Unit 3: Growth, Development, and Reproduction of Organisms

Content Area: **Science**
Course(s): **Science**
Time Period: **Marking Period 3**
Length: **8-10 Weeks**
Status: **Published**

Unit Overview

In this unit, students will generate arguments based on empirical evidence and scientist reasoning for how characteristics in animals and plants affect the probability of successful reproduction to include behaviors and physical adaptations. Students will learn how environmental and genetic factors can influence the growth of organisms, species, and populations in various geographical locations. Students will also develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism, which will lead to the modeling of sexual reproduction by creating genetic crosses. Finally, students will dive into modern genetics from which they will gather information about new technological advancements and how, we as humans, influence the inheritance of desired traits in organisms such as plants, cloning, animals, and treatment of disorders.

Performance Expectations

MS-LS1-4	Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
MS-LS1-5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
MS-LS3-1	Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.
MS-LS3-2	Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
MS-LS4-5	Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.

Three Dimensions

Science and Engineering Practices

SEP.1	Asking Questions and Defining Problems

SEP.2	Developing and Using Models
SEP.3	Planning and Carrying Out Investigations
SEP.4	Analyzing and Interpreting Data
SEP.5	Using Mathematics and Computational Thinking
SEP.6	Constructing Explanations and Designing Solutions
SEP.7	Engaging in Argument from Evidence
SEP.8	Obtaining, Evaluating, and Communicating Information

Disciplinary Core Ideas

LS1.B: Growth and Development of Organisms

- Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4)
- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4)
- Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5)
- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MSLS3-2)

LS3.A: Inheritance of Traits

- Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1)
- V ariations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2)

LS3.B: Variation of Traits

- In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals hav e two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (MS-LS3-2)
- In addition to v ariations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1)

LS4.B: Natural Selection

- In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. (MS-LS4-5)

Crosscutting Concepts

Cause and Effect

- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-4),(MSLS1-5)
- Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3- 2)
- □ Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-5)

Structure and Function

- Complex and microscopic structures and systems can be v isualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/sy stems can be analy zed to determine how they function. (MS-LS3-1)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS4-5)

Connections to Nature of Science

Science Addresses Questions About the Natural and Material World

- Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS4-5)

Knowledge, Skills, and Assessment

Essential Insights and Understandings/Guiding Questions	Critical Knowledge and Skills	
How do animal adaptations relate to reproduction rate and species survival? Who was the first to discover the diversity within populations and adaptations?	**Charles Darwin observed species when he traveled around the world taking observations and notes along his adventure on the Beagle. Among the places he visited was the Galapagos Islands. There, he noticed variations in species on the islands such as finches, iguanas, and tortoises. From these obserations, he developed his theory of natural selection. Darwin discovered that animals change over time, adapt to their environment, and that those species that are best adapted survive and therefore reproduce.** Skill; SWBAT: • explain the important observations Darwin made on	**Activity** noting s way. T groups map, or board to Journey **Activity** adaptati **Activity**

	his journey • hypothesize about Darwin's theory of natural selection • model how natural selection and adaptations lead to evolution and survival	students of beak Over ti birds su **Project** info gra animal) **Assessn** visuals,
What factors lead to growth within populations and species?	**Local environmental conditions could include availability of food, light, space, and water. If these elements are compromised, a species growth can be dramatically affected. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds** Skill: SWBAT: • construct an explanation of how environmental factors influence growth of organisms • construct an explanation of how genetic factors influence growth of organisms	**Assessn** geograp environ populat choose
What forms the genetic code? How does a cell produce proteins? How can mutations arise?	**The Central Dogma discusses how proteins are made. DNA contains the original codes for making the proteins that living cells require to perform functions. mRNA is a copy of a gene located on the DNA molecule. mRNA will leave the nucleus of the cell and ribosomes will read its coding sequences. Finally, the amino acids are placed together to make the protein. This process is referred to as protein synthesis and includes transcription and translation.** Skill: SWBAT: • explain DNA as it relates to cells • translate and transcribe a genetic code (protein synthesis) • hypothesize about possible causes of mutations	**Activit** a code b presenta graphic **Activity** discreti protein
What control's the inheritance of traits in	**Mendel first discovered genetics and his work with pea**	**Activity**

organisms? How can probability be determined? How are traits passed from parent to offspring in somatic cells and sex cells?	**plants lead to the basic understanding of genes and alleles. An organism's traits are controlled by the alleles it inherits from is parents. Some alleles are dominant, while other alleles are recessive. A dominant allele is one whose trait always shows up in the organism when the allele is present while a recessive allele, on the other hand, is hidden whenever the dominant allele is present. Based on parent's alleles, a Punnet Square can be created in order to determine the probability within the offspring for specific traits. Traits are passed from parent to offspring through the process of meiosis (sex cells) which is similar to mitosis which occurs in somatic cells.** Skill: SWBAT: • explain Mendel's contributions within genetics • create Punnet Squares based on specific information • compare and contrast mitosis vs. meiosis • model genetic crosses • model cellular division	studies, **Activity** students physica determi other st **Activity** students **Activity** complet comput **Activity** activity groups crosses. **Activity** students each ste **Activity** Throug the vari **Assessm** drawing division
What are the causes of genetic disorders? How can modern technology and advances aid in solving genetic disorders and create new aids in health?	**A genetic disorder is an abnormal condition that a person inherits through genes or chromosomes. Some genetic disorders are caused by mutations in the DNA of genes or by a change in the overall structure or number of chromosomes. Genetic disorders can be managed due to a variety of advancements within science. Tools such as karyotypes can be used to help diagnose the disorder, genetic counseling, physical therapy, selective breeding, cloning, and genetic engineering are all continually changing this field.**	**Activity** researc what fo researc the clas **Activity** students their ka chromo

Skill; SWBAT: find we

- explain how a genetic disorder is caused
- hypothesize about the positive and negatives to modern genetics
- develop personal viewpoints in advancements within science

Suggested Resources

Darwin, Adaptions, and Survival

- http://www.cnrs.fr/cw/dossiers/dosdarwinE/darwin.html
- http://www.nhm.ac.uk/resources/nature-online/science-of-natural-history/beagle-journey/beagle-journey.swf
- http://www.bbc.co.uk/nature/adaptations
- http://www.nhptv.org/natureworks/nwep1.htm
- http://www.ck12.org/biology/Natural-Selection/
- http://sepuplhs.org/high/sgi/teachers/evolution_act11_sim.html
- http://www.sciencechannel.com/games-and-interactives/charles-darwin-game/
- https://phet.colorado.edu/en/simulation/natural-selection
- https://d3jc3ahdjad7x7.cloudfront.net/Pak36Tto4OBQGFwu6UfYdHs7rFR0Q4lqW0mGRVyAOL0FNBIg.pdf

Growth Factors

- http://www.ck12.org/life-science/Limiting-Factors-to-Population-Growth-in-Life-Science/lesson/Limiting-Factors-to-Population-Growth-MS-LS/

Central Dogma

- http://www.indiana.edu/~ensiweb/connections/genetics/dna.ws.pdf
- http://monmouthregional.net/mrhs/Departments/Science/Science%20Teacher%20Websites/Jacqueline%20Roach/Biology%20Honors/Unit%204%20Genetics/Protein%20Synthesis%20Review%20Worksheet%20.pdf
- file:///C:/Users/keppinger/Downloads/Protein_Synthesis_WS.pdf
- http://infohost.nmt.edu/~klathrop/biology/dna/Transcription%20Worksheet.pdf
- http://www.beaconlearningcenter.com/documents/4935_4439.pdf
- http://www.3dmoleculardesigns.com/3DMD-Files/Insulin/mRNA_Coding_Activity_Teacher_Key_Color.pdf
- http://www.ck12.org/chemistry/Protein-Synthesis/
- http://learn.genetics.utah.edu/content/molecules/centraldogma/

Genetic Crosses

- http://www.ck12.org/life-science/Mendels-Pea-Plants-in-Life-Science/
- http://www2.edc.org/weblabs/Mendel/MendelMenu.html
- https://www.khanacademy.org/science/biology/classical-genetics/mendelian--genetics/v/punnett-square-fun
- http://vital.cs.ohiou.edu/steamwebsite/downloads/FurryFamily.swf
- http://www.glencoe.com/sites/common_assets/science/virtual_labs/E09/E09.html
- http://www.bioeyes.org/teachers/activities/inter/spongebob-genetics.pdf
- http://sciencespot.net/Media/gen_spbobgenetics2.pdf
- http://www.cellsalive.com/meiosis.htm
- http://www.wiley.com/college/test/0471787159/biology_basics/animations/meiosis.swf

Modern Genetics

- http://www.ck12.org/life-science/Modern-Genetics-in-Life-Science/
- https://mms.springbranchisd.com/Portals/278/teachers/kim%20tucker/WebQuest.pdf?ver=2012-01-26-170736-947

Technology Integration

- Ck-12 Flexbook
- Chromebooks
- i-Pads
- Cellular Devices
- internet
- SmartBoard
- Google Docs
- Google Apps
- Google Classroom
- quizlet

Differentiation

Differentiation for special education:

- General modifications may include:
    - Modifications & accommodations as listed in the student's IEP
    - Assign a peer to help keep student on task
    - Modified or reduced assignments
    - Reduce length of assignment for different mode of delivery

    - Increase one-to-one time
    - Working contract between you and student at risk
    - Prioritize tasks
    - Think in concrete terms and provide hands-on-tasks
    - Position student near helping peer or have quick access to teacher
    - Anticipate where needs will be
    - Break tests down in smaller increments
- Content specific modifications may include:
    - leveled or tiered work

Differentiation for ELL's:

- General modifications may include:
    - Strategy groups
    - Teacher conferences
    - Graphic organizers
    - Modification plan
    - Collaboration with ELL Teacher
- Content specific vocabulary important for ELL students to understand include: genetic, Punnet Square, mitosis, meiosis, cell division, adaptations, DNA, RNA, synthesis, natural selection, population, species, genes, and reproduction.

Differentiation to extend learning for gifted students may include:

- **Cell Differentiation Cycle** Students will look up how cells differentiate within the human body and when.
- **Useful Poison** Students collect data on colchicine.
- **Protein Synthesis Extensions** Students complete higher leveled protein synthesis coding problems.
- **Sex Linked traits** Students complete Punnet Squares for sex linked traits.
- **DiHybrid Crosses** Students complete various dihybrid crosses.
- **Cancer Research Project** Students research a specific cancer via internet and create a campaign.
- **Students will create and breed various plants. Cross them and create their own generations.

21st Century Skills

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through

	experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP3.1	Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP7.1	Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP9.1	Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.
CRP.K-12.CRP10.1	Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step

	in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.
CRP.K-12.CRP11.1	Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.
CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.
CRP.K-12.CRP12.1	Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.