Ohio Science - Extended Learning Standards

Biology

Heredity

1 Cellular Genetics B.H.1

Complexity a

a Describe that different genes code for proteins that determine different traits. B.H.1.A

Complexity b

b Communicate that genes code for specific traits (e.g., eye color, hair color). B.H.1.B

Complexity c

c Recognize that genes are made up of DNA. B.H.1.C

Learning Progression

- Build a model of DNA. B.H.1.LP.A
- Recognize that DNA codes for proteins that physically make the traits. B.H.1.LP.B
- Illustrate that portions of DNA represent a gene that codes for a variety of traits (hair, skin, feathers, leaves). B.H.1.LP.C
- Manipulate a physical model of DNA. B.H.1.LPD
- Recognize that DNA is a set of instructions for the cell. B.H.1.LPE

2 Structure and Function of DNA in Cells B.H.2

Complexity a

a Recognize that changing the segments of DNA molecules can alter genes. B.H.2.A

Complexity b

b Recognize that genes are made up of DNA, so changing the segments of DNA can alter genes. B.H.2.B

Complexity c

c When given a representation of individuals from the same parents, identify variations in physical traits. B.H.2.C

Learning Progression

- Recognize that changing the sequence of DNA may alter the development of a trait if the resulting protein is altered. B.H.2.LP.A
- Recognize that in sexual reproduction DNA is contributed from two parents to produce a new organism (genetically unique). B.H.2.LP.B
- Recognize that if the sequence of DNA is changed, the trait changes. B.H.2.LP.C
- Recognize that the sequence of DNA is specific for development of specific traits. B.H.2.LP.D

3 Genetic Mechanisms and Inheritance B.H.3

Complexity a

a Predict the possible phenotypes of an offspring when given the genotype of the parents (e.g., using a Punnett square). B.H.3.A

Complexity b

b Recognize that genes combine during sexual reproduction which causes the traits of offspring to not be exact replicas of either parent. B.H.3.B

Complexity c

c Identify X and Y as female and male chromosomes. B.H.3.C

Learning Progression

- Identify fertilization as sex cells combining.to produce a unique offspring. B.H.3.LP.A
- Identify the products of meiosis, sex cells (egg and sperm). B.H.3.LP.B
- Identify the genetic combination for female is XX and male is XY. B.H.3.LP.C
- Recognize that sex cells contain half the genetic information for the next generation. B.H.3.LP.D
- Observe a family pedigree and note the similarities and differences of the offspring. B.H.3.LP.E

4 Mutations B.H.4

Complexity a

a Describe how some mutations can be helpful and some can be harmful to organisms. B.H.4.A

Complexity b

b Recognize that genes can be altered and that those changed genes may then be passed to offspring. B.H.4.B

Complexity c

c Identify traits that can vary among a population (e.g., eye color, beak shape, etc.). B.H.4.C

Learning Progression

- Recognize that not all mutations have an impact on an organism. B.H.4.LP.A
- Recognize that only mutations in sex cells get passed on to offspring. B.H.4.LP.B
- Recognize that changes in DNA which causes different characteristics and functions are called mutations.. B.H.4.LP.C
- In a given population identify the various forms of a trait that exist (e.g., fur color). B.H.4.LP.D
- Observe a population of organisms to identify differences in individuals. B.H.4.LP.E

5 Modern Genetics B.H.5

Complexity a

a Describe specific ways in which scientists have used DNA to help people or the environment (e.g., sweeter fruit, etc.). B.H.5.A

Complexity b

b Identify one reason DNA would be purposely altered by humans. B.H.5.B

Complexity c

c Identify a model of DNA. B.H.5.C

Learning Progression

- Show pictures of animals and plants that have been genetically altered for food production. B.H.5.LP.A
- Discuss important attributes a farmer should consider for a food crop (yield, taste, shelf life). B.H.5.LP.B
- Describe why humans would want to change DNA in an organism. B.H.5.LP.C
- List the differences in the tastes of heirloom produce. B.H.5.LP.D
- Taste examples of heirloom tomatoes and store bought hybrids or field corn and hybrid sweet corn. B.H.5.LP.E
- Recognize a model of DNA. B.H.5.LP.F

Evolution

1 Mechanisms • Natural selection • Mutation • Genetic drift • Gene flow (immigration, emigration) • Sexual selection B.E.1

Complexity a

a Describe how the presence or absence of traits may help some individuals in a plant or animal population survive and reproduce in their environment (e.g., natural selection). B.E.1.A

Complexity b

b When given a population of animals or plants, identify how variation in traits impacts their ability to survive and reproduce (e.g., populations of endangered species). B.E.1.B

Complexity c

c When given a plant or animal, identify traits that help it to survive in its environment. B.E.1.C

Learning Progression

- Discuss how an organism must survive in order to pass on its traits (genes). B.E.1.LP.A
- Discuss how successful genes in a population get passed on through reproduction. B.E.1.LP.B
- Recognize that traits are produced by genes. B.E.1.LP.C
- Provide pictures of animals or plants with a variety of traits and match them to the environment in which they would survive (e.g., lots of fur in a snowy region). B.E.1.LP.D
- Discuss how coloration would impact a predator prey relationship, if prey is easy to see it is easy to catch and eat. (Pick up colored candies from a colored background and discuss why some colors are easier to see.) B.E.1.LP.E
- Given pictures of bird beaks or teeth of mammals and discuss what kinds of food the animal would be best able to eat. B.E.1.LP.F

2 **Speciation • Biological classification expanded to molecular evidence • Variation of organisms within a species due to population genetics and gene frequency** B.E.2

Complexity a

a Identify evolutionary changes to a given species that have allowed the species to continue to survive and reproduce. B.E.2.A

Complexity b

b Diagram and describe the evolutionary change in a species. B.E.2.B

Complexity c

c Given a visual representation, identify a species that has changed over the course of many generations (e.g., cladogram diagram). B.E.2.C

Learning Progression

- Given a cladogram with pictures, make a prediction of what the next generation willould look like based on a given environment. B.E.2.LP.A
- Use the horse as an example, show pictures of earlier forms and discuss the changes that have occurred. B.E.2.LP.B
- Use a cladogram with pictures of the organisms to describe changes from one clade to the next (an organism compared to its ancestors). Show the evolution of a trait. B.E.2.LP.C

Diversity and Interdependence of Life

1 Biodiversity • Genetic diversity • Species diversity B.DI.1

Complexity a

a Explain how low genetic diversity impacts population size, energy flow or the cycle of matter in a given environment (e.g., Isle Royale Wolf population). B.DI.1.A

Complexity b

b When given two examples of an animal or plant in a given environment, describe which one would have the higher chance to survive or reproduce based on traits (e.g., fur coat thickness, coloration). B.DI.1.B

Complexity c

c When given an environment, recognize a plant or an animal that could survive in that environment. B.DI.1.C

Learning Progression

- Show data (graphs or charts) for population sizes of predatory/prey for a particular environment and show how one species impacts another (e.g., wolves and moose oin Isle Royale). B.DI.1.LP.A
- Predict what will happen to an ecosystem when a population of organisms (wolves, ash trees) moves in or out. B.DI.1.LP.B
- Given pictures of two environments and a set of organism picture cards, place the organisms in the environment where they are most likely to survive. B.DI.1.LP.C
- Given two animals or plants, identify which of them is most likely to survive in a certain environment and match which traits would help it survive. B.DI.1.LP.D

2 Ecosystems • Equilibrium and disequilibrium • Carrying capacity B.DI.2

Complexity a

a Identify how both populations will change in a predator/prey relationship, when given a model of an ecosystem that is not in balance (e.g., carrying capacity). B.DI.2.A

Complexity b

b Identify how a human or natural change to an ecosystem results in a change to a predator or prey population. B.DI.2.B

Complexity c

c When given a set of before and after pictures of an ecosystem, (e.g., meadow changed to farm, forest changed to apartment buildings) observe the human caused changes. B.DI.2.C

Learning Progression

- Given an ecosystem that has experienced an event (natural or man made) discuss how an impacted organism may change the dynamics of the ecosystem (carrying capacity). B.DI.2.LP.A
- Given an environment and an event (natural or man made) predict what organisms will survive, thrive or perish as a result of that event. B.DI.2.LP.B
- Match the cause to the effect of a change to an ecosystem. (Given two pictures of an ecosystem and an event which occurred identify which came first (e.g., meadow, forest, apartment complex, volcanic eruption). B.DI.2.LP.C
- Examine a given ecosystem and identify the relationships between organisms. B.DI.2.LP.D

3 **Loss of Diversity • Climate change • Anthropocene effects • Extinction • Invasive species** B.DI.3

Complexity a

a Describe how drought, flood, volcanic eruption, habitat loss, or introduction of a new species may affect the diversity in an ecosystem. B.DI.3.A

Complexity b

b Match the cause (e.g., drought, flood, habitat loss, new species) to its effect on organisms in an ecosystem. B.DI.3.B

Complexity c

c Identify factors that can harm organisms in an environment (e.g., drought, floods, volcanic eruption, habitat loss, new species etc.). B.DI.3.C

Learning Progression

- Match worldwide temperature data to a given environment and the changes that have occurred to the populations that live there. (e.g., polar ice caps, coral reefs). B.DI.3.LP.A
- Use populations numbers of native species after the introduction of zebra mussels to the Great Lakes to provide an example of how human activities can impact an ecosystem. B.DI.3.LP.B
- Discuss what happens to organisms in an ecosystem after a human activity. (Show pictures of human activities such as strip mining, mall building, home developments and match them with the aftermath photos of the environment.) B.DI.3.LP.C
- Discuss what happens to organisms in an ecosystem after a natural event. (Show pictures of natural events and match them with the aftermath photos of the environment.) B.DI.3.LP.D
- Recognize the human activities can change an ecosystem impacting organisms. B.DI.3.LP.E
- Recognize that natural events will change an ecosystem impacting organisms. B.DI.3.LP.F

Cells

1 Cell Structure • Structure, function and interrelatedness of cell organelles • Eukaryotic cells and prokaryotic cells B.C.1

Complexity a

a Compare and contrast a prokaryotic cell and a eukaryotic cell. B.C.1.A

Complexity b

b Match the organelle with the process it helps to execute (e.g., chloroplast, photosynthesis). B.C.1.B

Complexity c

c Identify the function of the cell membrane. B.C.1.C

Learning Progression

- Model materials going into and out of the cell. B.C.1.LP.A
- Recognize that materials need to enter and leave the cell through the cell membrane. B.C.1.LP.B
- Match cell organelles to functions. B.C.1.LP.C
- Identify a cell as prokaryotic or eukaryotic. B.C.1.LP.D
- Given a variety of cells sort into prokaryotic and eukaryotic cells. B.C.1.LP.E
- Show what cell type is responsible for photosynthesis. B.C.1.LP.F
- Given a cell with missing part, identify what function the cell is unable to do and how that affects the cell. B.C.1.LP.G
- Recognize that cells are classified by their cell parts. B.C.1.LP.H
- Recognize that organelles do specific jobs for the cell. B.C.1.LP.I
- Recognize that cells have parts (organelles). B.C.1.LP.J
- Recognize that all living things are made of cells. B.C.1.LP.K

2 **Cellular Processes • Characteristics of life regulated by cellular processes • Photosynthesis, chemosynthesis, cellular respiration, biosynthesis of macromolecules** B.C.2

Complexity a

a Describe how the cell needs specific conditions (e.g., temperature, pH) in order to perform its essential functions (e.g., respiration, photosynthesis). B.C.2.A

Complexity b

b Complete a diagram that depicts the process of photosynthesis. B.C.2.B

Complexity c

c Identify photosynthesis and cellular respiration as occurring in a cell. B.C.2.C

Learning Progression

- Identify the importance of photosynthesis. B.C.2.LP.A
- Identify the importance of respiration. B.C.2.LP.B
- Investigate plant seedlings in different environments (temperature, pH) to show optimum range of growth. B.C.2.LP.C
- Identify the products of cellular respiration. B.C.2.LP.D
- Identify the products of photosynthesis. [Use pictures to complete a diagram of the process of photosynthesis (picture of sun, tree, water, oxygen, carbon dioxide and glucose)] B.C.2.LP.E
- Compare the cell to a factory and show how cells make products for an organism. B.C.2.LP.F