Life Science

UNIT 6 – Heredity and Genetics

Standards, Elements & Skills:

S7L3. Students will recognize how biological traits are passed on to successive generations.

a. Explain the role of genes and chromosomes in the process of inheriting a specific trait.

Skills:

- Explain that cells divide to reproduce.
    1. Understand the relationship between DNA, chromosomes, and genes.
    2. Explain a mutation is a change in the genes or chromosomes.

b. Compare and contrast that organisms reproduce asexually and sexually (bacteria, protists, fungi, plants & animals).

Skills:

- Compare and contrast organisms that reproduce asexually and those that reproduce sexually.

c. Recognize that selective breeding can produce plants or animals with desired traits.

Skills:

- Demonstrate understanding that selective breeding is used to reduce susceptibilty to disease and pests and to increase lifespan and other consumer-driven traits.

Key Learnings:

Students will know that:

- Asexual reproduction involves one organism making a copy of itself (binary fission).
- In sexual reproduction, both parents produce cells that have half of the information needed for a complete offspring.
- Traits are determined by genes. Information for genes is in the chromosomes of a cell.
- Punnett squares can be used to determine the likelihood of a trait showing up in the offspring of parents with known allele combinations for a trait.
- Specific traits of plants or animals can be used to produce offspring showing desirable traits. This is called selective breeding.

Students will be able to:

- Compare and contrast asexual and sexual reproduction for organisms.
- Demonstrate the use of a Punnett Square.
- Explain the role of genes and chromosomes in the process of inheriting a specific trait.
- Demonstrate an understanding that selective breeding can produce plants or animals with desired traits.

Vocabulary:

- alleles - the different forms of a gene
- chromosome - a doubled rod of condensed chromatin
- DNA - the genetic material that carries information about an organism and is passed from parent to offspring
- heterozygous - having two different alleles for a trait
- homozygous - having two identical alleles for a trait
- mutation - a change in a gene or chromosome
- Punnett Square - a chart that show all the possible combinations of alleles that can result from a genetic cross
- trait - a characteristic that an organism can pass on to its offspring through its genes
- dominant - a gene that covers up or dominates the recessive gene
- recessive - a gene that is covered up or hidden by the dominant trait
- hybrid - an organism that has two different alleles or is heterozygous for a trait
- genotype - an organisms genetic makeup or allele combinations
- phenotype - an organisms physical appearance or physical traits

Essential Questions & Answers:

What is the relationship between the type of reproduction and the genetic diversity of the resulting offspring, and what are some examples of organisms that use each type of reproduction?

Asexual reproduction involves only one parent donating genes to the next generation. As a result, all offspring are an exact copy of the parent organism and there is lower genetic diversity in the population. In sexual reproduction, two parents donate genes to the offspring, resulting in offspring that have their own unique combination of genes and a population with a higher genetic diversity. Bacteria and fungi often reproduce asexually, while animals and plants most often reproduce sexually.

How do genetic traits affect an organism's survival?

The genetic traits of an organism (genotype) determine the physical and behavioral characteristics of that organism (phenotype). If the traits an organism receives are useful in their environment – such as helping them access resources or avoid predation – the organism will survive and likely pass on those traits to their own offspring. If those traits are not useful in the environment the organism is in, the organism may not survive and those traits may not be passed on.

How are Darwin's finches an example of evolution by natural selection?

Darwin's finches show that depending on the demands of the environment certain traits may or may not be useful. Traits are beneficial if the trait helps the organism survive. When a number of finches started a population in the Galapagos islands, finches with beak's that were best able to access the different food sources on each island were more likely to survive and pass on those useful genes. Over time, each island developed a population of finches with beaks adapted to the food available on that island.

How does the fossil record provide evidence for evolution?

The preserved remains of organisms, when dated and compared to other similar fossil remains and living organisms, allow scientists to produce a timeline of change in different species of organism and show evolutionary relationships between species. A series of fossils might show a series of changes between an ancient, extinct species and a different, but related modern species.

How does selective breeding produce plants and animals with desired traits?

By controlling which organisms are allowed to breed and choosing only those organisms with desirable traits to breed, the potential genes passed on to offspring can be controlled. Plants or animals with desirable traits are allowed to breed; those without desirable traits are not allowed to breed. This ensures that any offspring produced have or are likely to have the desired traits of the parents.

Why are the traits of sexually produced offspring not exactly like their parents?

Sexual reproduction means that some of the traits of each parent are combined in the offspring. Each offspring only gets ½ of each parent's traits, therefore the offspring never look exactly like either parent.

Why does sexual reproduction produce more genetic diversity than asexual diversity?

Asexual reproduction produces offspring that are identical to their parent. The genetic material is an exact copy passed from parent to offspring, resulting in no new diversity. In sexual reproduction, the offspring receives ½ of its genes from each parent, producing a new combination and increasing diversity.

What is the difference between a dominant and recessive allele?

Alleles are the different forms of a trait that make up a gene pair. One form is usually dominant, or a trait that covers or "dominates the other trait. It is the one that shows up physically. The other trait is usually recessive, or is the trait that is covered over be the dominant trait and seems to disappear.

Explain the role of genotypes in inheriting a specific phenotype.

Each sexually reproducing organism receives one gene from each parent for a particular trait, or their genotype. In most cases, one of these genes is dominant over the other. The dominant allele is the one that shows physically in the organism's phenotype, or the way the organism looks and behaves. Either one of these alleles can be passed on to the next generation's genotype, thus allowing for the possibility of recessive traits to show up in following generations' phenotypes.

How can we predict the probability of a certain trait showing up in an organism?

First, we'd have to know the genotype of the parents. Then, we could us a Punnett square. The Punnett square allows us to predict the probability of one specific trait appearing in the phenotype. A Punnett Square is a tool that allows us to see the different ways the parents' alleles could combine.