Chapter 7 Extending Mendelian Genetics
Section 7.1 Chromosomes and Phenotypes

- **The chromosomes on which genes are located can affect the expression of traits.**

I. Two copies of each ***autosomal gene*** affect phenotype
* Mendel studied autosomal gene traits, like flower color, seed shape, and plant height.

II. Mendel's ***rules of inheritance*** apply to autosomal genetic disorders.
1. Disorders caused by ***dominant alleles are uncommon***

2. Most mutations are ***recessive***.
- A heterozygous individual ***would not express the condition.***
- A ***heterozygote*** for a recessive disorder ***is a carrier.***
- It is unlikely that a person, who is heterozygous for a recessive mutation, will ***mate with someone who is heterozygous*** for the same mutation.
- Therefore, it is ***less likely for the most*** recessive mutations to show up in an individual.

III. Simple Recessive Heredity

A. Mutations are Changes in Genes

1. Mutation = ***a change in a gene, caused by damage or an error in copying*.**

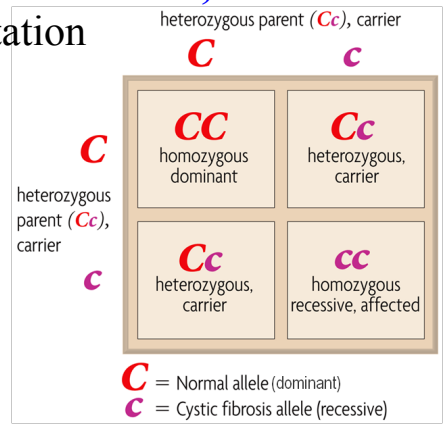
   - Mutations are a source of ***variation*** a species needs in order to adapt to changing conditions and thus evolve over time.

B. Genetic Disorders

- Genetic disorders = ***the harmful effects that some mutations produce*.**

1. Cystic Fibrosis

- Cystic fibrosis is a ***recessive genetic disorder,*** on chromosome #7, caused by a mutation in a gene that codes for **a protein responsible for transporting chloride ions.**

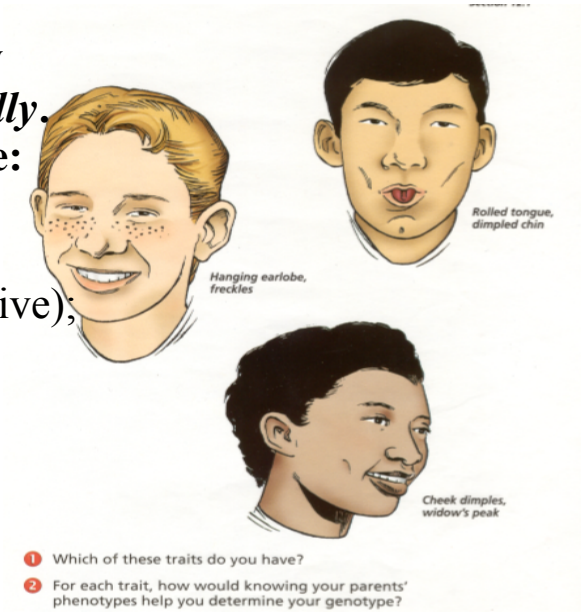


IV. Simple Dominant Heredity

1. Most dominant traits not *deadly*.

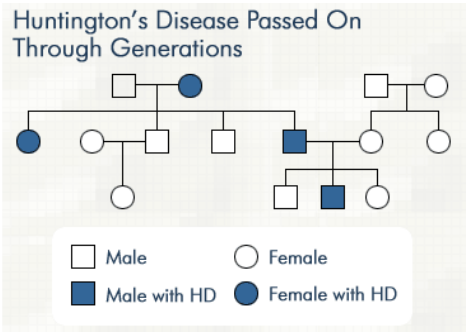
A. *Simple dominant* traits include:

-Cleft chin; Widow's peak;
Hitchhiker's thumb;
Almond shaped eyes (round recessive);
Thick lips (thin recessive)
Earlobe type:
free hanging - dominant;
attached earlobes - recessive



B. Huntington's Disease

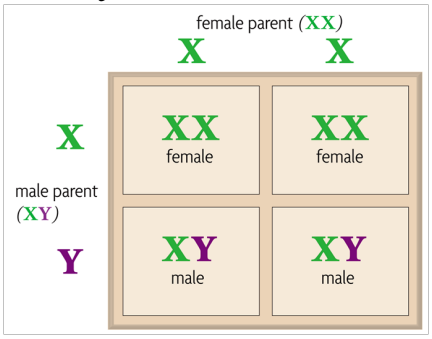
- Is a ***lethal*** genetic disorder caused by a rare dominant allele. Result in ***breakdown certain areas of the brain***. No effective treatment known.
- Onset of disorder doesn't occur until individual affected is in their ***30s to 50s*****,** so an individual could have children unknowing they had disorder.
- There is a test to determine carriers; however, some individuals choose not to know.



V. Males and females can differ in sex-linked traits

A. Genes on ***sex chromosomes are called sex-linked genes*** .

- ***Y*** chromosome genes in mammals are responsible for male characteristics.
- ***X*** chromosome genes in mammals affect many traits.



B. Some Traits/Disorders are Sex Linked

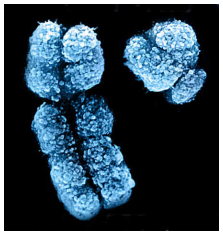
-***Sex linked*** = Characteristics carried on the X-sex chromosome.

1. In males, the part that is ***missing*** is what balances a recessive gene
   a. All of a male's sex-linked genes are ***expressed***. ***Males have no second copies*** of sex-linked genes.

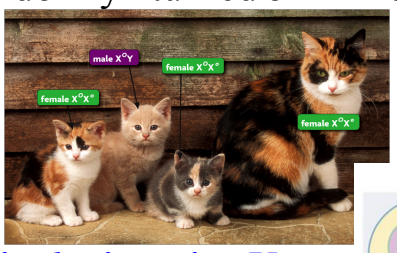
EXAMPLES: red-green color-blindness, hemophilia, baldness, speech disorders

b. Because a female has 2 X chromosomes, ***she must have 2 recessive alleles to show the trait/disorder***.

Symbols used for Sex Linked Crosses

Female = X^cX^c  ***Male*** = X^cY

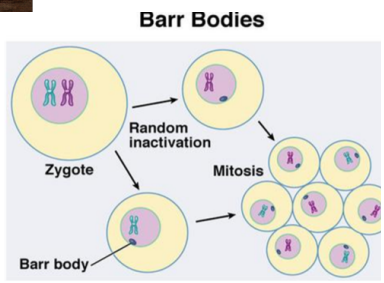
2. Female mammals have an XX genotype.
   a. Expression of sex-linked genes is similar to ***autosomal genes*** in females.
   b. In mammals, female ***"X-inactivation"*** may occur, in which a gene is randomly "turned off" in one of the X chromosomes.



EX: Calico cat coloring

ADD TO NOTES:

A Barr body (named after discoverer Murray **Barr**) ***is the inactive X chromosome in a female somatic cell.***



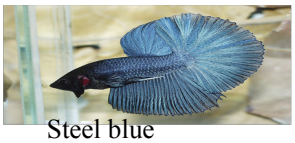
Section 7.2 When Heredity Follows Different Rules

A. Complex Patterns of Inheritance

- Patterns of inheritance by simple dominant and recessive alleles are explained by Mendelian rules. However, some are more complex than simple rules.

1. **Two traits appear to blend in *incomplete dominance*.** Incomplete dominance = when an individual has an ***intermediate form***, or a ***blending of two factors,*** which are displayed by the two parents.


Green beta


Steel blue


Royal Blue

2. **Two traits are fully displayed in codominance.**
Codominance = ***when both genes in a heterozygote are fully expressed.***

- Codominant alleles are ***neither dominant nor recessive*** .
- The ***AB blood types*** result from codominant alleles.
- Blood types are also an example ***multiple alleles***, since there are three alleles available for the two allele expression.

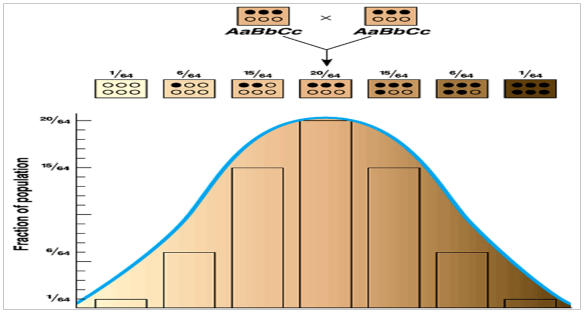
PHENOTYPE (BLOOD TYPE)		GENOTYPES
A	antigen A	I^AI^A or I^Ai
B	antigen B	I^BI^B or I^Bi
AB	both antigens	I^AI^B
O	no antigens	ii

3. **Some traits are controlled by many genes.**
-Polygenic =***a trait that is controlled by more than one pair of genes.***
The genes may be scattered along the same chromosome or located on different chromosomes.

*For example: human height, weight, body build, hair, and skin color.

Order of dominance:
brown > green > blue.

GENE NAME	DOMINANT ALLELE	RECESSIVE ALLELE
BEY1	brown	blue
BEY2	brown	blue
GEY	green	blue



4. An *epistatic* gene can interfere with other genes.

- Certain genes determine whether or not a trait will be expressed.

-The system of genes that determines skin color in mammals, for example, is independent of the gene responsible for albinism (lack of pigment).

-This gene is an ***epistatic*** gene.

When the albino condition occurs, the ***genes that determine skin color are present but not expressed***.

5. Phenotype is a combination of genes and environment.

1. Gene expression can be affected by***external*** environmental conditions.

   An individual's phenotype often depends on surrounding environments.

   *For example, during the ***warm*** temperatures, sea turtles eggs will develop into ***female*** eggs and in ***cooler*** temperatures they develop into ***male*** eggs.

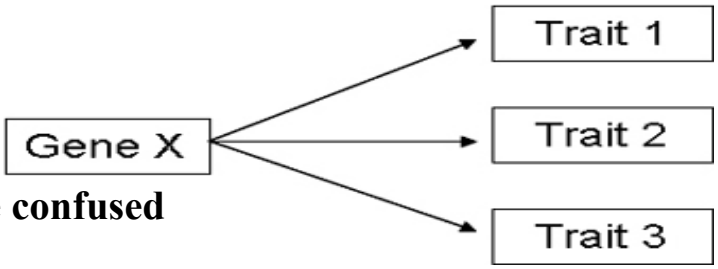
2. ***Internal*** environment conditions include differences in ***hormones and nutrition***.

   EX: Twins during fetal development.

When one gene affects many traits -

-*Pleiotropy* occurs when ***one gene influences multiple traits.***

Example: Phenylketonuria (PKU), which is a human disease that affects multiple systems but is caused by one gene defect. If left untreated, the **build up of phenylalanine in the central nervous system it leads to mental retardation, eczema, and pigment defects that make affected individuals lighter skinned**.



Pleiotropy should not be confused with polygenic traits, in which multiple genes converge to result in a single phenotype.