

Unit 02C: Inheritance and Variation of Traits - Advanced Genetics

Content Area: **Science**
Course(s): **Generic Course**
Time Period: **Semester 2**
Length: **2 weeks**
Status: **Published**

Standards

LS1.A: Structure and Function (pp. 143-145, NRC, 2012)

- All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. (secondary to HS-LS3-1) (Note: This Disciplinary Core Idea is also addressed by HS-LS1-1.)

LS1.B: Growth and Development of Organisms (pp. 145-147, NRC, 2012)

- In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)

LS3.A: Inheritance of Traits (pp. 158-159, NRC, 2012)

- Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)

LS3.B: Variation of Traits (pp. 160-161, NRC, 2012)

- In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2)
- Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. (HS-LS3-2),(HS-LS3-3)

SCI.9-12.HS-LS1-1	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells.
SCI.9-12.HS-LS1-4	Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
SCI.9-12.HS-LS3-3	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

SCI.9-12.HS-LS3-2	Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.
SCI.9-12.HS-LS3-1	Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

Essential Questions

How are the characteristics of one generation related to the previous generation?

- How can we use genetics to study human inheritance?
- How does biological information pass from one generation to another?
- Why do organisms have their specific traits?

Content

Content

- Does the environment have a role in how genes determine traits?
- How can pedigrees be used to analyze human inheritance?
- What are some exceptions to Mendel's principles?
- What patterns of inheritance do human trait follow?

Skills

- Create and read a pedigree to answer critical thinking questions.
- Use a karyotype to determine if an individual has a chromosomal abnormality.
- Use a karyotype to determine the sex of an individual.
- Use genetic crosses to determine an individuals blood type.

