

Lab #10 – Concepts of Biology: Manual of Laboratories and Review Activities

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Below are some representative simple genetics problems that you should be able to solve. Note that problems involving dihybrid inheritance are not included, since it the objective of the course is only introduce the principle behind this topic. When doing problems, remember to show your work so that you can get partial credit! For each problem, list the key (what letters you are using and what each stand for – i.e. B = individual with brown eyes; b = individual with blue eyes); the parents genotype (if applicable) and the phenotypic results (if applicable).

1. If a man homozygous for widow's peak (dominant) reproduces with a woman homozygous for continuous hairline (recessive), what are the chances of the children having a widow's peak? A continuous hairline? **KEY:**

Male: _____

1) Chance of having a child with a widow's peak?

Female: _____

2) Chance of having a child with a continuous hairline?

2. A son with cystic fibrosis is born to a couple who neither has cystic fibrosis. Cystic fibrosis is inherited as an autosomal recessive disease. What are the chances that any child to this couple will have cystic fibrosis? **KEY:**

Male: _____

1) Chance of having a child with cystic fibrosis:

Female: _____

3. Huntington's disease is a caused by a dominant allele found on autosome (not a sex chromosome). A man who is heterozygous for Huntington's disease reproduces with a woman who does not have the disease. What are the chances that a child will inherit the allele for Huntington's disease? If the child does inherit the allele, what are the chances that she or he will pass it on?

KEY:

Male: _____

1) What are the chances that a child will inherit the allele for Huntington's disease?

Female: _____

2) If the child does inherit the allele, what are the chances that she or he will pass it on?

4. In humans, the ability to taste phenylthiourea (PTU) is dominant. “Tasters” perceive a bitter taste from PTU, while “non-tasters” experience no bitter taste.
What are the genotypes of Mr. and Mrs. Coleman who can both taste PTU, and who have three children, one of who is a non-taster?

KEY:

Male: _____

Female: _____

What is the genotypes of the child that is non-taster?

What offspring phenotypes (give %'s or fractions) would be expected from the following crosses?

Homozygous taster x heterozygote

Parents: _____

Offspring phenotypes:

Heterozygote x non-taster

Parents: _____

Offspring phenotypes:

5. Coat colors of the Shorthorn breed of Cattle represent a classical example of codominant alleles. The red allele and white allele are codominant which results in cattle with roan color when both alleles are present. If roan Shorthorns are crossed among themselves, what phenotypic results are expected in the offspring?

KEY:

Parents: _____

Offspring phenotypes?

6. Human eye color was once thought to be controlled by a single gene: Brown (B) dominant over blue (b). It is now known that eye color is polygenic. Assuming simple Mendelian inheritance (one gene – not polygenic), can a brown eyed parents have a blue-eyed child? Explain.

Explain:

Male: _____

Female: _____

Again, assuming simple Mendelian genetics, would it be possible for blue-eyed parents have a brown-eyed child? Explain.

7. Brown fur is dominant to white fur in mice. A mouse with brown fur (Mouse 1) is mated with a white furred mouse (Mouse 2) and all ten of the offspring had brown fur. When Mouse 3 (also brown phenotype) was mated with Mouse 2 (white fur), some of the offspring had white fur. Determine the probable genotype of each of the mice.

Key:

Mouse 1: _____

Mouse 2: _____

Offspring Phenotypes?

Mouse 1: _____

Mouse 2: _____

Offspring Phenotypes?

From above:

If a male from the first litter was mated with a brown furred female mouse from the second litter, what phenotypic ratios might be expected among the offspring?

Male: _____

Female: _____

Offspring Phenotypes?

What would the expected results be if a male from the first litter were mated with a white furred female from the second litter?

Male: _____

Female: _____

Offspring Phenotypes?

8. In radish plants, the shape of the radish may be long (LL), round (ll) or oval (Ll). If oval is crossed with oval, what proportion of the offspring will also be oval? What genetic property do the L and l alleles exhibit?

Parents: _____

Genetic property? _____

% of oval offspring?

9. A man has type AB blood. What is his genotype? _____
Could this man be the father of a child with type B blood? _____
If so, what blood types could the child's mother have? _____
(Proof each possibility with a Punnett square, circling the child with B blood— add more Punnett squares if necessary)

10. In fruit flies, the gene that controls eye color is on the X chromosome. Red eye color is dominant to white colored eyes. What are the expected phenotypic results if a heterozygous female is crossed with a male with white eyes?

Phenotypic results:

Male: _____

Female: _____

11. Hemophilia is also a recessive, sex linked trait. What are the expected phenotypic results among the children of a woman who does not have hemophilia but her dad, and whose husband is non-hemophilia?

Phenotypic results:

Male: _____

Female: _____

12. Red green color blindness in humans is a sex-linked recessive trait.
In a very large family in which all the daughters have normal vision and all the sons are color-blind, what are the probable genotypes of the parents? Show work.

13. A phenotypically normal male and a phenotypically normal female have five children – Two fraternal twin boys and three girls. One of the boys has hemophilia.

What are the probable genotypes of all individuals in this family?

KEY:

Male: _____

Female: _____

Son with hemophilia: _____

Son without hemophilia: _____

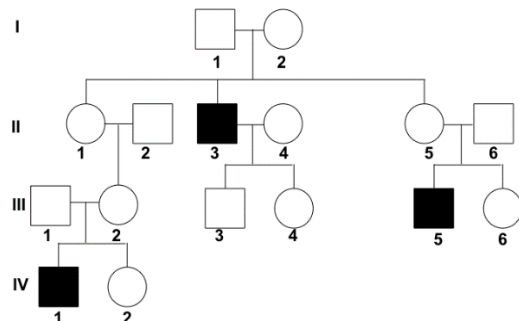
Daughters: _____

What is the probability that any one daughter has hemophilia?

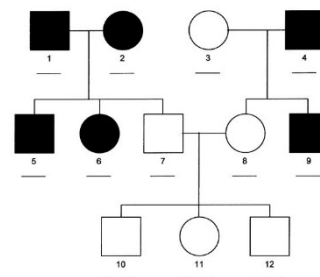
What is the probability that any one daughter is a carrier?

14. Explain the inheritance pattern (i.e. – autosomal dominant; autosomal recessive; sex-linked dominant; sex-linked recessive) for each of the pedigrees show below:

A.



B.



15. The gene associated with color blindness is recessive and is located on the X chromosome. John married Joan and had 3 children, one boy and two girls. The boy, Andy, who is the oldest, was colorblind. The youngest child, Nora, married George and they had 3 boys, none of whom were colorblind. The middle child, Rose, married Rob and they had 4 children (2 boys followed by 2 girls). The oldest boy (Chris) was colorblind; the second boy (Jim) was not. The older daughter, Marilyn, was not colorblind but the youngest daughter (Joy) was. Draw a pedigree for this family. Write the name of each person on the pedigree. List the probable genotypes (or put them on the pedigree) for each individual. For individuals where their phenotype was not given, you will need to figure that out based on the children/parents. Shade them in on the pedigree if you determine that they are colorblind. Attach additional paper as necessary.