MIDTERM 1. MCB 104. Genetics, Genomics, and Cell Biology Spring 2013.

NAME:

SID:

Points:

Pg. 2. Definitions:

Pg. 3. Short answers:

Pg. 4. Short answers:

Pg. 5: Problem set:

Pg. 6: Problem set:

Pg. 7: Problem set:

Total Points:

SID:

- I. Definitions. 2 pts each.
  - 1. centiMorgan
  - 2. anther
  - 3. CTCF
  - 4. merozygote
  - 5. nondysjunction
  - 6. Barr body
  - 7. episome
  - 8. Spo 11
  - 9. Branch migration
  - 10. codominance
  - 11. pleiotropy
  - 12. auxotroph
  - 13. Turner's syndrome
  - 14. heteroduplex DNA
  - 15. Gynandromorph

Name:

II. Short answers. 5 pts each.

1. Why do exceptional white-eye females produce a higher incidence of exceptional progeny than normal white-eye females?

2. Why do only half of all mitotic recombination events cause twin spots in y  $sn^+/y^+$  sn females?

3. Consider a double heterozygote for two linked genes, A and B (AB/ab). What would happen to the frequency of recombinant germ cells produced by this individual if only the splice mode of resolution was available?

4. Is it possible for a color-blind mother to produce a son with normal vision? Justify your answer.

5. Consider reciprocal matings in mice. Cross 1: wild-type female X heterozygous male carrying a deletion in the Igf2 enhancer. Cross 2:heterozygous female carrying the enhancer deletion X wild-type male. What proportion of the F1 mice exhibit a phenotype in Cross 1 and Cross 2? State the nature of the phenotype.

6. Propose a purpose for the high incidence of psychological disorders such as obsessive-compulsive disorder and manic depression in human populations. (Hint: sickle cell anemia.)

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III. Problem sets.

- 1. (10 pts). A cross is made between an Hfr strain that is arg+ bio+ leu+ and an Fthat is arg-, bio-, leu-. Interrupted mating experiments showed that arg is the last gene transferred from Hfr. Exconjugants were grown on medium lacking arginine and recombinant bacteria were tested for all possible combinations of genotypes:
- arg+bio+leu+ 320

arg+ bio+ leu- 8

arg+ bio- leu+ 0

- arg+ bio- leu- 48
  - a. Why was arginine excluded from the growth medium?

b. What is the gene order?

c. What are the map distances between the gene pairs?

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2. (20 pts). Consider three linked autosomal genes in Drosophila: black (b), waxy (wx), and cinnabar (cn). b+ is dominant to b (brown body vs. black body); wx+ is dominant to wx (normal wings vs. waxy wings); cn+ is dominant to cn (normal red eyes vs. dark brick eyes). A triply heterozygous female with a normal phenotype (brown body, nonwaxy wings, normal eyes) is testcrossed with a male containing a black body, waxy wings and cinnabar eyes. The following phenotypes are observed in the progeny:

-382 cinnabar eyes (brown body and nonwaxy wings)

-379 black body and waxy wings (normal eyes)

-69 waxy wings and cinnabar eyes (brown body)

-67 black body (normal wings and normal eyes)

-48 waxy wings (brown body and normal eyes)

-44 black body and cinnabar eyes (normal wings)

-6 black body, waxy wings, cinnabar eyes

-5 wild-type (brown body, nonwaxy wings, and normal eyes)

- a. Draw the parental genotypes (combination of alleles on each of the maternal homologues)
- b. Indicate the gene order
- c. Indicate the map distances between each of the 3 gene pairs. Draw on a simple genetic map.

d. Is there interference? Justify your answer.

3. (10 pts). The human genes for colorblindness and hemophilia are linked on the X chromosome and map 10 cM away from one another. Consider the following pedigree. Shading identifies hemophiliacs and X identifies color blind individuals.



What is the probability that individual III-4 will have a hemophiliac son?

What is the probability that individual III-5 will have a hemophiliac son?