


Mendelian genetics exceptions worksheet answers

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This photo of a South African family shows some of the variations that exist in the color of human skin. The colour of human skin can vary from very light to very dark with all possible gradations in between. As expected, the skin color trait has a more complex genetic base than a gene with two alleles, which is the type of simple trait that Mendel studied in pea plants. Like skin color, many other human traits have more complicated modes of inheritance than Mendelian traits. These modes of inheritance are called non-Mendelian inheritance and include the inheritance of multiple allele traits, traits with codominance or incomplete dominance, and polygenic traits, among others, all of which are described below. Figure \ (PageIndex{1}\): Family Most human genes are thought to have more than two normal versions or alleles. Traits controlled by a single gene with more than two alleles are called multiple allele traits. One example is ABO blood type. Your blood type refers to which of certain proteins called antigens are found in your red blood cells. There are three common alleles for this trait, which are represented by the letters IA, IB and i. Table \ (PageIndex{1}\): ABO Blood Group Genotype Phenotype IAIA A IAI A IBIBIB B IBi B ii OR IAIB AB As shown in the table below, there are six possible ABO genotypes because the three alleles, taken two at a time, result in six possible combinations. The IA and IB alleles are dominant for the i allele. As a result, both the IAIA and IAI genotypes have the same phenotype, with the A antigen in their blood (type A blood). Similarly, both IBIB and IBi genotypes have the same phenotype, with the B antigen in their blood (B blood type). No antigens are associated with allele i, so people with genotype ii do not have antigens for the ABO blood type in their blood (type O blood). The IAIB genotype in the ABO blood group table. The alleles IA and IB for blood type ABO are neither dominant nor recessive a another one. Instead, they are co-dominant among themselves. Codominance occurs when two alleles of a gene are expressed equally in the heterozygote phenotype. In the case of the ABO blood type, IAIB heterozygots have a unique phenotype, with A and B antigens in their blood (Blood type AB). Another relationship that may occur between alleles for the same gene is incomplete dominance. This occurs when the dominant allele is not completely dominant, so an intermediate phenotype gives rise to heterozygotes that inherit both alleles. Generally, this happens when the two alleles of a given gene produce proteins but a protein is not functional. As a result, the heterozygous individual produces only half the amount of normal protein that a homozygous individual produces for the normal allele. An example of incomplete dominance in humans is Tay Sachs disease. The normal allele for the gene, in this case, produces an enzyme that is responsible for breaking down the lipids. A defective allele for the gene results in the production of a non-functional enzyme. Heterozygous cells that have a normal allele and a defective allele produce half the functional enzyme of the normal homozygous, and this is enough for normal development. However, homozygots that have only defective alleles produce only the non-functional enzyme. This leads to the accumulation of lipids in the brain that starts in the uterus, causing significant brain damage. Most people with Tay Sachs disease die at a young age, usually at the age of five. Many human traits are controlled by more than one gene. These traits are called polygenic traits. The alleles of each gene have a minor additive effect on the phenotype. There are many possible combinations of alleles, especially if each gene has multiple alleles. Therefore, a whole continuum of phenotypes is possible. Figure \ (PageIndex{2}\). Height of Human Adult. Like Other polygenic features, adult height has a bell-shaped distribution. An example example. A polygenic human trait is adult height. Several genes, each with more than one allele, contribute to this trait, so there are many possible heights in adults. For example, an adult may be 1,655 m (5,430 ft) tall and another adult may be 1,656 m (5,433 ft). The height of the adults ranges from less than 5 feet to more than 6 feet, with males slightly taller than females on average. Most people are found about half the height range for their sex, as shown in the graph in Figure \ (PageIndex{2}\). Many traits are affected by the environment, as well as by genes. This may be especially true for polygenic traits. Adult height, for example, may be adversely affected by poor diet or childhood illness. Skin color is another polygenic feature. There is a wide range of skin colors on people all over the world. In addition to differences in skin color genes, differences in exposure to ultraviolet (UV) light cause some of the variations. As shown in Figure \ (PageIndex{3}\), exposure to UV light darkens the skin. Figure \ (PageIndex{3}\): The skin on the lower arm is much darker than the skin protected near the upper arm due to the effects of UV radiation. Some genes affect more than one phenotypic trait. This is called pleiotropic. There are numerous examples of pleiotropic in humans. They usually involve important proteins that are needed for the normal development or functioning of more than one organ system. An example of pleiotropic in humans occurs with the gene that codes for the main protein in collagen, a substance that helps to form bones. This protein is also important in the ears and eyes. Mutations in the gene cause problems not only in the bones, but also in these sensory organs, so it is the pleiotropic effects of the gene. Another example of pleiotropic occurs with sickle cell anemia. This recessive genetic disorder occurs when there is a mutation in the gene that normally encodes the protein in red blood cells Hemoglobin. People with the disorder have two alleles for sickle cell hemoglobin, named after the shape of the sickle (Figure \ (PageIndex{4}\)) that their red blood cells take under certain conditions such as physical exertion. Sickle-shaped red blood cells block small blood vessels, causing multiple phenotypic effects, including retardation of physical growth, certain bone deformities, kidney failure, and stroke. Figure \ (PageIndex{4}\): The sickle-shaped red globule on the left is shown next to several normal red globules for comparison. Some genes affect the expression of other genes. This is called epistasis. Epistasis is similar to dominance, except that it occurs between different genes rather than between different alleles for the same gene. Albinism is an example of epistasis. A person with albinism has practically no pigment on the skin. The condition occurs because of a gene completely different from the genes that encode skin color. Albinism occurs because a protein called tyrosinase, needed for the production of normal skin pigment, is not produced due to a genetic mutation. If a person has an albinism mutation, they will not have any skin pigment, regardless of the skin color genes they inherited. Do you know your ABO blood type? In an emergency, knowing this valuable information could save your life. If you ever need a blood transfusion, it is vital that you receive blood that matches your own blood type. Why If the blood transfused to your body contains an antigen that your own blood does not contain, the antibodies in your blood plasma (the liquid part of your blood) will recognise the antigen as foreign to your body and cause a reaction called agglutination. In this reaction, the transfused red blood cells are grouped together, as shown in the picture below. The reaction agglutination is serious and potentially deadly. Figure \ (PageIndex{5}\): Here are two samples of the same blood. The sample on the left is with anti-B antibodies; The sample on the right is mixed with anti-A antibodies. The agglutination by antibodies against anti-a on the right shows that the sample is blood type. Knowing the antigens and antibodies present in each of the ABO blood types will help you understand which type (s) of blood you can safely receive if you ever need a transfusion. This information is shown in the table below for all ABO blood types. For example, if you have a blood type A, this means that your red blood cells have an antigen an antigen and that your blood plasma contains anti-B antibodies. If you were to receive a type B transfusion or type AB AB, both have antigen B, your anti-B antibodies would attack the blood cells. red transfused, causing agglutination. Table \ (PageIndex{2}\): antigens and antibodies in Abo's blood types Characteristics Type A Type AB Type O Plasma red blood cell antibodies Anti-B Anti-A None Antigens Anti-A and Anti-B antigen in red CA Blood cells An antigen B and B antigens, you may have heard that people with blood type are called universal donors and that people with a blood type AB are called universal recipients. People with O blood type don't have antigens or B in their blood, so if their blood is transferred to someone with a different ABO blood type, it doesn't cause an immune reaction. In other words, they can donate blood to anyone. On the other hand, people with type AB blood do not have anti-A or anti-B antibodies in their blood, so they can receive a blood transfusion from anyone. What type (s) of blood can receive a type AB blood transfusion, and what type (s) of blood can be safely received by those with type O blood? What is non-Mendelian inheritance? Explain why the human blood group ABO is a of a multiple allele trait with codominance. What is incomplete dominion? It gives an example of this type of non-Mendelian inheritance in humans. Explain the genetic basis of human skin colour. How can the human trait? Human? Adult height is influenced by the environment? Define pleiotropy and give a human example. What is the difference between pleiotropy and epistasis? What about the following terms fits better with each trait description? Choose only the thormer that best suits each feature. (Codominance, Traci3n Allele Multiple; Mendelian Trait, Polygildic Tracing) Trait controlled by four genes. A trait in which each allele of a heterozygous makes a contribution equal to the phenotype. Trait controlled by a unique gene that has three different versions. Trait controlled by a single gene in which an allele is totally dominant to the other allele. People with blood of type AB have: anti-A anti-A and anti-B anti-B anti-B anti-B anti-B antitudes. People with blood type or can not receive a blood transfusion of any other person who is not blood of type or true or false. People with blood type or can be heterozygous by this trait. To learn more about the non-Mendelian inheritance, check out this video: Video:

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