

NAME: _____ SS#: _____

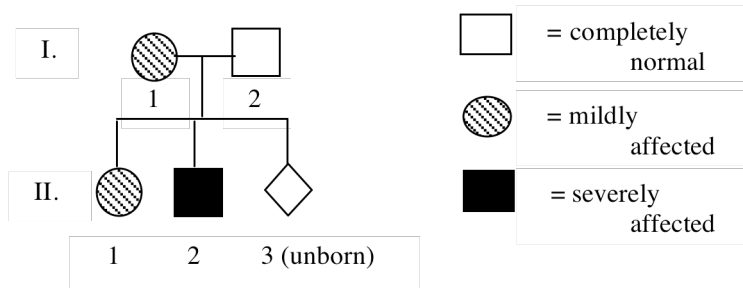
L225 Worksheet 3: Due 09/28/07

REMEMBER: The “For Credit” problems are due at the end of your learning group. You must at least make an attempt to answer ALL of the problems Before learning group.

Recommended Text Problems: Chap. 2: 26-29; Chap. 3: 37-46; Chap.4: 1-14, 22-23, 29-30, 32-36

“For Credit” Problems:

1. Below is a pedigree of a family affected by an X-linked recessive genetic disorder. The dominant (=normal) allele of this gene exhibits **incomplete dominance** over the recessive allele in heterozygous individuals.



- a. If the third child of I-1 and I-2 is female, what is the probability that she will be **severely affected**? Please explain how you arrived at this conclusion. (0.5 pts.)
- b. If the third child of I-1 and I-2 is male, what is the probability that he will be severely affected? Please explain how you arrived at this conclusion. (0.5 pts.)
- c. Is it possible to have a male who is **mildly affected** by this disorder? Please explain. (0.5 pts.)

2. There are several genes in addition to the ABO gene that give rise to recognizable antigens on the surface of red blood cells in humans. The MN and Rh genes are two examples that were discussed in class/lab.

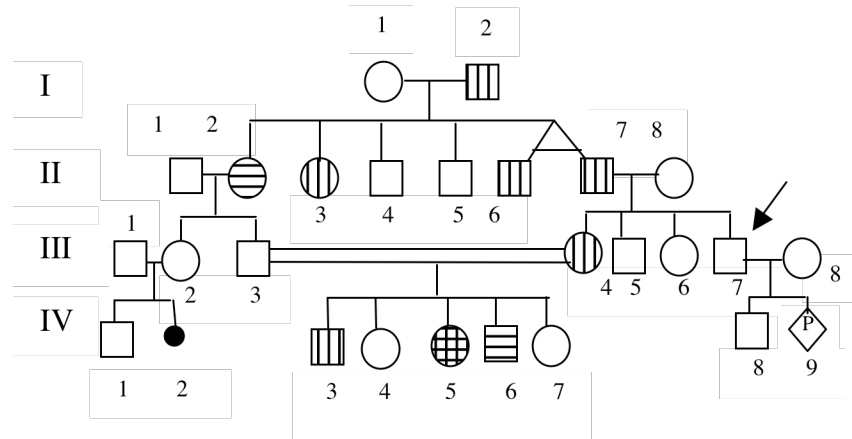
- (A) The following chart shows several mothers and their children and their bloodtypes. For Each mother-child pair, choose the father of the child from among the males in the right hand column, assuming one child per male (0.25 pts. Each, 1 pts. Total).

	<u>Mother</u>	<u>Child</u>	<u>Males</u>
_____	O M Rh ⁻	B MN Rh ⁺	a. AB M Rh ⁻
_____	B MN Rh ⁻	O N Rh ⁻	b. A M Rh ⁺
_____	O M Rh ⁺	O M Rh ⁻	c. O MN Rh ⁺
_____	AB N Rh ⁻	B MN Rh ⁻	d. B MN Rh ⁺

- (B) Fill in the blanks (0.25 pt. each, 1 pt. Total):

- A person with genotype I^Ai has _____ antigens on their red blood cells.
- A person with genotype I^Ai has anti-_____ antibodies in their blood serum
- A person with genotype I^Ai can receive blood from a person with type _____ or _____.
- The I^A allele and the I^B allele are _____ to each other.

3. People with nail-patella syndrome have poorly developed or absent kneecaps and nails. Individuals with alkaptonuria have arthritis as well as urine that turns black when exposed to air. Both conditions are rare phenotypes. In the following pedigree, vertical lines (|) indicate individuals with nail-patella syndrome and horizontal lines (-) indicate individuals with alkaptonuria.



(A) Based upon the pedigree above, what is the MOST LIKELY PATTERN OF INHERITANCE of nail-patella syndrome? Explain by giving two reasons why you chose this mode of inheritance and define genetic symbols (letters) for the alleles of this trait (0.5 pts.)

(B) Based upon the pedigree above, what is the MOST LIKELY PATTERN OF INHERITANCE of alkaptonuria? Explain by giving two reasons why you chose this mode of inheritance and define genetic symbols (letters) for the alleles of this trait (0.5 pts.)

(C) List the most probable genotype at both genes for each of the following individuals. (Note: Your genotypes and genotypic symbols must be consistent with the pattern of inheritance you selected in part (A).) (0.5 pts.)

I-2: _____

II-2: _____

III-4: _____

IV-4: _____

(D) In a mating between IV-5 and an individual who is heterozygous for both genes, what is the probability that their first child (0.5 pts.)

i) Has both nail-patella syndrome and alkaptonuria: _____

ii) Has nail-patella syndrome but not alkaptonuria: _____

4. In a species of tropical fish, a colorful orange and black variety called Montezuma exists. When two montezumas are crossed, 2/3 of the offspring are Montezuma and 1/3 are wild-type (a dark, grayish-green color).

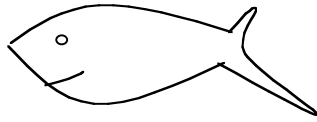
- (A) Explain the inheritance of color observed here, being sure to define your genetic symbols (0.5 pts.).
- (B) Show by means of a Punnet square how your explanation accounts for the phenotypic ratio seen in a cross of two montezumas (0.5 pts.).
- (C) In the same species, the morphology of the dorsal fin is altered from the wild-type shape to a ruffled shape when an individual is homozygous for a recessive allele designated *f*. (0.5 pts.)
- i. What progeny would you expect and in what ratio in a cross of a Montezuma fish homozygous for wild-type fin to a fish that is green and has a ruffled fin?
 - ii. What phenotypic ratios would you expect if you crossed two of the Montezuma progeny from part (i)?

5. In shorthorn cattle, coat color can be red, white, or a sandy-red color called roan. Roan is not as red as the red coat. Cattle breeders have taken meticulous records and have determined that the mating of different cattle types produce the following results:

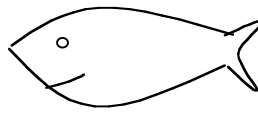
Cross	Offspring	Genotypes of Parents
Red x Red	All red	_____
White x White	All white	_____
Roan x Roan	1 red: 1 white: 2 roan	_____

- a. Explain the mode of inheritance of coat color in these cattle. Be sure to identify the number of genes involved and assign gene symbols to any and all alleles involved (0.5 pts.)
- b. Using the gene symbols you defined in (a), fill in the genotypes of the parents in the crosses in the table above. (all or nothing, 0.5 pt.)
- d. When examined carefully, the cattle with the roan coat color actually have a mixture of completely red hairs and completely white hairs. Does this change your answer to (a)? Explain. (0.5 pts.)

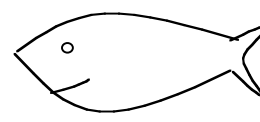
6. The Poeciliids are a family of fish consisting of some species that possess sword-tails and other species that don't. You are interested in studying the genetics of sword-tails in a certain species. Within this species, there are three "morphs" of individuals shown below:



Male with swordtail



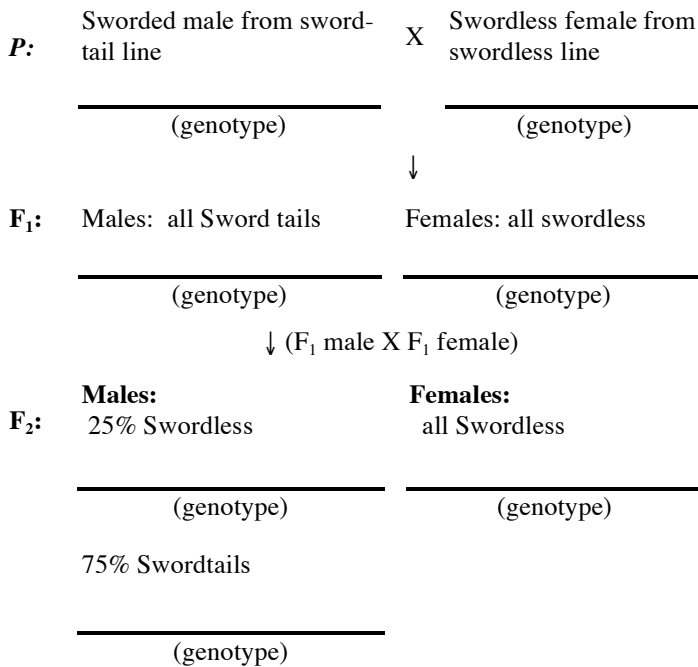
Male without swordtail



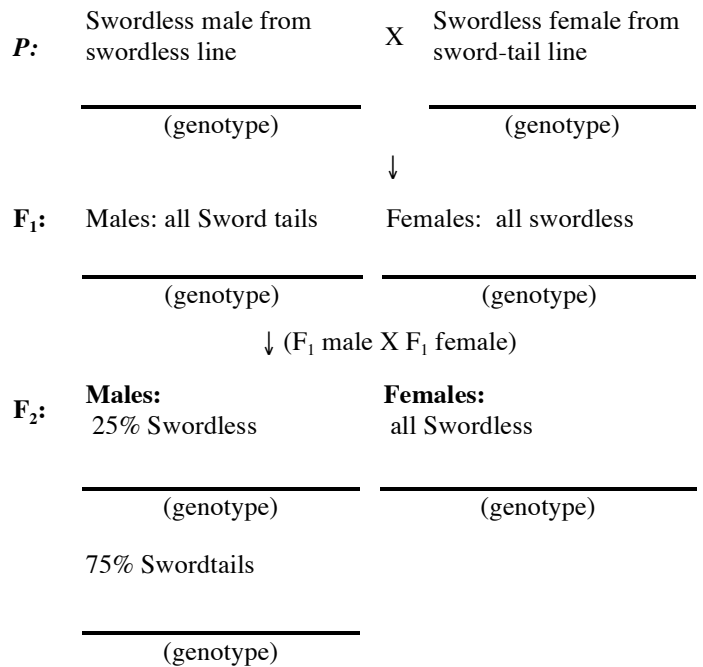
Female without swordtail

To investigate, you perform crosses using fish from lines of true-breeding swordless and true breeding sword-tails, the results of which are shown below:

CROSS #1



CROSS #2



(a) Is the gene for sword-tails sex-linked? How can you tell? (We are referring to the standard definition of "sex-linked" in this part of the question.) (0.5 pts.)

(c) In the spaces provided on the previous page, fill in the genotypes of the individuals in the crosses. (1 pts. total)