HS. Inheritance and Variation of Traits

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A Performance Expectations HS.LS1.IVT

1. HS-LS1-4. Use a model to illustrate cellular division (mitosis) and differentiation. HS.LS1.IVT.1
2. 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. HS.LS1.IVT.2
3. 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, (3) mutations caused by environmental factors and/or (4) genetic engineering. HS.LS1.IVT.3
4. HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. HS.LS1.IVT.4
5. HS-LS1-8. Use models to illustrate how human reproduction and development maintains continuity of life. HS.LS1.IVT.5

B Science and Engineering Practices HS.IVT.SEP

1. Asking Questions and Defining Problems HS.IVT.SEP.1
   - a Ask questions that arise from examining models or a theory to clarify relationships. (HS-LS3-1) HS.IVT.SEP.1A
2. Developing and Using Models HS.IVT.SEP.2
   - a Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-4),(HS-LS1-8) HS.IVT.SEP.2A
3. Analyzing and Interpreting Data HS.IVT.SEP.3
   - a Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (HS-LS3-3) HS.IVT.SEP.3A
4. Engaging in Argument from Evidence HS.IVT.SEP.4
   - a Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and studentgenerated evidence. (HS-LS3-2) HS.IVT.SEP.4A

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C Disciplinary Core Ideas HS.IVT.DCI

1. LS1.A: Structure and Function HS.IVT.DCI.LS1.A
    a. 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: Disciplinary Core Idea is also addressed by HS-LS1-1.) HS.IVT.DCI.LS1.A.1
    b. (NYSED) The structures and functions of the human female reproductive system produce gametes in ovaries, allow for internal fertilization, support the internal development of the embryo and fetus in the uterus, and provide essential materials through the placenta, and nutrition through milk for the newborn. The structures and functions of the human male reproductive system produce gametes in testes and make possible the delivery of these gametes for fertilization. (HS-LS1-8) HS.IVT.DCI.LS1.A.2
2. LS1.B: Growth and Development of Organisms HS.IVT.DCI.LS1.B
    a. 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) HS.IVT.DCI.LS1.B.1
    b. (NYSED) The continuity of life is sustained through reproduction and development. Human development, birth, and aging should be viewed as a predictable pattern of events influenced by factors such as gene expression, hormones, and the environment. (HS-LS1- 8) HS.IVT.DCI.LS1.B.2
3. LS3.A: Inheritance of Traits HS.IVT.DCI.LS3.A
    a. 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) HS.IVT.DCI.LS3.A.1

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4 LS3.B: Variation of Traits HS.IVT.DCI.LS3.B

a 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. (HS-LS3-2) HS.IVT.DCI.LS3.B.1

b (NYSED) Environmental factors can cause mutations in genes. Only mutations in sex cells can be inherited. (HS-LS3-2) HS.IVT.DCI.LS3.B.2

c (NYSED) Advances in biotechnology have allowed organisms to be modified genetically. (HS-LS3-2) HS.IVT.DCI.LS3.B.3

d 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) HS.IVT.DCI.LS3.B.4

D Crosscutting Concepts HS.IVT.CC

1 Cause and Effect HS.IVT.CC.1

a Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS3- 1),(HS-LS3-2) HS.IVT.CC.1A

2 Scale, Proportion, and Quantity HS.IVT.CC.2

a Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). (HS-LS3-3) HS.IVT.CC.2A

3 Systems and System Models HS.IVT.CC.3

a Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions— including energy, matter, and information flows— within and between systems at different scales. (HS-LS1- 4),(HS-LS1-8) HS.IVT.CC.3A

4 Science is a Human Endeavor HS.IVT.CC.4

a Technological advances have influenced the progress of science and science has influenced advances in technology. (HS-LS3-2),(HS-LS3- 3),(New NYSED PE) HS.IVT.CC.4A

b Science and engineering are influenced by society and society is influenced by science and engineering. (HS-LS3-2), (HS-LS3-3),(HS-LS1-8) HS.IVT.CC.4B