

Genetics Problem Set #3: Incomplete Dominance and Codominance

Incomplete Dominance

1. A cross between a black bird and a white bird produces all gray offspring.

Black = (B); white = (B')



A) What are the genotypes of the parents? _____ and _____

B) What are the genotypes of the offspring? _____

C) Cross 2 gray birds and give the phenotypes of the offspring. _____ →

Phenotype ratio of offspring _____

2. In some mice, the allele for brown hair is incompletely dominant over white hair. Heterozygous individuals have **TAN fur.**

Brown = (R) white = (R')



A) Cross a white mouse with a brown mouse to obtain the F₁ generation.

> F₁ generation genotype ratio: _____

> F₁ generation phenotype ratio: _____

B) Now cross 2 individuals from the F₁ generation to get the F₂ generation.

> F₂ generation genotype ratio: _____

> F₂ generation phenotype ratio: _____

3. In snapdragon flowers, the allele for RED (R) flowers shows incomplete dominance for the allele for white (R') flowers. Heterozygous plants (RR') produce pink flowers. Perform the following crosses.

A) Pink flowering plant crossed with a white flowering plant:

> Offspring genotype ratio: _____

> Offspring phenotype ratio: _____



B) Red flowering plant crossed with a pink flowering plant:

> Offspring genotype ratio: _____

> Offspring phenotype ratio: _____

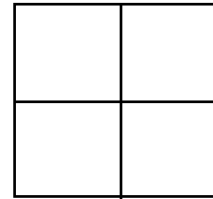
CODOMINANCE

4) In cattle, the alleles for red coat (R) and white coat (W) behave as codominant alleles. Both red and white hairs are produced in the heterozygote producing a coat pattern that is called "roan."

A. Give the phenotypic and genotypic ratios to be expected among the offspring from a cross of two roan animals.

> Genotype ratio: _____

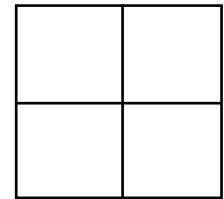
> Phenotype ratio: _____



B. What are the expected genotypic and phenotypic ratios from a cross of a roan animal and a white one?

> Genotype ratio: _____

> Phenotype ratio: _____



5) A cross between a black cat (B) and a tan cat (T) produces a tabby pattern (*black and tan fur together*).

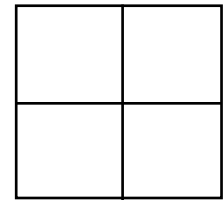
A) Why does this illustrate **CODOMINANCE**? _____

B) Write the genotypes for each of the following phenotypes:

→ black fur: _____ → tan fur: _____ → tabby fur: _____

C) Show the cross between a tabby cat and a black cat. →

→ What percentage of the offspring are tabby cats? _____



6) If there are genes that have more than 2 alleles, this is known as _____

> Give an example of this _____

7) If a trait is controlled by 2 or more genes, this is known as _____

> Give an example of this _____

8) How many alleles for any given trait can one person have? _____

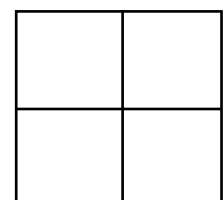
MORE CODOMINANCE: HUMAN BLOOD GROUPS!

RECALL: In humans type A blood is caused by the antigen A in the red cells resulting from gene A.
Type B is caused by a gene B for antigen B.
Type O blood results from the absence of either gene.
The presence of both genes causes both antigens to be formed resulting in type AB blood.

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies present	Anti-B	Anti-A	None	Anti-A and Anti-B
Antigens present	A antigen	B antigen	A and B antigens	No antigens

9) If a person of blood group AB marries one belonging to blood group O what are all of the possible blood groups of their children?

> all possible blood groups of their children: _____



10) If one parent has Type A blood and the other has **type B, but all four types are represented among the offspring, what must be the genotypes of the parents?** Support your answer by completing the Punnett Square:

→ Parent Genotypes: _____

11) If both parents are type A but $\frac{3}{4}$ of their children are type A and $\frac{1}{4}$ of the children are type O, **what are the parent's genotypes?** Support your answer by completing the Punnett Square:

→ Parent Genotypes: _____

12) **What genotypes must the parents be** if one has type AB blood and the other type B, but their children are $\frac{1}{4}$ A, $\frac{1}{4}$ AB and $\frac{1}{2}$ type B? Support your answer by completing the Punnett Square:

→ Parent Genotypes: _____

13) In a case of disputed paternity, the mother belongs to group B, the child to O, one possible father to A and the other to AB. **Which one is the true father of the child?** Support your answer by listing the genotypes of each individual and complete a Punnett Square for the mother with each potential father:

→ mother's genotype: _____

→ child's genotype: _____

→ possible father #1: _____

→ possible father #2: _____

14) Mrs. Doe and Mrs. Roe had babies at the same hospital at the same time. Mrs. Doe took home a girl and Mrs. Roe a boy. Mrs. Roe was sure that she had had a girl and brought suit against the hospital. Blood tests showed that Mr. Roe was type O, Mrs. Roe was type AB, Mr. and Mrs. Doe were both type B. The baby girl was type A and the boy was type O. **Had an exchange in the babies occurred?** Support your answer by completing a Punnett Square for Mr. and Mrs. Roe and for Mr. and Mrs. Doe.



Mr. and Mrs. Roe:

Mr. and Mrs. Doe:

→ Mr. Roe's genotype: _____

→ Mrs. Roe's genotype: _____

→ Mr. Doe's genotype: _____

→ Mrs. Doe's genotype: _____

→ Baby girl's genotype: _____

→ Baby boy's genotype: _____

Had an exchange of babies occurred? _____

15) What are ALL POSSIBLE blood types of children in the following families? (HINT: Consider all possible genotypes for the parents before doing the cross)

(a) Type A mother, Type A father

→ all possible blood types of children: _____

(b) Type A mother, Type AB father

→ all possible blood types of children: _____

(c) Type AB mother, Type AB father

→ all possible blood types of children: _____

(d) Type A mother, Type B father

→ all possible blood types of children: _____

CHALLENGE DIHYBRID CROSS PROBLEM:

Consider the following 2 traits in the alien species of “borgs”:

(1) Antenna length exhibits INCOMPLETE DOMINANCE, so that when an alien with LONG antennae (L) is crossed with an alien with short antennae (L'), the offspring (LL') show antennae of intermediate length.

(2) Skin color exhibits CODOMINANCE, so that a blue-skinned alien (B) and a green-skinned alien (G) will produce offspring with blue and green spotted skin!

Perform the following cross and answer the questions that follow:

Goroo, a male borg with long antennae and blue-green spotted skin, falls in love and marries Leera, a female borg with intermediate-length antennae and blue-green spotted skin. Complete the Punnett Square below:

Parents' gametes				



A) What is the phenotype ratio in Goroo and Leera's offspring?

B) What is the probability they will have a baby alien with:

-long antennae / green skin? _____

-short antennae / blue skin? _____

-medium antennae / blue skin? _____

-short antennae / spotted skin? _____

-long antennae / spotted skin? _____

-medium antennae / spotted skin? _____