Advisement Teacher & Room #_____

Student Name_____Tutor:_____ *Biology Tutorial #11*

Biology Teacher's Name_____Period_____

CA State Standard 2g – Students know how to predict possible combinations of alleles in a zygote from the genetic makeup of the parents. 3a - Students know how to predict the probable outcomes of phenotypes in a genetic cross from the genotypes of the parents and mode of inheritance (autosomal or X-linked, dominant or recessive). 3b - Students know the genetic basis for Mendel's laws of segregation and independent assortment.

Read the summary and complete the following activity questions.

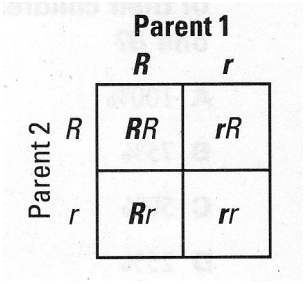
Allele Separation in Parents

Normal body cells are **diploid:** They contain two sets of **homologous chromosomes.** Homologous chromosomes are chromosomes that are similar but not identical. They contain the same sequence of genes, but each chromosome may have different **alleles,** or versions of those genes.

During meiosis, homologous chromosomes are separated and placed in different sex cells, or **gametes.** Each gamete contains only one allele for any particular trait. If the two alleles are the same, they are described as **homozygous.** If the two alleles are different, they are described as **heterozygous.** If the makeup of an individual's alleles for a trait, its **genotype,** is known, we can predict how likely it will be that those alleles will appear in its offspring, or its **phenotype**.

Predicting Zygote Genotypes

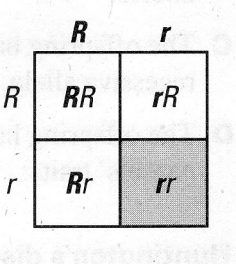
Punnett squares are a convenient method of calculating genetic probabilities. The square is a grid of boxes that represent all of the possible genotypes the progeny of a particular cross may have. Parental alleles are placed by each box on the axes of the grid. In the diagram, both parents have one *R* allele and one *r* allele. The number of squares with each genetic combination corresponds to the ratio of those genotypes in the offspring.



When two organisms mate, they each donate half of their **alleles,** or copies of each gene, to their offspring. Because the parents' alleles are randomly separated into gametes, scientists use probability and Punnett squares to predict how likely it is that the offspring will inherit certain traits.

Calculating Probability of Inheritance

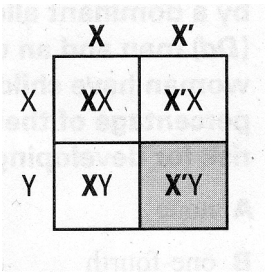
Every organism of a species has the same number of alleles. Half of these alleles come from one parent and half from the second parent. This collection of alleles makes up the organism's **genotype.** The traits an organism expresses make up its **phenotype.** A phenotype can be predicted if you know which trait is dominant and which is recessive.



Dominant and Recessive

Two alleles of the same gene interact to produce phenotypic traits. When one version of an allele is expressed over another, the expressed allele is called **dominant.** The allele that is not expressed is called **recessive.**

Genes on the sex chromosomes can also contribute to phenotype. Only males have a Y chromosome, so genes on the Y **chromosome** are only expressed in males. Both males and females have at least one X chromosome, so genes on the **X chromosome** affect traits in both sexes. Because females have two copies of the X chromosome, they inherit X-linked alleles in the same way as genes described above, from their mother. Because males have only one X chromosome, all X-linked alleles—whether dominant (X) or recessive (X')—are expressed in males. Females that have one recessive X-linked allele (X'X) will pass the recessive allele to half of their children, but only sons will express it, as the Punnett square shows.



1. Explain the term Phenotype:

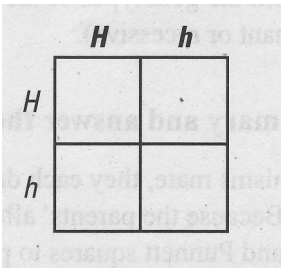
2. Explain the term Genotype:

3. Which parent contributes an X chromosome to male offspring?
   a) the father b) the mother c) either the father or the mother d) both the father and the mother

4. Suppose you have two pea plants, one with green peas and one with yellow peas. After you cross the two plants, you find that all of the offspring have green peas. What can you conclude from observing these phenotypes?
   a) The offspring have only dominant alleles.
   b) The offspring have only recessive alleles.
   c) The offspring have a dominant and a recessive allele.
   d) The offspring have a mixture of their parents' traits.

5. Huntington's disease is a genetic disease that causes cells in the brain to die. Suppose it is caused by a dominant allele. If an affected (Dd) man and an unaffected (dd) woman have children, what percentage of their offspring are at risk for developing the disease?
   a) none b) one-fourth c) one-half d) all

6. Suppose that the genotype *HH* produces an individual with a curly hair phenotype. *Hh* produces individuals with a curly hair phenotype. And *hh* produces individuals with a straight hair phenotype. If the two individuals represented in the Punnett square (right) were to mate, what percentage of their offspring will have straight hair?
   a) 0% b) 25% c) 50% d) 100%



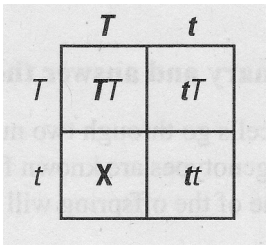
7. The *SRY* gene controls testicular development and is only found in males. Which chromosome is it most likely found on?
   a) Y chromosome b) X chromosome c) both X and Y chromosomes d) neither X nor Y chromosome

8. In moths, the gene for dark wings (D) is dominant to the gene for light wings (d). If a homozygous dark moth *(DD)* is crossed with a heterozygous dark moth (Dd), which combination of alleles will be most common among the offspring?
   a) DD b) Dd c) dd d) DD and Dd are equally common.

9. The letters inside the grid boxes of a Punnett square represent the
   a) genotypes of the parents c) phenotypes of the parents
   b) genotypes of the offspring d) phenotypes of the offspring.

10. The gene for brown eyes (B) is dominant to the gene for blue eyes (b). If a pair of individuals that are heterozygous for brown eyes (Bb) have children, what proportion of their children will have at least one B?
   a) 100% b) 75% c) 50% d) 25%

11. In the cross to the right, which combination of alleles will be found in the box marked X?
   a) TtTt b) tt c) TT d) Tt



12. In a Punnett square, the letters on the outside of the grid represent the
   a) parent's alleles b) parent's traits c) offspring's alleles d) offspring's traits.