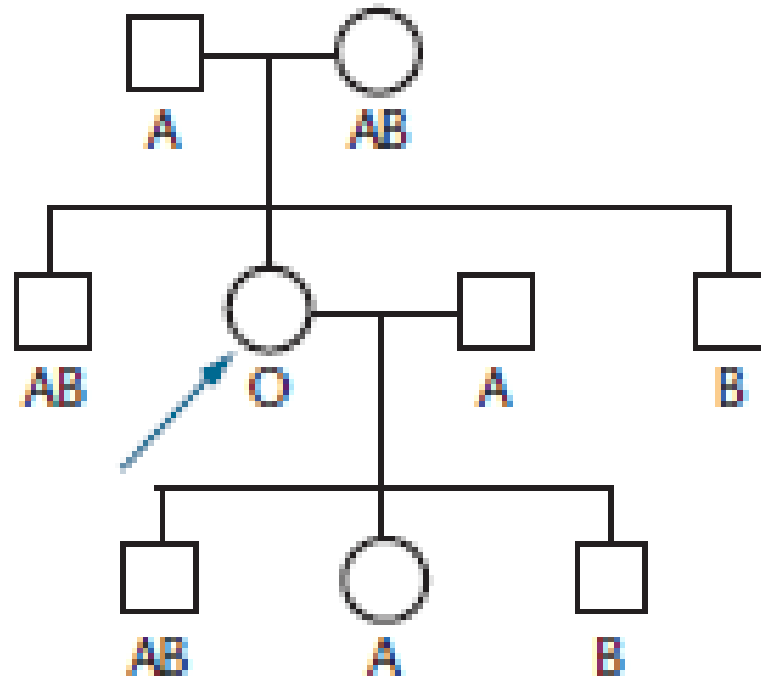
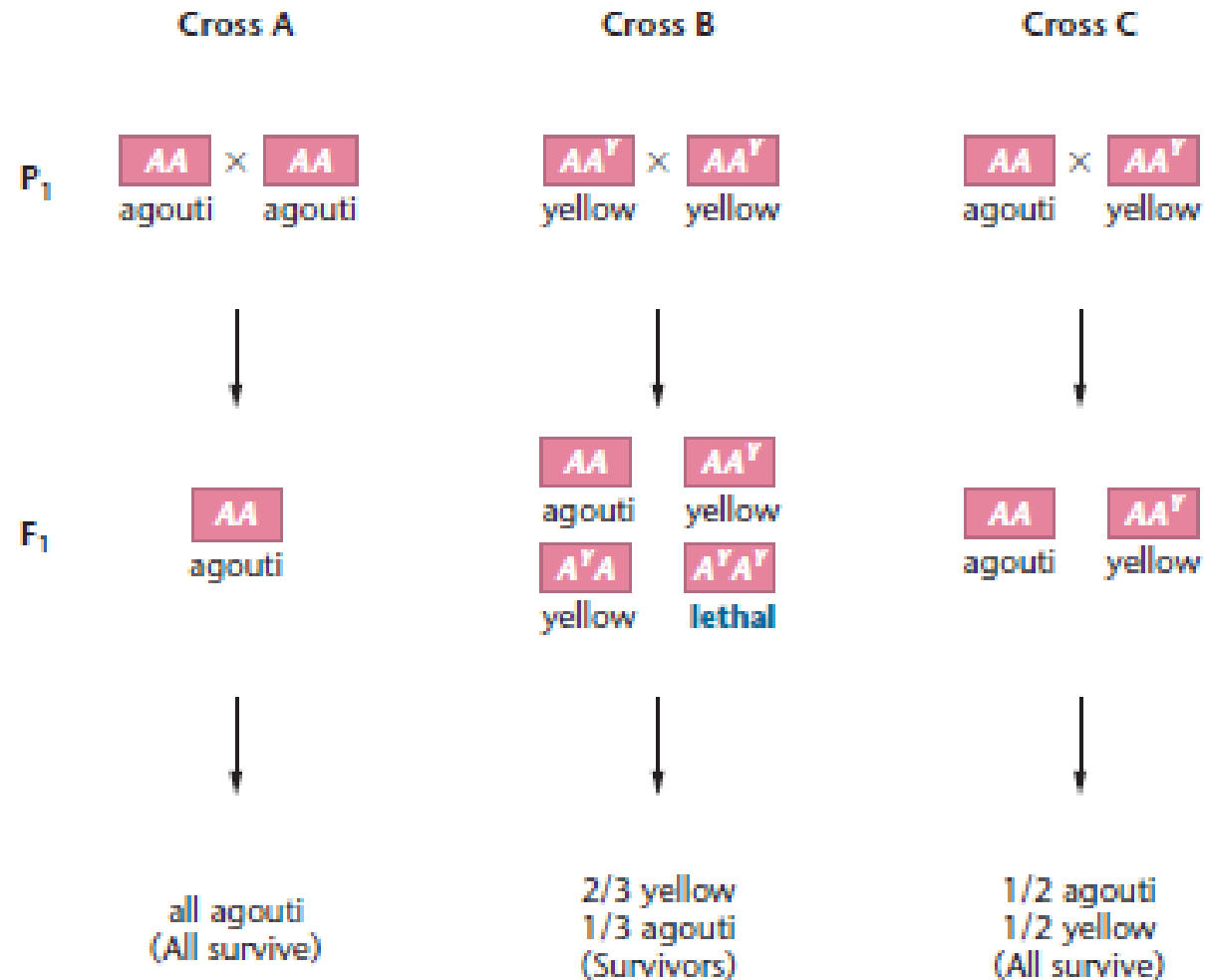
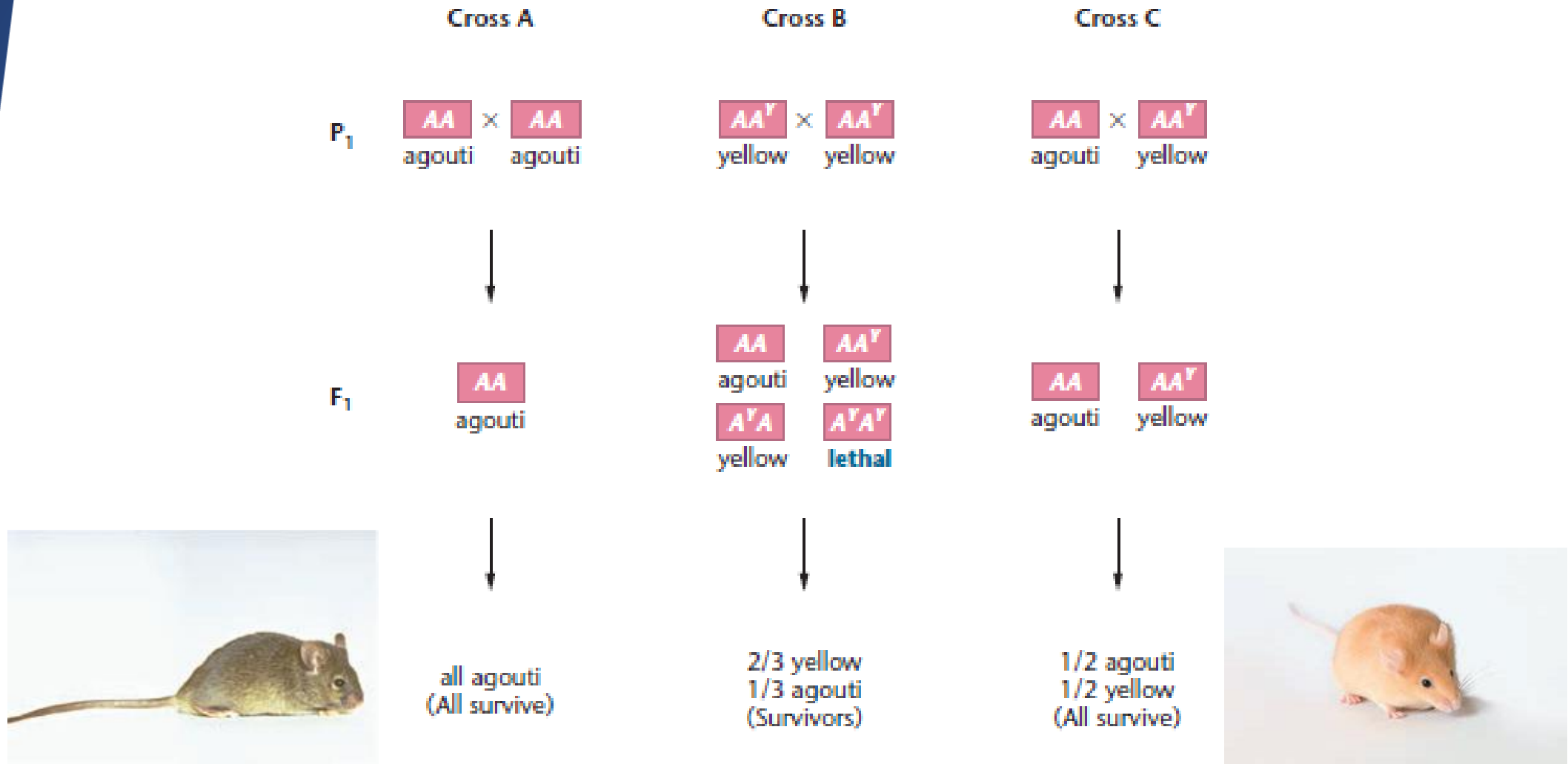


FIGURE 4.3 A partial pedigree of a woman with the Bombay phenotype. Functionally, her ABO blood group behaves as type O. Genetically, she is type B.

Lethal Alleles Represent Essential Genes



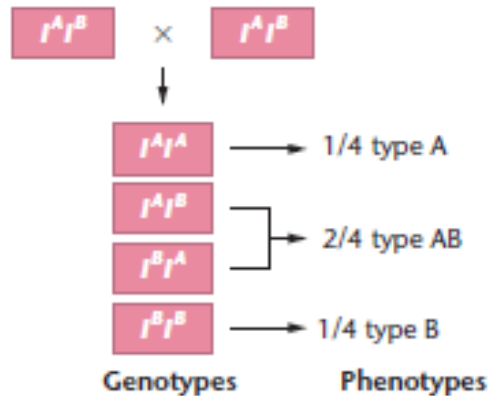
Lethal Alleles Represent Essential Genes



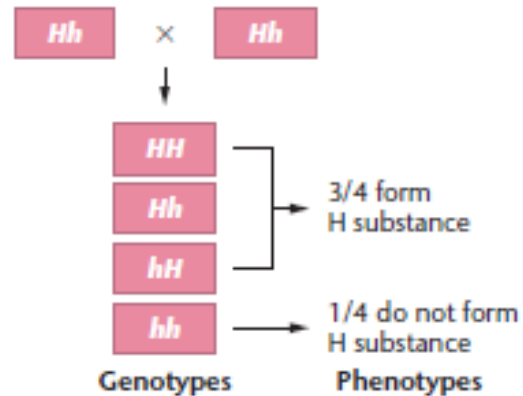
Phenotypes Are Often Affected by More Than One Gene

$$I^A I^B Hh \times I^A I^B Hh$$

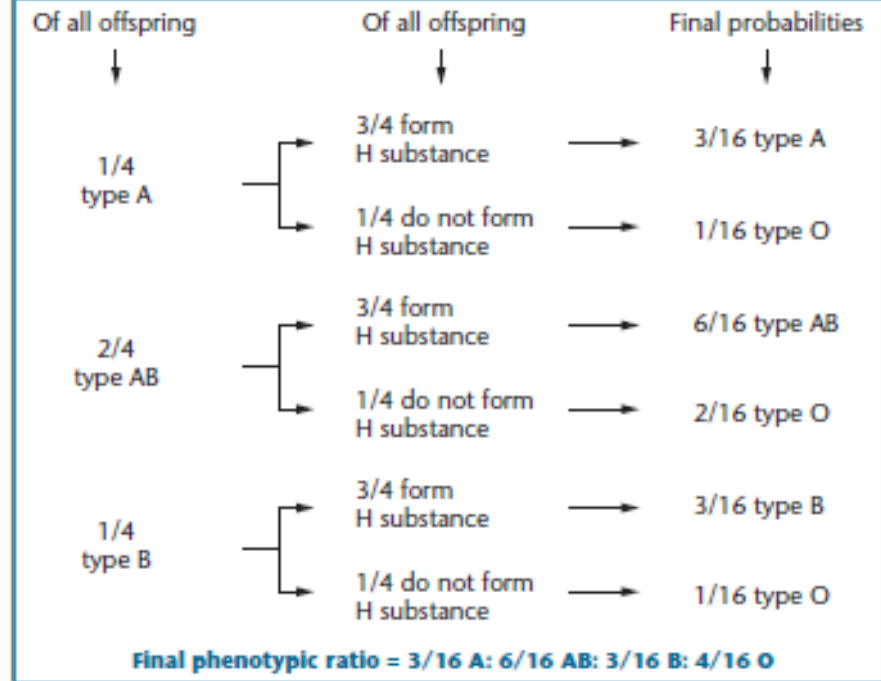
Consideration of blood types



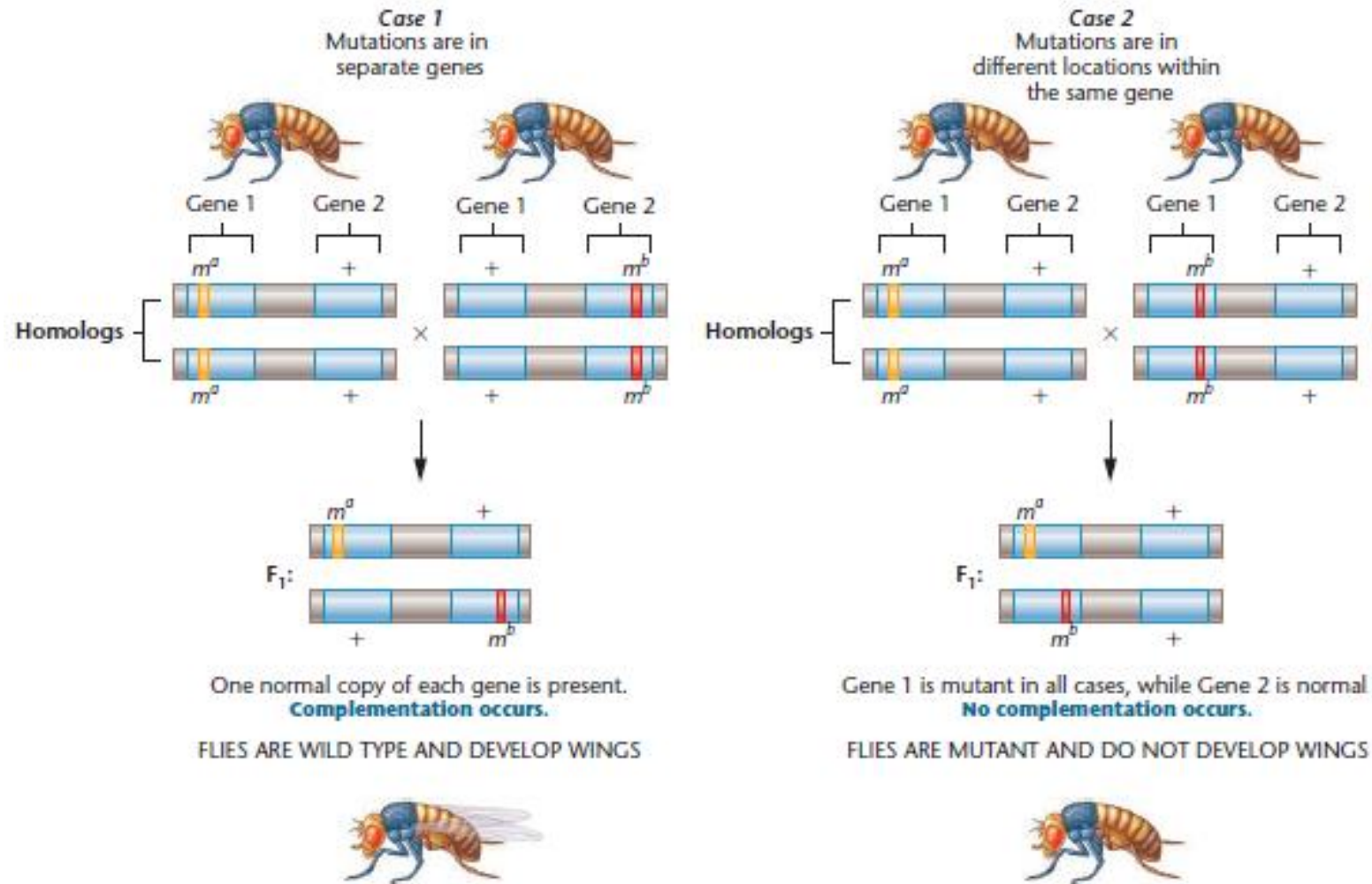
Consideration of H substance



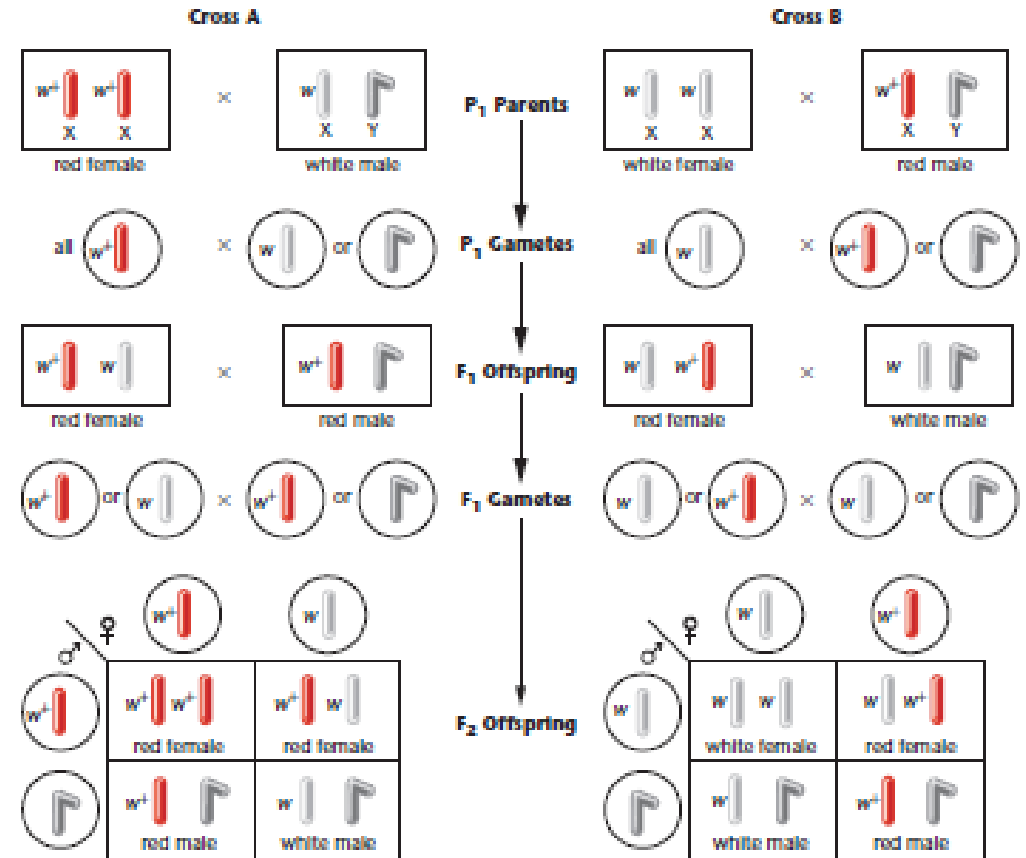
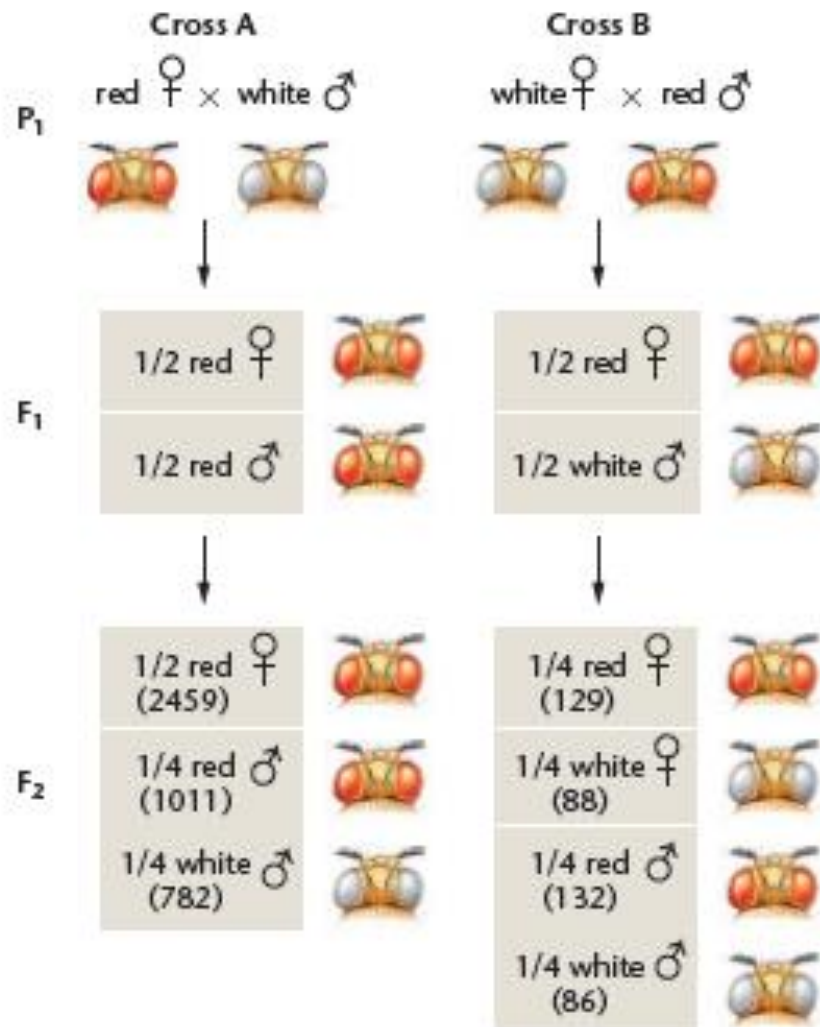
Consideration of both gene pairs together



Complementation Analysis Can Determine if Two Mutations Causing a Similar Phenotype Are Alleles of the Same Gene.



X-Linkage Describes Genes on the X Chromosome



In Sex-Limited and Sex-Influenced Inheritance

Genotype	Phenotype	
	♀	♂
HH	Hen-feathered	Hen-feathered
Hh	Hen-feathered	Hen-feathered
hh	Hen-feathered	Cock-feathered



Genotype	Phenotype	
	♀	♂
BB	Bald	Bald
Bb	Not bald	Bald
bb	Not bald	Not bald



Genetic Background and the Environment May Alter Phenotypic Expression

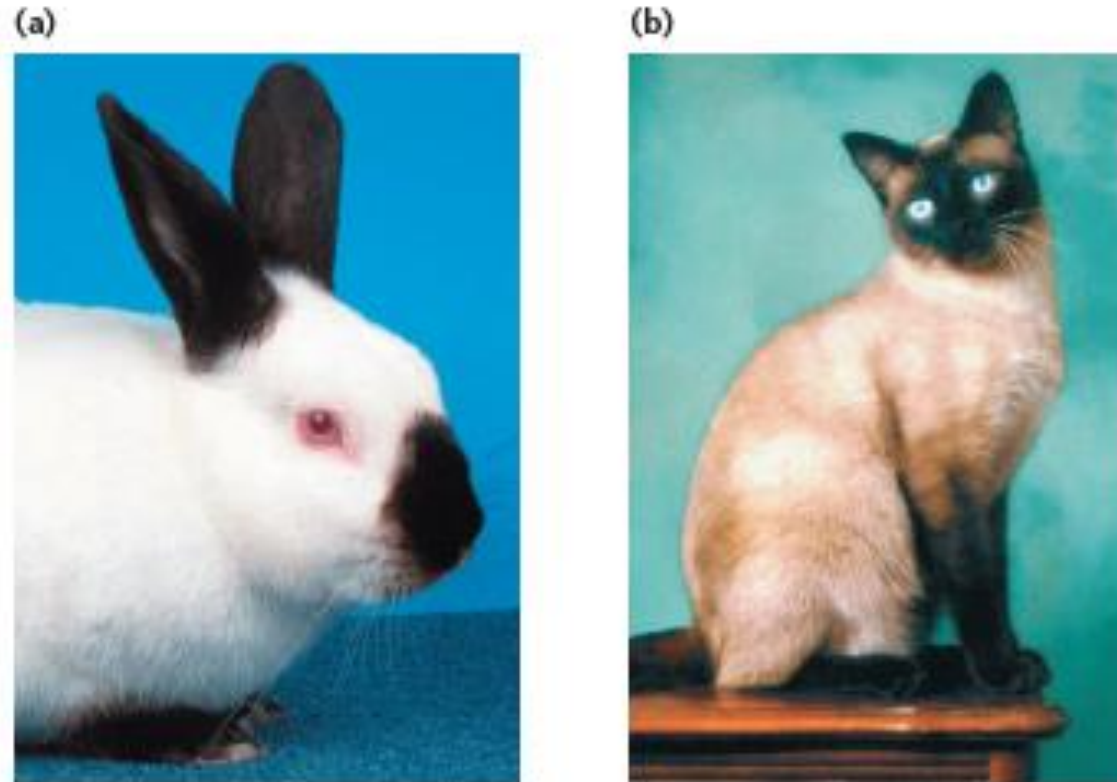


FIGURE 4.19 (a) A Himalayan rabbit. (b) A Siamese cat. Both show dark fur color on the snout, ears, and paws. These patches are due to the effect of a temperature-sensitive allele responsible for pigment production.