DOWNLOAD PDF HOW TO SOLVE GENETICS PROBLEMS

Chapter 1 : Lab 5: Mendelâ€™s Laws: Their Application to Solving Genetics Problem

Solving Genetic Problems What is a Genetic Problem? A genetic problem is a type examination question that involves both a knowledge of Mendel's experiments, and an analysis of data produced during.

Below is a sampling of Punnett Square problems that you will be expected to solve. In order to do this, you will have to understand the meaning of the terms below. The letters that make up the individual. TT or Tt Phenotype: The physical characteristics of the particular trait. Tall or short Dominant trait: Signified by capital letter-E. If the traits you are using are dominant or recessive, this trait will "overpower" the recessive trait and will be expressed. Signified by small case letter-e. An organism with a recessive allele for a particular form of a trait will have that form only when the dominant allele for the trait is not present Homozygous: Also known as true breeding. Individuals genotype is homozygous and will only make one type of gamete. Represented by letter N meaning they are haploid-contain half the chromosomes P generation: The parental generation Usually the first one in a genetic cross F1 generation: Latin for "son" F2 generation: Latin for "son" Monohybrid Cross: Also known as a Single-Factor Cross. Only one trait is used in the genetic cross. Tt x Tt Dihybrid Cross: Also known as a Two-factor Cross. Two trait are used in the genetic cross. One allele is not completely dominant over the other. There is a blending with the heterozygous offspring. Both alleles contribute to the phenotype. Offspring will have combination of two alleles. Genes located on the sex-chromosomes called sex-linked genes. Usually found on the X chromosome. X-linked alleles are always expressed in males because males have only one X chromosome. There are more than two-choices for the allele. Example is human blood group genes. There are three possible alleles for this gene. IA, IB, and i. IA and IB are co-dominant. There are four possible phenotypes: A, B, AB, and O. The ratio of different genotype in the offspring from a genetic cross. The ratio of different phenotypes in the offspring from a genetic cross. Cross two heterozygous Tall pea plants. Give genotypic and phenotypic ratios. Determine what kind of problem you are trying to solve. Is it a monohybrid or dihyrid? In this case there is only one trait Determine letters you will use to specify traits. In this case it is dominant and recessive, so you can use T and t. In this case you were told the parents were heterozygous. You therefore know that the parents must be Tt and Tt The Cross is: Make your punnet square and make gametes these go on the top and side of your punnett square. Complete cross and determine possible offspring. Determine genotypic and phenotypic ratios. Make a list of all the different genotypes the letter combinations and determine how many of each you have. In your problem this would be: The genotypic ratio would therefore be 1: Make a list of all the different phenotypes physical characteristics. In you problem this would be: The phenotypic ratio would therefore be 3: Cross two heterozygous plants. The tall gene is this plant is incompletely dominant over the short gene. In this case it is a incomplete dominant problem. The phenotypic ratio would therefore be 1: Cross two heterozygous tan cows. Cross a female carrier for hemophilia with a male with hemophilia. In this case it is a sex-linked problem. Remember that XX is female, and XY is male. Normally you would not write the capital letters on the genotypes, only the small case the recessive gene responsible for the disorder STEP 3: In this case you were told the parents were: The females gametes always go on top of the punnett square and the males on the side. The phenotypic ratio would be 1: Cross a person with type AB blood with a person who is heterozygous for type A blood. Cross two heterozygous Tall Black cows. Tall is dominant over short, and Black is dominant over white. Give genotypic and phenotypic ratios of offspring. In this case there are two traits In this case there are two traits you will need letters for. In this case you were told the parents were heterozygous for both traits. The phenotypic ratio would therefore be 9: The genotypic ratio would therefore be 4: The phenotypic ratio would therefore be 4: I do not intend your child to visit any pages beyond those to which I have provided specific links.

Chapter 2 : How to solve genetic linkage problems

A supplement for any genetics book, this guide gives readers thorough instruction and practice for solving genetics problems. Using callout comments, the author walks readerse through the process of breaking down word problems by dissecting each sentence.

Two Drosophila with normal wings are crossed. Among progeny, 88 have normal wings and 35 have Among progeny, 88 have normal wings and 35 have "dumpy" wing. What inheritance pattern is shown by the normal and "dumpy" alleles? What were the genotypes of the two parents? If a dumpy-winged female from above is crosses with her father, how many normal-winged flies will be expected among 80 offspring? In human beings, brown eyes are dominant over blue eyes. Suppose a blue-eyed male marries a brown-eyed woman whose father was blue-eyed. What proportion of their children would you predict will have blue eyes? How many unique gametes can organisms with each of the following genotypes produce? In tomato plants, the gene for purple stems A is dominant to its allele for green stems a and gene for red fruit R is dominant to its allele for yellow fruit r. If two tomato plants heterozygous for both traits are crossed, what proportion of the offspring are expected to have: In tomato plants, what would be the expected genotypic and phenotypic frequencies if a heterozygous purple stemed, yellow fruit bearing plant was crossed with a green stemed, heterozygous red fruit bearing plant. In sesame plants, the one-pod condition P is is dominant to the three-pod condition p , and normal leaf L is dominant to wrinkled leaf l. These traits are inherited independently. Determine the genotypes for the two parents for all possible matings producing the following offspring: A peony plant with straight stamens and red petals was crossed with another plant having straight stamens and streaky petals. The seed were collected and germinated, and the following offspring were obtained: Which allele in each pair straight vs. What were the genotypes of the parental plants? What further crosses would you have to make in order to get a definate answer for part a? In some flowers, a true-breeding, red flowered strain gives all pink flowers when crossed with a white-flowered strain: Flower position is determined by the dominant axial base of the branch gene A and the recessive terminal tip of the branch gene a. What will be the ratios of phenotypes and genotypes of the generation resulting from the following cross: Axial-red homozygous X terminal-white? What will be the ratios in the F2 generation? Pooh had a colony of tiggers whose stripes went across the body. His American pen-pal, Yogi, sent him a tigger whose stripes ran lengthwise. When Pooh crossed it with one of his own animals, he obtained plaid tiggers. Interbreeding among the plaid tiggers produced litters of a majority of plaid members, but some crosswise- and lengthwise-striped animals were also produced. Diagram the crosses made Pooh, showing the genotypes of the tiggers which account for the coat patterns observed. In cattle, the gene for straight coat S is dominant to its allele for curly coat s. If a curly red cow is mated to a homozygous straight white bull, what will the genotype and phenotype of the calf be? If the calf is mated to a roan animal with curly hair, what are the possible phenotypic ratios? Blood typing is often used as evidence in paternity cases, when the blood type of the mother and child may indicate that a man alleged to be the father could not possible have fathered the child. For the following mother and child combinations, indicate which blood groups of potential fathers would be exonerated. Use the pedigree at the right to determine when possible the genotypes of the individuals indicated.

Chapter 3 : Monohybrid Cross Problem Set

Description. A supplement for any genetics textbook, this guide gives students thorough instructions for solving genetics problems. Using callout comments, the author walks students through the process of breaking down word problems by dissecting each sentence.

What types of offspring might be produced by a cross between two spotted animals? Types of offspring in the F2 generation of a dihybrid cross: Determine what traits are dominant and which are recessive. Often you must marshal background knowledge to do this â€" which may not be explicitly mentioned in the problem. Are any letters assigned to the genes? If not, make some up. We usually take the dominant characteristic and use the first letter of that word. For example, if polydactyly extra fingers is dominant over the normal fiveâ€"fingered condition , we would pick P for the dominant gene, and small p for the recessive normal allele. Determine, if possible, the genotypes of the parents. In 9 out of 10 problems this information is given, or at least implied. Sometimes you have to deduce it from other information given. Write it down so that you can remember what it is, e. Determine all the possible kinds of gametes that can be made by each parent. Be careful, remember that a gamete can ordinarily receive only one gene of a pair of alleles. This is the part that most people have trouble with! Make a Punnett square, using each of the gametes for one parent across the top of each column, those of the other parent go vertically. Work the cross carefully. Now read the problem again. Find out exactly what it is asking for. This is another place where many people get lost. In most problems, these steps should get you through adequately. Some are slightly altered â€" for example, if the genotype of one of the parents is unknown, and that is what the problem wants you to discover. Put the offspring genotypes in the square and work backward. Finally, the actual genetic information you need to solve these problems often appears concealed rather than revealed by the wording of the problem. Notice that, in this kind of a problem you may need to solve several subsidiary problems before you can proceed with the final solution. How would you explain this in the light of the facts expounded by Mendel? These children would be carriers and when marrying another carrier or a homozygous recessive person, the recessive phenotype could reappear. Aa x Aa produce AA, Aa and aa. A study of family pedigrees shows that a person never has woolly hair unless at least one parent also has woolly hair. How would this character most likely be inherited? Dominant traits do not skip generations. Only one dominant allele is required for expression in the phenotype. Since woolly hair only occurs when one parent has it too, it is due to a dominant allele not a recessive one. In Holstein cattle the spotting of the coat is due to a recessive gene while a solidâ€"coloured coat is dominant. Show how you reach your conclusion. The gene P is responsible for coat pattern. Let P be the dominant allele for a solid coloured coat. Let p be the recessive allele for a spotted coat.

Chapter 4 : How to Solve Punnett Squares

Help with basic genetics problems, including the use of the Punnett square and rules of probability to solve monohybrid, dihybrid and even - wait for it - YES, the dreaded trihybrid cross!

How to solve genetic linkage problems Details SHARE Genetic Linkage Definition In the end of nineteenth century as a result of technological progress was be significantly increased the optical characteristics of microscopes, and was also significantly improved cytological research methods. This allowed scientists to make a series of important discoveries. They drew attention to the striking similarity between the behavior of chromosomes during the formation of gametes and fertilization, and scheme of inheritance of genetic factors, that Mendel described. On the basis of these data has been formulated the chromosome theory of inheritance. According to this theory a pair of factors localized in a pair of homologous chromosomes, and each of these chromosomes is carrier of one factor. Later, the term factor, which mean the basic unit of heredity, has been replaced by the term - gene. Thus we can say that genes, that located in the chromosomes, is the physical unit, through which the hereditary traits transmitted from parents to offspring. Each gene is represented in homologous chromosomes as a pair of alleles, which located in one locus, which means in the same place in these chromosomes. Now it was possible to explain the basic laws of inheritance in terms of the chromosome theory, as the characteristics of chromosomes motions during meiosis. Segregation of homologous chromosomes that occurs during anaphase 1 of meiosis and random distribution of alleles between the gametes is the basis for explanation of first law - Law of Segregation. And the independence of the segregation nonhomologous chromosomes during anaphase 1 of meiosis is the basis of the second law - the Law of Independent Assortment. However, it is absolutly clear that every organism has a large number of traits and this quantity can be considerably greater than the number of chromosomes in haploid set. This is especially noticeable for species with a small number of chromosomes. For example number of chromosomes in haploid set in pea equal to 7, in rye is also equal to 7, fruit fly 4, and in roundworm 1. Then it is obvious, that in each chromosome must be located genes that determine the development at least a few different traits. Such genes are called linked and the number of linkage groups is equal to the number of chromosomes in the haploid set. Genetic Linkage Calculator In the genetic calculator, for designation of genetic linkage in the parental genotypes notation, the linked genes must be concluded in brackets. For dihybrid there are two possible localization of dominant and recessive alleles in the chromosomes. In the first case, the dominant alleles are localized in one of the pair of homologous chromosomes and recessive in the other - AB ab. This variant of alleles localization is called cis-position. In the second case the dominant and recessive alleles of a gene localized in different homologous chromosomes - Ab aB. This variant of localization is called trans-position. The difference in the ratio of phenotypes in the offspring for Mendelian inheritance and genetic linkage can demonstrated in the test crossing. In this crossing the number of types of gametes is equal to the number of phenotypic classes in the progeny. In the case of independent inheritance the genotype AaBb will give the four types of gametes AB, Ab, aB and ab with the ratio 1: In the case of a genetic linkage genotype AB ab can give only two types of gametes AB and ab. Accordingly, by crossing the individuals with the genotype AB ab and ab ab , we obtain two classes of phenotypes AB and ab with the ratio 1: Genotype Ab aB will also give two types of gametes Ab and aB. And by crossing parents with genotypes Ab aB and ab ab , we also obtain two classes of phenotypes Ab and aB with ratio 1: As you can see in both cases of genetic linkage. But such results can be obtained only in the case of complete linkage. Typically, complete linkage is quite rare. The fact is that during meiosis, homologous chromosomes can exchange of regions with each other. This process is called crossing-over or genetic recombination. In the process of genetic recombination, the alleles, which located in linkage group in the parents, can segregate and give the new combinations in the gametes. Phenotypes, which are obtained from these gametes are called recombinants or crossovers. Thus, the progeny will be not two but four phenotype, as in the independent inheritance. But for linked inheritance the ratio will be different. Classes with the parental phenotypes will be form the bigger part of offspring, and the recombinant classes - smaller part. For example, for the genotype AB ab will be more offspring with

phenotypes AB and ab and less with phenotypes Ab and aB, and for genotype Ab aB vice versa. The exact phenotype ratio will depend on the distance between genes. The farther away from each other located linked genes, then greater the probability, that crossing-over occurs between them. Thus, the frequency of crossing-over or recombination can be a measure for determination of the distance between genes. If the single crossing-over occur between genes and we known the amount of crossovers, then the distance between the genes can be calculated by the formula: In the examples that you see below, we will use the Crossing Over Map Calculator to calculate the distance between genes and the Genetic Calculator for modeling genetic crosses with genetic linkage. It is important to note that Crossing Over Map Calculator can give correct results only for test crosses. It can be divided into two parts - in the part "Genes and phenotypes" you can enter the required data, and in the right - "Results" is shown the results of the calculations. Since we are going to consider examples for two linked genes, then you should switch it to "Two Genes". And the specifications of genetic problems solution for the three linked genes will be considered later. Algorithm for data entry will look like this: The program automatically fills the first column in the second table by all possible combinations of phenotypes. For examples with the two linked genes you can get the following results on the right side: This distance takes into account the effect of interference and possible double crossovers. Based on the parental genotypes you can judge about genes localization - is they in cis- or trans- position. In tomato genes that determine the height of the plants - T tall and t dwarf and the shape of the fruit - S round and s pear-shaped , located in one chromosome, ie they are linked. If we cross the homozygous plants with genotypes TTSS and ttss, it is also, as in the case of independent assorment, all the offspring will have the same phenotype. In this case, all the plants were high, with rounded fruits and have genotype TtSs. As a result of test cross, when these plants are crossed with homozygous recessive plants ttss , was be obtained in the offspring 40 tall plants with round fruits, 40 dwarf plants with pear-shaped fruits, 10 tall plants with pear-shaped fruits, and 10 dwarf plants with round fruits. If the genes linkage was be complete, then in the offspring would be only tall plants with round fruits and dwarf plants with pear-shaped fruits in equal proportions, and if the genes were not linked, then the ratio of phenotypes would be 1: Thus we can say that in this case between the linked genes occurs crossing over, which gives a new recombinant phenotypes. Toggle Radio Button in "Two Genes". Write the dominant and recessive alleles of genes in the first table: T S s Get the combination of phenotypes in the first column of the second table and write the amount of plants for each phenotype:

Chapter 5 : Simple Genetics Practice Problems

This is a fine book for understanding patterns that can be found in all aspects of genetics from Mendelian inheritance to DNA to cell division and chromosomes.

Tail spikes are dominant to plain tails. Set up the square for each of the crosses listed below. The trait being studied is round seeds dominant and wrinkled seeds recessive Rr x rr What percentage of the offspring will be round? A TT tall plant is crossed with a tt short plant. What percentage of the offspring will be tall? A Tt plant is crossed with a Tt plant. What percentage of the offspring will be short? A heterozygous round seeded plant Rr is crossed with a homozygous round seeded plant RR. What percentage of the offspring will be homozygous RR? A homozygous round seeded plant is crossed with a homozygous wrinkled seeded plant. What are the genotypes of the parents? In pea plants purple flowers are dominant to white flowers. If two white flowered plants are cross, what percentage of their offspring will be white flowered? A white flowered plant is crossed with a plant that is heterozygous for the trait. What percentage of the offspring will have purple flowers? Two plants, both heterozygous for the gene that controls flower color are crossed. What percentage of their offspring will have purple flowers? In guinea pigs, the allele for short hair is dominant. What genotype would a heterozygous short haired guinea pig have? What percentage of the offspring will have short hair?

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Chapter 6 : Probability in Genetics â€" bozemanscience

Using Statistics to Solve Genetics Problems â€¢ For a monohybrid cross, a Punnet square is quick and easy. For 2 or 3 traits (or more), those squares get big and ugly REAL fast.

In the question the solver is presented with information concerning the genotypes and phenotypes of individuals involved in a genetic cross, and the genotypes and phenotypes of their offspring. A red flowered plant is fertilized with pollen from a plant of unknown phenotype. What was the phenotype and genotype of the unknown parental plant? What you should know already Flower color is controlled by a single gene. The dominant form of this gene is often written R When ever the R gene is present in the genotype of a plant, the flower color is always red. The mutant form of this gene, which is recessive, is often written r. Plants with the genotype RR or Rr have red flowers. Plants with the genotype rr have white flowers. Take this information and write it out in a logical sequence as it appears in a typical genetic cross. See what you have and what is missing. Phenotypes and Genotypes of parents Parental Genotypes The pollen grains used in this cross came from the unknown plant, and the egg cells came from the red flowered plant. The pollen grains contain the male gametes, and the egg cells in the red flowered plant are the female gametes. At least half the gametes must have been R for the plant to have red flowers. In classical one factor and two factor crosses, there are only three ratios that matter. Heterozygous x Heterozygous which gives a ratio of 3: Heterozygous x Homozygous recessive which gives a ratio of 1: Heterozygous x Heterozygous two factors Aa. Bb which gives a ratio of 9: There are, of course, other combinations of genes, but their results can usually be reduced to one or other of these ratios. If you learn know or even understand how these ratios arise during a genetic cross, you can often go straight to the final answer in many genetic problems. Even if it is not possible to deduce the correct answer directly from these ratios, they are valuable clues. In the example we have worked on so far

Chapter 7 : Punnett square practice and examples

HOW TO SOLVE GENETICS PROBLEMS 1. Read the problem. 2. Determine what traits are dominant and which are recessive. Often you must marshal background knowledge to do this - which may not be explicitly mentioned in the problem.

Chapter 8 : Nickla, How To Solve Genetics Problems | Pearson

*Applying these rules to solve genetics problems involving many genes. If you're seeing this message, it means we're having trouble loading external resources on our website. If you're behind a web filter, please make sure that the domains *calendrierdelascience.com and *calendrierdelascience.com are unblocked.*

Chapter 9 : Punnett Squares

Solutions to Genetics Problems that are reasonable, and strategies that you can use to solve any genetics problem. The value of this chapter depends on you. In.