Genetics Lesson Plans: Scope and Sequence

Lesson Number	Focus Question(s)	Main Learning Goal	Science Content Storyline
1a/b	Can you predict what offspring will look like by looking at their parents? Why or why not?	Offspring may exhibit the same trait as one parent or the other rather than a blending of both parents' traits.	Individuals within a species are similar to one another in some ways and different from one another in other ways. Some of the differences—or variations—between individuals are due to the traits offspring inherit from their parents. Offspring may exhibit the same trait as one parent or the other rather than a blending of both parents' traits. A trait that is present in one generation may not show up in the next generation.
2a	Can certain traits disappear in a family? Why or why not?	Some forms of a trait can mask or cover up other forms so they seem to disappear in the next generation. But these masked traits don't actually disappear.	Sometimes when parents have different traits, all of their offspring will exhibit one parent's trait, and the other parent's trait will seem to disappear because none of the offspring exhibit it. A trait that is present in one generation might not appear in the next generation, and conversely, a trait that doesn't show up in one generation might appear in the next generation. For each trait, individuals inherit a set of instructions from their mother and another set of instructions from their father. The instructions for a particular trait are called *genes*, and different instructions for the same trait are called *alleles*. If an individual gets the same set of instructions from both parents, that trait will be expressed. If an individual gets a different set of instructions from each parent, only one of the traits will be expressed. When this happens, the trait that's expressed is called a *dominant trait*, and the trait that's hidden or unexpressed is called a *recessive trait*. Tracking the pattern of trait expression across several generations of a family can help you figure out whether a particular trait is dominant or recessive.
2b	Can certain traits disappear in a family? Can offspring have traits their parents don't have?	Some traits mask or cover up other traits. The traits that mask other traits are called *dominant traits*. The traits that are covered up are called *recessive traits*.	
3a/b	What do we know about genes today that Gregor Mendel didn't know?	The pattern of chromosome movement matches the way Gregor Mendel described gene behavior. This led scientists to conclude that genes are located on chromosomes.	About 40 years after Gregor Mendel researched genes and their behavior, scientists discovered how chromosomes move by examining them under microscopes that enabled them to observe cells in greater detail. *Chromosomes* are thread-like structures inside the nucleus of each reproducing cell. Sexually reproducing organisms have pairs of chromosomes that are identical in size and shape. Offspring inherit one chromosome from the mother's pair, and one from the father's pair. Scientists also discovered that when sperm and egg cells are made and then unite to make a new individual, the chromosomes behave in exactly

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			the way Mendel described the behavior of genes: • One sperm or egg cell receives one chromosome from each pair of the parents' chromosomes. • The single chromosome each parent contributes to the sperm or egg is randomly selected. • When the sperm and egg unite at fertilization, a new individual with two sets of chromosomes is created. • One set of chromosomes comes from the mother, and the other set comes from the father. Because the behavior of chromosomes matches the behavior of genes exactly, scientists proposed that genes are located on chromosomes.
4a	How can a model of inheritance explain how a trait may seem to disappear in a family?	During reproduction, parents' chromosomes (and the genes located on them) are randomly separated and recombined in their offspring. All offspring will exhibit the dominant trait if they inherit a dominant allele from one or both parents.	Genes provide instructions for a trait. Different forms of the same gene are called *alleles*. Alleles provide instructions for variations of a trait. Organisms that reproduce sexually have two alleles for each gene, one allele from their mother, and the other from their father. Just like traits, alleles can be described as dominant or recessive. Offspring exhibit the dominant trait if they inherit a dominant allele from one or both parents. They exhibit the recessive trait if they inherit a recessive allele from each parent. The particular alleles offspring inherit from their parents are one factor that explains the variations we see among individuals of a species.
4b	How can a model of inheritance further explain how offspring can have a trait their parents don't have?	During reproduction, parents' chromosomes (and the genes located on them) are randomly separated and recombined in their offspring. All offspring will exhibit the dominant trait if they inherit a dominant allele from one or both parents. If offspring inherit a recessive allele from each parent, they will exhibit the recessive trait even though their parents don't.	

5a/b	Do the dominant and recessive traits of parents always result in similar patterns of trait variation in offspring? Why or why not?	By understanding the movement of chromosomes (and the genes located on them) when egg and sperm are produced and unite to make a new individual, we can predict inheritance patterns for some traits. The Punnett square is a helpful tool for representing the possible combinations of alleles in offspring.	Different combinations of alleles in parents lead to trait variations in their offspring. A *Punnett square* is a helpful tool for representing all the possible allele combinations for a trait that offspring can inherit from their parents. Since recessive traits are expressed only if an individual inherits a recessive allele from each parent, a Punnett square makes it possible to predict which traits might show up in the offspring. A Punnett square can also forecast the expected frequency (ratio) of dominant to recessive traits among offspring resulting from crosses between parents who have different combinations of alleles.
6a/b	How can ideas about trait inheritance help solve real-world problems?	Understanding how parents' chromosomes segregate to make sex cells and unite to produce offspring enables scientists and doctors to reconstruct a family's genetic history for particular traits across multiple generations. It can also answer questions or solve problems related to inherited traits.	In most cases, individuals have two sets of instructions, called *genes*, for any specific trait. They get one set of instructions from each parent. *Alleles* are different forms of the same gene. For certain traits, one allele is dominant and the other is recessive. Each individual has a combination of alleles that determine what a particular trait will look like. If you have a trait controlled by a recessive allele, you must have two recessive alleles, one from your mother and one from your father. If you have a trait controlled by a dominant allele, you could have either two dominant alleles—one from each parent—or a dominant allele from one parent and a recessive allele from the other. A *pedigree* is a helpful tool for tracking specific alleles through several generations of a family.