

Waynesville High School
Biology
Unit 2: Heredity
Estimated Time: 9 weeks

Essential Understanding:

Students will understand...

- how characteristics of living things are passed from parents to offspring.
- how science is done including observing, questioning, hypothesizing, designing, analyzing data, and communicating and supporting conclusions.

Essential Questions:

- How are characteristics inherited through generations?
- How can genetics be used to improve our lives?
- How do mutations happen?

Learning Goal:

Estimated time: 2 weeks

1. Students will understand the structure and function of DNA.

Targets:

Students will be able to...

- describe the function of DNA.
- explain that the biological information of all living things is contained in a genome encoded in DNA.
- describe the structure of DNA as a double helix.
- explain that DNA is composed of nucleotides (sugar, phosphate, nitrogenous base).
- explain that all somatic cells within a eukaryotic organism have identical genetic information (DNA).
- define gene and genome.
- explain the process of DNA replication.
- explain how a mistake in the replication of DNA results in mutations.
- explain the history of the discovery of the structure of DNA from the contributions of many scientists and the development of new technology.
- explain the role of complementary base pairing in the replication of DNA.
- identify questions and concepts that guide scientific investigations such as in the discovery of the structure of DNA.
- analyze explanations and models of the structure of DNA.
- develop a timeline of major milestones in genetics and DNA.

Learning Goal:**Estimated time: 2 weeks**

2. Students will understand how proteins are synthesized in a cell and how cells with identical DNA become different from each other.

Targets:

Students will be able to...

- explain the structure and primary functions of the three types of RNA.
- describe the genetic code and use it to determine an amino acid sequence from a strand of DNA.
- distinguish between a codon and anticodon.
- explain the roles of start and stop codons.
- describe stem cells.
- define the types of point mutations (substitution, addition and deletion).
- define gene and genome.
- compare and contrast DNA and RNA.
- summarize the process of transcription.
- describe the role of ribosomes in protein synthesis.
- summarize the process of translation.
- explain how a mutation in DNA affects protein synthesis and the result can be neutral, harmful or beneficial.
- explain that genes in cells are turned on and off to perform various functions (gene expression) causing the differentiation of cells and this can be influenced by the cell's environment.
- explain how the structure of differentiated cells reflects the function of the cells. (Example: muscle cells contain many mitochondria, skin cells are flat, blood cells are round, etc.).
- analyze DNA sequences to detect and identify mutations.
- explain how the type of cell a mutation occurs in affects whether the mutation affects the organism or its offspring.
- construct a model and/or explanation for how the sequence of DNA bases determines the sequence of amino acids in a protein..

Learning Goal:**Estimated time: 1 week**

3. Students will understand how eukaryotic organisms reproduce sexually.

Targets:

Students will be able to...

- define gametes.
- summarize the major characteristics of spermatogenesis and oogenesis (production of gametes).
- define the types of chromosomal mutations (deletion, inversion, translocation, and nondisjunction).
- explain the process of meiosis in terms of the formation, movement, number and division of chromosome that results in four genetically different haploid cells.
- explain the process of crossing over and how it contributes to the production of unique individuals.
- compare mitosis and meiosis in terms of the end products.
- translate information on the process of meiosis into a diagram or other visual display.
- research chromosomal genetic disorders and their symptoms and identify and explain the mutation that causes the disorder as well how this mutation could occur.

Learning Goal:**Estimated time: 3 weeks**

4. Students will understand the mechanisms of genetics.

Targets:

Students will be able to...

- define the terms genotype, phenotype, homozygous, heterozygous, dominant and recessive.
- construct a Punnett square to predict results of monohybrid crosses.
- explain how probability is used to predict the results of genetic crosses.
- use the information in a pedigree to determine hereditary relationships.
- construct a Punnett square to predict results of dihybrid crosses.
- analyze a Punnett square for classical inheritance (complete dominance) and modern inheritance (incomplete dominance, codominance and sex-linked traits).
- analyze a pedigree to determine mode of inheritance.
- given a scenario, construct a pedigree correctly and determine genotypes of individuals in the pedigree.
- investigate and explain pleiotropy, epistasis, and polygenic traits using real world examples
- use dihybrid crosses to explore linkage groups.
- communicate and support a scientific argument, such as Mendel's laws, with evidence from real data.

Learning Goal:**Estimated time: 1 week**

5. Students will understand modern genetic techniques.

Targets:

Students will be able to...

- explain that the biological information of all living things is contained in a genome encoded in DNA.
- list examples of modern genetic techniques.
- describe examples of modern genetic techniques (karyotyping, cloning, DNA fingerprinting, stem cells, gene therapy, genetically modified foods, vaccines, evolutionary relationships).
- investigate how the structure of genes and genetic processes (replication, transcription, translation, etc.) allows for advancements in modern genetics techniques (karyotyping, cloning, DNA fingerprinting, stem cells, gene therapy, genetically modified foods, vaccines, evolutionary relationships).
- evaluate the merits of competing ethical arguments for the research, development and growth of new genetic technologies.