

Unit 5: Mendelian Genetics

Content Outline: Meiosis (5.3)

I. Heredity

- A. This refers to the transmission of traits *from one generation to the next* by *inheriting DNA* from the parent (for asexual reproduction) or parents (for sexual reproduction).

II. Genetics

- A. This is the science that deals with *the transmission of information in the form of DNA*. It can range from studying how traits are passed from one generation to the next using Punnett squares or identifying DNA segments (what we call genes) and the proteins or enzymes that they make. It is a huge field of science.
- B. This field has had a tremendous impact on society as a whole. Such things as cloning, to new medicines, to making bacteria and yeast making human hormones, to making biological weapons such as Super Anthrax.
- C. **Please help students understand that science is only as good or as bad as we intend to use it. Knowledge is always good, but what people do with it is sometimes the problem. See what good or bad ideas they can come up with that might be realistic.**

III. Gene

- A. A *unit of hereditary information* in the form of a DNA sequence of nucleotides.
1. Most genes code for some type of protein or enzyme. It is the “million dollar blueprint” for making ONE thing. It would be like the blueprint for making a steering wheel.
 2. **If your school is made of cinder blocks, you can use it to help explain. A single block is a single nucleotide. A group of blocks that makes something functional (a room) is a gene. The whole school would be a chromosome. There are many different rooms within a school just as there are many different genes on a chromosome.**

IV. Genome

- A. This refers to an organism’s *entire* genetic make-up. *All* the DNA within a cell. It would be like the “blueprint” for making the whole functioning car.
- B. Half of the DNA comes from the *mother* (“*half*” is represented by “*n*”); The other half of the DNA comes from the *father* (*n*). *Therefore, a half plus a half equals 2 halves which is equal to 1 organism.* ($n + n = 2n$. (“half” is also called **haploid/monoploid** and “two halves” is called **diploid**) **(Please help students understand why we “need” halves and not wholes, quarters, etc. in terms of making organisms.**

V. Locus

- A. The *location* of a gene on a chromosome. Important when you are talking about autosome vs. sex chromosomes. **(A karyotype picture showing autosomal and sex chromosomes is useful here.)**

VI. The two *types* of reproduction that can occur by living organisms:

A. Asexual Reproduction

1. This involves only *one* parent. The parent is producing *genetic clones* of itself. The parent and offspring are 100% identical in terms of DNA content and DNA nucleotide sequence.
2. Benefits – Reproduction can occur *very quickly* (Good for taking over a new area). It is a simple process. You only need one parent. **(Please stress the benefits and risks of each as it is important.)**
3. Risks – Every organism is the same. So if a disease affects one; it will affect all. **(There is no variation!)** This caused the Irish Potato Famine. Potatoes are originally from South America. One species of potato plant was taken to Ireland. This became the only species that the farmers could plant, as no new species were brought over afterwards. A pathogenic fungus, called Potato Blight, began attacking the plants. Since they were all alike in terms of DNA because they were clones, they fungus wiped them out quickly causing the famine to occur.

B. Sexual Reproduction

1. This involves *two parents* to contribute DNA. This process “*creates*” *variation*, which is important in terms of *survival in the environment*.
2. Benefits – It produces variation. This is why some organisms have *advantages over others* within the same species in terms of survival and the ability to reproduce. Variety means there exists the *possibility* to evolve over time while living in an ever changing environment. For example, Woolly Mammoth. Those with *less* hair survived and passed on those genes for *less* hair to their offspring as the environment became warmer over time. This led to the evolution of our modern elephant, which has very little hair. The mammoths with *more* hair died before they could reproduce; thereby “wiping” out those genes and eventually causing the extinction of the *old* species.

3. Risks – It takes *two* to be able to reproduce and they *must* be of the opposite sex for the Physical Reproduction to occur. This is not good for an endangered species. It also takes more time. It also involves a more complicated process to create the gametes that have *half* the DNA content.