

Biology 121 – PRACTICE Midterm 2

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***Please note: This is not necessarily the same length as the actual midterm (the midterm will probably be a bit shorter). The questions will be similar in format, but could test different concepts or be different kinds of questions or have different lengths or have a different mark break-down.**

The answer key will be provided after reading break in a separate file. It is **STRONGLY** recommended that you try and solve **ALL** of the problems on your own before the answers are provided.

The review session will be on Monday, Feb 25th from 4 to 5:30 pm. The location will be posted on Connect, but will most likely be our lecture hall.

You will be allowed to bring with you to the exam: one sheet of paper, with your concept map on one side and hand-written notes on the other and any kind of calculator. No cell-phones or devices with cameras or internet access will be allowed.

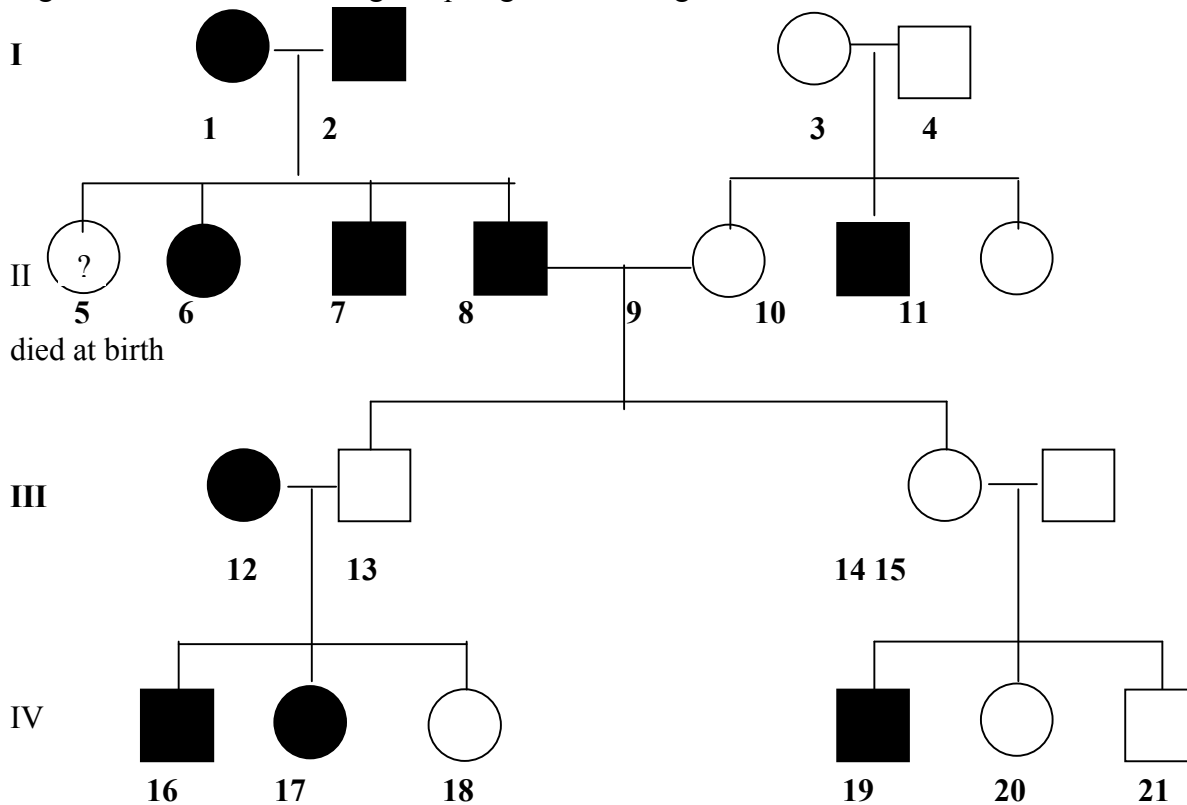
One mark on the exam will be for a Concept Map. Please see the instructions from the first assigned concept map (on the Connect website) the only difference will be the terms used:

Concept Map 2 Terms

Homologous chromosomes	Alleles
Linkage	Pedigree
Cell-cycle checkpoint	Haploid
Meiosis	Recombination
Chromatids	Mutation
Testcross	Diploid
Genotype Ratio	Phenotype Ratio
Dominance	Mitosis
Crossing over	Sex-linked
Autosomal	Oncogene

-Greg, Mike and Phoebe

1. (10 marks) Lactose intolerance is a common genetic condition where adults cannot digest lactose, the sugar in milk. The following is a pedigree indicating individuals with lactose intolerance:



- a. What is the best explanation for how this trait is inherited, i.e., is it recessive or dominant? Is it autosomal or sex-linked? Justify your answer by referring to specific individuals from the pedigree. (5 marks)
- b. Write the possible genotypes of the following individuals: (3 marks)
- c. If individuals 8 and 9 had a third child, what is the probability that it would be lactose intolerant? Show all your work. (2 marks)

2. (8 marks) A true-breeding *Drosophila* with red eyes and normal body size (wild type) was crossed with a true-breeding *Drosophila* with sepia eyes and small body size. The F1 were all wild type for eye colour and body size. The F1 were crossed with *Drosophila* with sepia eyes and small bodies. The progeny were as follows:
- red eyes and normal body size 218
 - red eyes and small body size 56
 - sepia (dark brown) eyes and normal body size 44
 - sepia eyes and small body size 182

Explain why you suspect these genes are on the same chromosome. (4 marks)

3. (6 marks) You have been hired as a summer student to work in the UBC *Drosophila* lab. You are given a strain with apricot-colored eyes and asked to determine how this trait is inherited. You do the following crosses and then self the F1 (F1 x F1). You obtain these results:
- Cross A: Red-eyed female x apricot-eyed male
 F1: all have red eyes
 F2: 100 red-eyed females, 46 red-eyed males, 44 apricot-eyed males
- Cross B: Apricot-eyed female x red-eyed male
 F1 all females have red eyes, all males have apricot eyes
 F2: 48 red-eyed females, 52 apricot-eyed females, 46 red-eyed males, 45 apricot-eyed males

Use the results from crosses A and B (F1 and F2) to explain how apricot eye colour is inherited. Justify your answer and show all your work.

4. (8 marks) Jane and John Doe recently gave birth to a darling baby boy. When he was brought to Jane for one of his feedings she had a strange feeling that he was not her son. There were two other boy babies in the nursery that day. These are their blood types as well as those of their parents:

Baby Doe – type O
Jane Doe type A
John Doe type AB

Baby X – type B
Mommy X – type O
Daddy X – type B

Baby Y – type AB
Mommy Y type A
Daddy Y type O

- a. Based on the blood type is Jane correct in assuming a switch has occurred? Explain. (4 marks)
- b. Who is the most likely candidate to be the real Baby Doe? Explain. (4 marks)

5a. During what phase of mitosis is there a checkpoint that acts as a control to the cell cycle? What is being checked? (2 marks)

5b. What could be the result if the cell proceeds through this check point when it shouldn't? (1 mark)

5c. Why does the checkpoint happen during this phase of mitosis? (1 mark)

5d. Would the resulting daughter cells be able to function properly? Why or why not? (2 marks)

6. In a certain breed of dog long hair is dominant over short hair; the gene involved is autosomal. Another gene, B controls hair colour, which is X-linked, one allele B1 produces gray coloured hair; the other allele B2 produces red coloured hair; and the heterozygous combination B1B2 produces brindle coloured hair (a mix with patches of both gray and red coloured hairs).

If a red male homozygous for long hair is mated with a brindle short-haired female, what kind of puppies could be produced in the F1? (for each possible kind of puppy, state the length of their hair, their colour and their sex) (4 marks)

7. A dominant gene, A, causes yellow color in rats. The dominant allele of another independent gene, R, produces black coat color. When the two dominants occur together (A_R_), they interact to produce gray. Rats of the genotype aarr are cream-colored. If a gray male and yellow female produce approximately 3/8 yellow, 3/8 gray, 1/8 cream, and 1/8 black offspring, what are the genotypes of the two parents? (4 marks)

8. In humans, curly hair (H) is dominant over straight hair (h); brown eyes (B) over blue eyes (b); and right handedness (R) over left-handedness (r). Normal vision (C) is dominant over colour blindness (c) which is X-linked. A curly-haired, brown-eyed, left-handed man marries a curly-haired, blue-eyed, right-handed woman. Both have normal colour vision. They have five children, as follows:

- child 1 - a daughter, curly-haired, blue-eyed, right-handed, normal vision
- child 2 - a daughter, straight-haired, blue-eyed, right-handed, normal vision
- child 3 - a son, curly-haired, brown-eyed, right-handed, colour blind
- child 4 - a son, curly-haired, brown-eyed, right-handed, normal vision
- child 5 - a son, curly-haired, blue-eyed, right-handed, normal vision

a. Create a pedigree and mark “affected” individuals who are colour-blind. (2 marks)

b. What is the genotype of each parent? (4 marks)