

## Unit 5: Mendelian Genetics

### Content Outline: Non-Mendelian Patterns Of inheritance (5.5)

#### I. Linked Genes

- A. This term is usually to describe genes found on the Autosomes (1 – 22). These are usually inherited as a *linked unit* because they are found on the *same* chromosome. These genes are not independently assorted but rather they are inherited as a package.
- B. **Genetic Recombination** occurs at Crossover in Prophase I when chromosome *segments are exchanged* between *homologous paired chromosomes*.
  1. **Parental types** – These offspring organisms look like *the parents*.
  2. **Recombinant types** – These offspring organisms look like *a combination of both parents* because of crossing over occurring.

#### II. Sex-Linked Genes

- A. This term refers to genes *found on the sex chromosomes*; 95% of the time it refers to the X chromosome. (Think X when it is seX linked.)
  1. This is because *both sexes have at least one X chromosome* in their genome.
  2. XX (Female and homologous) ; XY (Male and heterologous)
- B. Sex chromosomes undergo *very little crossover* during Prophase I of Meiosis.
- C. Sex of the organism will be determined at **conception**. (This is when egg is fertilized by the sperm. You will either get a sperm containing an X chromosome or a sperm containing a Y chromosome.) **(Please remind students that males produce sperm and therefore the male “decides” the sex of the offspring. The mother provides her half of the DNA and also the cellular organelles.)**
- D. Everyone starts out *female*. (This is why we all have nipples.)
  1. At about two months of age in the womb, the Y chromosome’s SRY (sex determining region of Y) gene goes active to convert estrogen to testosterone to finish development of the male. **(Students should be reminded that those are the sex determining hormones. They most likely have heard of these hormones. If not, good place to just tell students that hormones are ligands in cell signaling. Hormones tell cells what “to do”. They are chemical messengers.**
  2. After development is complete, testosterone production is turned off until puberty. At puberty it is turned back on so as to make the secondary sexual characteristics, such as facial hair.
- E. **Patterns of Inheritance and some Human Sex-Linked Genetic Disorders:** (No cure exists, because the problem is *in the DNA*.) **(Good place to use the recipe and blank index cards again.)**
  1. **Color Blindness**
    - a. This is the result of a faulty gene (recessive) on the X chromosome for making a particular type of color absorbing protein in cones of the retina of the eye.
    - b. The most common type is Red/Green Colorblindness. (Red and Green appear gray.)
  2. **Hemophilia** (Means “love of bleeding”)
    - a. These individuals cannot make Anti-Hemolytic Factor. (AHF for short.)
    - b. They experience problems with bleeding to death.
    - c. This was a disorder associated with the “Royal Blue-Bloods of Europe” – They were inbreeding to keep the crown “ In the Family”. The “carrier” is traced by to Queen Victoria.
    - d. Treatment? These individuals have to keep AHF with them at all times in case they get hurt. If they do get hurt and start to bleed they will require a shot of AHF to stop the bleeding. Even a bruise (bleeding under the skin) can possibly lead to death.
  3. **THE PATTERN ON A PEDIGREE:** It will *appear to mainly affect males* (as they only have one X chromosome). This is because if the inherited X chromosome has a recessive gene on it; it *will not be covered up* by a dominant one on another X chromosome (as is the case in most females). Females can still get these disorders, but they must inherit *two* recessive X chromosomes. The females tend to be **carriers**, so they appear unaffected. So they tend to pass the recessive X on to their sons. The son will be a **sufferer**, if he gets the recessive X, of the disorder. *It appears to “skip” a generation, because the mother is a carrier and the sons are showing the disorder.* **(Please make sure students can spot a sex-linked pedigree as the standardized EOC and ACT love to use these and ask students “What type of trait is being displayed in the pedigree.”)**