Course Title – MD Biology

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Unit #3– Heredity

Transfer Goal – Students will be able to independently use their learning to describe the advantages and disadvantages of inherited traits and assess the role of environmental factors.

Stage 1 – Desired Results

HS-LS3 Heredity: Inheritance and Variation of Traits

LS1.A: Structure and Function

- 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.)*

LS3.A: Inheritance of Traits

- 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

- 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

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_x__ Global Awareness
___Financial, Economic, Business and Entrepreneurial Literacy
_x__Civic Literacy
_x__Health Literacy
_x__Environmental Literacy

21st Century Skills

Learning and Innovation Skills:
_x__Creativity and Innovation
_x__Critical Thinking and Problem Solving
_x__Communication and Collaboration

Information, Media and Technology Skills:
_x__Information Literacy
_x__Media Literacy
_x__ICT (Information, Communications and Technology) Literacy

Life and Career Skills:

distribution of traits observed depends on both genetic and environmental factors. (HS-LS3-2),(HS-LS3-3) HS-LS4 Biological Evolution: Unity and Diversity **LS4.A: Evidence of Common Ancestry and Diversity** • Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. (HS-LS4-1) **LS4.B: Natural Selection** • Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. (HS-LS4-2),(HS-LS4-3) • The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (HS-LS4-3) **LS4.C: Adaptation** • Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. (HS-LS4-2) • Natural selection leads to adaptation that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (HS-LS4-3),(HS-LS4-4) • Adaptation also means that the distribution of traits in a population can change when conditions change. (HS-LS4-3) • Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (HS-LS4-5),(HS-LS4-6) • Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost. (HS-LS4-5) **LS4.D: Biodiversity and Humans** • Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity	_x__Flexibility and Adaptability _x__Initiative and Self-Direction _x__Social and Cross-Cultural Skills _x__Productivity and Accountability _x__Leadership and Responsibility

through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (HS-LS4-6) *(Note: This Disciplinary Core Idea is also addressed by HS-LS2-7.)* **ETS1.B: Developing Possible Solutions** • When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. *(secondary to HS-LS4-6)* • Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. *(secondary to HS-LS4-6)*	
Enduring Understandings: *Students will understand that . . .* *EU 1* DNA is the blueprint for an organism's traits. *EU 2* Genetic variation leads to differences in organisms both good and bad.	**Essential Questions:** *EU 1* • How do the codes of DNA manifest in the traits we inherit? *EU 2* • How are you a unique individual because of meiosis? • How do genetic mutations contribute to the acquisition of disease?
Knowledge: *Students will know . . .* *EU 1* • genes are segments of DNA molecules located in the chromosomes of each cell. • dominant and recessive traits. • DNA structure • 23 pairs of chromosomes are the blueprint for human traits. *EU 2* • gametes are created through the process of meiosis.	**Skills:** *Students will be able to . . .* *EU 1* • use alleles to create and analyze a Punnett Square to determine traits of offspring. • 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-LS3-1. • apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. HS-LS3-3

• mutations can occur during meiosis. • symptoms of genetic disorders including: Sickle Cell Anemia, hemophilia, muscular dystrophy, Tay-Sachs, PKU, and Huntington's Disease • sorting and recombination of genes in sexual reproduction results in a great variety of possible gene combination.	*EU 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. HS-LS3-2.

Stage 2 – Assessment Evidence

Recommended Performance Tasks:

You are a fertility doctor. You work with parents who would like their offspring to have certain characteristics. You must use the characteristics of the given male and female (facial features, hair color and style, body type) and complete Punnett squares to predict the likelihood of traits in the offspring. You will create a picture of the offspring and write a paragraph describing the dominant and recessive traits he or she is likely to inherit. You will present your report and picture to the parents. You will be graded on the accuracy and explanation of each trait given and the Punnett squares completed. (EU 1)

You are a geneticist working with genetic diseases. Part of your job is to explain to potential parents who carry the genotype for a specific genetic disease the way it may manifest in their offspring's life. You will create a brochure to give an overview, causes, signs and symptoms, diagnosis, treatment, prevention, lifestyle, and support for the disease. You will be graded on your thoroughness and accuracy of information provided for each category listed above. (EU 2)

Other Recommended Evidence:

- Tests (Punnett Squares, traits, DNA structure, genetic mutations, meiosis)
- Quizzes (Punnett Squares, traits, DNA structure, genetic mutations, meiosis)
- Alternate Proficiency Assessment (APA)
- Formative assessment
- Reports and Presentations
- Diagrams, flow charts (meiosis, Punnett Squares, DNA)
- Participate in various labs and write lab reports using the scientific method
- Class discussion/teacher observation
- Student reflection

- Multimedia presentations (PowerPoint, Prezi, iMovie, Keynote) on Punnett Squares, traits, DNA structure, genetic mutations, meiosis.

Stage 3: The Learning Plan

Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections:

- List the different amino acids in DNA and how they pair up (A)
- List dominate and recessive traits seen in self and classmates (A)
- List dominate traits in animals that lend to survival (A)
- Blueprint own DNA as a combination of traits passed on from individual's mother and father (A)
- Build a model of DNA (A/M)
- Chart dominant and recessive traits found in different organisms (M)
- Perform a survey to determine which traits your classmates possess (M/T)
- Read and interpret a family tree to trace the history of family traits (M/T)
- Evaluate Punnett squares on basic organisms and describe offspring (A/M)
- Chart characteristics inherited from parents (M/T)
- List and define traits that can occur from genetic mutation (A)
- Venn diagram how DNA, genetics, and evolution intertwine (M)
- Complete a color blind test to determine a genetic mutation in classmates (T)

Timeline: 1-2 marking periods