3.3.2 PEDIGREES AND SEX-LINKED TRAITS
OBJECTIVES

- Use a pedigree to interpret patterns of inheritance within a family.
- Explain why X-linked traits are more often expressed in males.
- List three traits that are only carried on sex chromosomes.
Pedigree Basics

It is important to study how the trait is passed from one generation to the next. A **pedigree** chart, which shows the relationships within a family, helps geneticists do so.

Symbols:
- Squares- males
- Circles- females
- Completely shaded in- affected
- Half shaded in- carrier
- Not shaded- not affected
- Horizontal line- marriage
- Vertical Lines- children
A circle represents a female.

A square represents a male.

A horizontal line connecting a male and female represents a marriage.

A half-shaded circle or square indicates that a person is a carrier of the trait.

A completely shaded circle or square indicates that a person expresses the trait.

A black X represents death of the individual.

A vertical line and a bracket connect the parents to their children.

A circle or square that is not shaded indicates that a person neither expresses the trait nor is a carrier of the trait.
Pedigree for Attached Earlobes

- How many males have attached earlobes?
- Label each individual’s genotype.
- Can you determine if the trait for attached earlobes is dominant or recessive from this pedigree? Explain your answer.
Answer to Second Question

Pedigree for Attached Earlobes, With Genotypes

- Parent: FF or Ff
- Child: ff
- Parent: ff
- Child: Ff
- Parent: Ff
- Child: Ff
- Child: ff
- Child: FF or Ff
Sex Linked Inheritance

- X chromosome is always female
- Y chromosome is always male
  - XXY, XY represents males
- Sex-linked trait
  - Trait that is carried on the X chromosome
    - Y chromosome is unaffected
- Sex-linked traits can be dominant or recessive
  - Dominant- has one or both dominant alleles
  - Recessive- has both recessive alleles
Sex-Linked Traits

- Remember that humans have 23 pairs of chromosomes and that the 23rd pair are the sex chromosomes. Females are XX and males are XY.
- The traits found on the 23rd X chromosome are called X-linked traits.
- If an X-linked trait is recessive, females have a 1 in 3 chance of inheriting that trait. Males have a 1 in 2 chance of inheriting that trait. For this reason, these recessive phenotypes are more often expressed in males.
- Ex: colorblindness, hemophilia, and baldness
Baldness Example

- If $B =$ normal hair growth and $b =$ baldness...

- Possible Female Genotypes with their Phenotypes
  - $X^B X^B$ Normal hair growth
  - $X^B X^b$ Normal hair growth
  - $X^b X^b$ Baldness

- Possible Male Genotypes with their Phenotypes
  - $X^B Y$ Normal hair growth
  - $X^b Y$ Baldness
Identifying Sex-Linked Traits by Analyzing a Pedigree

- To determine if a pedigree is illustrating the inheritance of a sex-linked trait, there are three characteristics you should look for:
  - More males than females are affected
  - Only females are carriers
  - Trait is usually passed from mother to son
Pedigree for Colorblindness

**Key**
- Carrier female
- Colorblind male