Student Conducted Lab: Cat Genetics

This document is a GRADED Assignment.._____/10

In cats there are about seven (7) major loci or genes that determine coat color, and one gene that determines color pattern. Several additional genes have smaller effects on color and pattern. And, still other genes control hair length, presence of a tail, form of ears, etc. Eye color is under genetic control and is sometimes affected by genes that determine coat color.

In this lab, we will examine five (5) major loci or genes and four (4) other loci or genes of cat coat color. This is a base analysis. There are MANY genes that code for cat coat color! But, you will be able to determine basic cat coat color phenotypes from genotypes and genotypes from phenotypes by the end of the lab.

The FIVE MAIN Loci or Genes
(use in the order listed)

#1 – The C Locus............C = permits color ....cc = albino (with pink eyes and nose, all white fur)

#2 – The O Locus ....O = orange fur ....oo = other genes expressed

This gene is **sex linked** to the X chromosome and will override the B gene. Use this guide:

- $X^O X^O$ or $X^O Y$ = orange fur …**Remember**: XX is female and XY is male.
  - And dd will dilute orange to cream
- $X^O X^o$ = Tortoiseshell (at least two colors, no white)
- $X^O X^o$ and Ss = Calico (many colors with white)
- $X^o X^o$ = other genes expressed – no orange fur

Agouti A-   Non-Agouti aa
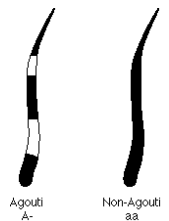
#3 – The W Locus ....W = white fur (blue, yellow or odd eyes) ....ww = normal pigment

#4 – The A Locus ....A = Agouti (banded color on each hair) ....aa = solid color expressed (on each hair)

#5 – The Tabby Locus....T = Tabby/Tiger (stripes, only expressed if A present) ....$t^b t^b$ = mackerel tabby (stripes in whorled pattern)

Other Loci or Genes
(can be examined in any order after the first five)

FILL IN BLANKS (from class)

The B Locus ....B = ___ ....bb = ___
         When dilute (dd): ...Grey/blue ....lilac

The D Locus ....D = ___ ....dd = ___

The L Locus...................L = ___ ....ll = ___

The S Locus (**codominance**)
         ....SS = mostly white with normal or spotted backs
         ....Ss = white underparts ("socks" and/or belly)
         ....ss = no white parts

So, let's start simple …
What are the phenotypes/genotypes of these cats? (from class)

1. aaBbCCDd =

2. aaBBCCdd =

3. aabbccDd =

4. _ _ / _ _ / _ _ / _ _ = a grey cat

PART 1: <mark>**Convert EACH genotype to the phenotype!**</mark> …………………………1 point each ……… _____ /5

1. aaBbCCDdLl =

2. AaBBCcDdX^{o}X^{o}SswwTT =

3. aaBBCcddX^{O}X^{O}SswwTT =

4. aaBBCCDDLLX^{O}X^{o}SSwwTT =

5. AaBBCCddX^{O}Ysswwt^{b}t^b =

PART 2: <mark>PICK FIVE</mark> <mark>to convert the phenotype to the genotype!</mark> ………………………………
Must do FIVE, 1 point each…………………………………………………………………………………._____/5

<u>ONLY the first five you complete will be graded!</u>
If you do 1 through 6, I'll grade 1-5 … if you do all 10, I'll grade 1-5.

<mark>… COMPLETE the FIVE you want me to grade!</mark>
<mark>REMEMBER – you MUST do the first five genes IN ORDER!</mark>

<mark>**NOTE^1:**</mark> **If you cannot determine a gene from the phenotype** *(because other genes override it)* **leave it blank.**
<mark>**NOTE^2:**</mark> **You cannot determine the second allele just by appearance.**
Remember there only needs to be ONE dominant allele for the gene to be expressed. The second allele is unknown – without seeing the parents!

… **When the second allele could be a capital or lower case letter**, put a **?** in the 2nd blank - since you can't tell!
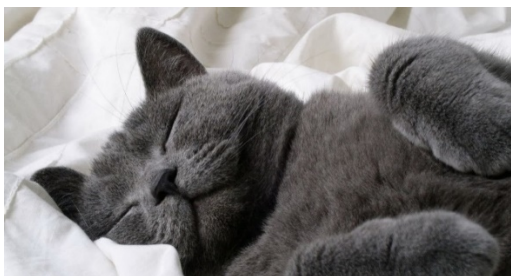   **For example**: *can you tell from a photo if the cat is **male** or **female**?*
      No, so you would put an X in the first blank with the superscripted letter and a ? in the second blank with the super scripted letter. It would look like this: X^O?^{o}

1. = _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _
        A   B   C   D   L   S   T   W   X-Y

2. = _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _

A B C D L S T W X-Y

3. = _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _
A   B   C   D   L   S   T   W   X-Y

4. = _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _
A   B   C   D   L   S   T   W   X-Y

5. = _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _
A   B   C   D   L   S   T   W   X-Y

(6 more options below)

6. = _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _
A   B   C   D   L   S   T   W   X-Y

7. = _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _
A   B   C   D   L   S   T   W   X-Y

8. = _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _
A   B   C   D   L   S   T   W   X-Y

9. = _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _
A   B   C   D   L   S   T   W   X-Y

10. = _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _ / _ _
A   B   C   D   L   S   T   W   X-Y