Assignment 9

1. Essay (3 points)
Read the descriptions of alternate sex determination systems, then write a short essay that answers the following questions:

a) The ZW system of sex determination
What animals (or animal groups) have ZW sex determination? How does this differ from the human system?

b) Temperature-dependent sex determination
How are male turtles produced in this system? (Indicate one of the two common ways.)

2. Multiple-choice (1 point)
In humans, the gene for red-green color vision is located on the X chromosome with no corresponding gene on the Y. The defective allele is recessive and causes red-green colorblindness.

Fill in the Punnett square for a marriage between a man and a woman, both with normal vision, who marry and have a colorblind son.

		Maternal	
Paternal			

The genotype of the mother is:

X_BX_B

X_bX_b

X_BX_b

X_BY

X_bY

3. Multiple-choice (1 point)
The woman in the previous question is divorced and remarries to a colorblind man. Fill in the Punnett square to show the genotypes of children that could be expected from her second marriage.

	Maternal	
Paternal		

What percent of the children in the Punnett square are colorblind?

25%
50%
75%
100%
none of them are colorblind

4. Multiple-choice (1 point)
In a cross between a white-eyed female fruit fly and a red-eyed male, what percent of the female offspring will have red eyes? (White eyes are X-linked and recessive to red eyes)

25%
50%
75%
100%
none of them will have red eyes

5. Essay (2 points)
Hemophilia in humans is due to a mutated allele on the X-chromosome. The mutated allele is recessive to the normal allele. What will be the results of mating between a normal (non-carrier) female and a hemophiliac male? (Fill out the Punnett square to determine the possible genotypes of their children.)

	Maternal	
Paternal		

Write a short essay that answers the following questions:

a) What percent of the children are predicted to have hemophilia?
b) What percent of the children do not have hemophilia, but are carriers of the defective allele?
To receive full credit, you must explain your reasoning.

6. Essay (2 points)
In humans, there is a gene that controls formation of the tongue muscles that allow people to roll their tongues. People who lack these muscles cannot roll their tongues. The ability to roll the tongue is dominant over non-rolling. The ability to taste certain substances is also genetically controlled. For example, there is a substance called phenylthiocarbamate (PTC for short), which some people can taste (the dominant trait), while others cannot (the recessive trait). Let R represent tongue-rolling and r represent the lack of this ability. T will represent ability to taste PTC, and t non-tasting.

Suppose a woman who is a homozygous tongue-roller and a non-PTC-taster marries a man who is a heterozygous tongue-roller and is a PTC taster. They have three children: a homozygous tongue-roller who is also a PTC taster, a heterozygous tongue-roller who is also a taster, and a heterozygous tongue-roller who is a non-taster.

Cross :	Maternal gametes			
Paternal gametes				

Write a short essay that answers the following questions:

   a) What are the genotypes of the parents?
   b) If these parents have more children, what percentage of all their children would you predict to be homozygous for tongue-rolling as well as non-tasters?
   To receive full credit, you must explain your reasoning.

7. Multiple-choice (1 point)
The first child from the previous question (the homozygous tongue-roller who is also a PTC taster) marries someone who is heterozygous for both traits. Fill in the Punnett square to show the possible genotypes of their children.

Cross :	Maternal gametes			
Paternal gametes				

What is the likelihood that a child will be heterozygous for both traits?

2/16
3/16
4/16
8/16
9/16

8. Multiple-choice (1 point)
In sweet pea plants, the genes for flower color and pollen shape are linked (they are on the same chromosome). The allele for purple flowers (P) is dominant to the allele for red (p) and the allele for long pollen (L) is dominant to the allele for round pollen (l). You have a plant with purple flowers and long pollen, but you do not know its genotype. To determine the genotype, you cross this plant with a plant that has red flowers and round pollen (test cross). The offspring of the cross are 48% purple with long pollen, 49% red with round pollen, 1.5% purple with round pollen, and 1.5% red with long pollen.

What is the genotype of your plant and did crossing over occur?

PpLl genotype, crossing over occurred

PpLl genotype, no crossing over

Ppll genotype, crossing over occurred

PpLL genotype, crossing over occurred

PPLL genotype, no crossing over

9. Essay (2 points)
In fruit flies, the genes for wing length and eye color are linked. Long wings and red eyes are dominant over vestigial wings and cinnabar eyes. A wild-type fruit fly that is heterozygous for long wings and red eyes is mated to a fly with vestigial wings and cinnabar eyes. The offspring have the following phenotypes:

wild type, 800
vestigial-cinnabar, 786
vestigial-red, 91
long-cinnabar, 84

What is the recombination frequency between the genes for wing type and eye color? You must show your calculations to receive full credit.

10. True/false (2 points-0.5 points each)
Diagram the mouse cross, CcBb X ccbb from Activity 3 to be sure that you understand the system.

Cross :	Maternal gametes			
Paternal gametes				

Using the same gene system as above, cross two mice that are heterozygous for the color/no color and brown/black genes. Fill in the Punnett square to determine the genotypes of offspring.
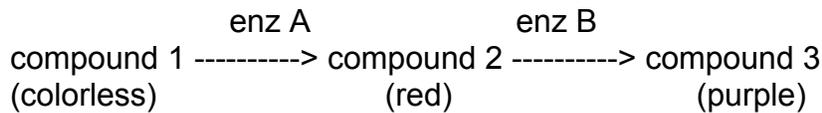
Cross :	Maternal gametes			
Paternal gametes				

Now answer the following true/false questions:

_____ The color of both parents is black.

_____ Out of 16 offspring in the Punnett square, only 1 is white.

_____ Out of 16 offspring in the Punnett square, the majority are black.

_____Out of 16 offspring in the Punnett square, 50% are brown.

11. Multiple-choice (1 point)

Assume the following pigment-producing pathway for flower color of a plant:

```
            enz A                 enz B
compound 1 ----------> compound 2 ----------> compound 3
(colorless)             (red)                  (purple)
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The A and B alleles produce a normal enzyme, while the a and b alleles produce a non-functional enzyme, and one functional copy of an enzyme is sufficient to catalyze the reaction. The genes for enzyme A and enzyme B are not linked.

Fill in a Punnett square for the cross AaBb X AaBb.

Cross :		Maternal gametes			
Paternal gametes					

The expected ratio of phenotypes in the offspring is:

   9 purple: 6 red: 1 white
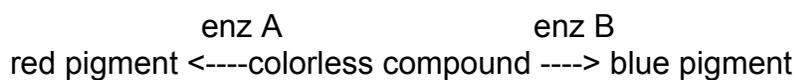
   9 red: 6 purple: 1 white

   9 purple: 4 white: 3 red

   8 purple: 8 white

   12 purple: 4 red

12. Essay (2 points)
Assume that A and B are the same as in the previous question, but that two parallel pathways are present for flower color:

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            enz A                       enz B
red pigment <----colorless compound ----> blue pigment
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Fill in a Punnett square for the cross Aabb X aaBb to determine the genotypes of offspring.

| Cross :		Maternal gametes			
Paternal gametes					

A large number of such crosses produced offspring with these flower colors:
    33 white
    32 red
    35 blue
    34 violet

Write a short essay that explains the presence of these 4 different phenotypes in approximately equal numbers.

13. Multiple-choice (2 points)
    Determine the most likely mode of inheritance for the trait shown in these pedigrees:
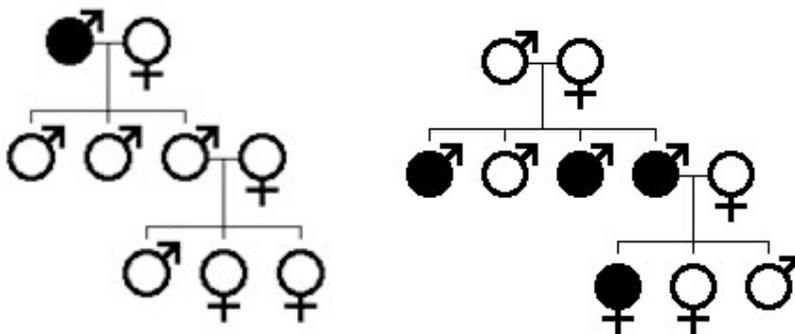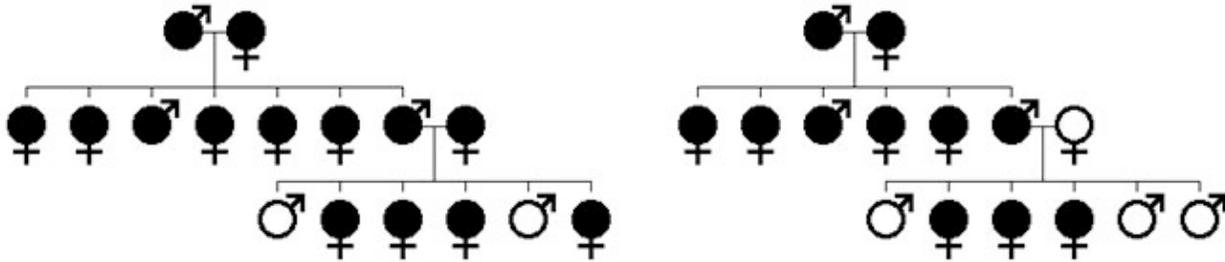

The trait is:

    autosomal and dominant
    autosomal and recessive
    sex-linked and dominant
    sex-linked and recessive
    could be any of these

14. Multiple-choice (2 points)
Determine the most likely mode of inheritance for the trait shown in these pedigrees.

The trait is:

    autosomal and dominant
    autosomal and recessive
    sex-linked and dominant
    sex-linked and recessive
    could be any of these

15. Essay (3 points)
Go to the Karyotyping Activity, a biology project on the University of Arizona website. Read the introduction, then click on "Patient Histories". You will find the histories of patients A, B, and C. For each patient, complete the karyotype. Then list the correct notation to characterize the patient's karyotype and make a diagnosis. (The directions are on the web site). When you have finished the exercise, answer these questions in WebAssign:

    a) Give the karyotype notation and diagnosis for patient A

    b) Give the karyotype notation and diagnosis for patient B

    c) Give the karyotype notation and diagnosis for patient C

16. True/false (2 points-0.5 points each)

Read the article "George Otto Gey and Henrietta Lacks". Then indicate whether each statement is true or false by writing true or false in the blank.

_____ The diploid chromosome number of the Hela cell shown in the assignment is 46.

_____ Hela cells have been used worldwide for research in medicine.

_____ Hela cells were derived from a cancerous tumor of the cervix.

_____ Henrietta Lacks wanted to donate her cells for scientific research and was
        rewarded for her donation.