

Name: _____ Block: _____ Date: _____

Biology 621—Genetics Problem Set
Sex Determination/ Sex-Linked Problems

- Use a separate sheet of paper and give yourself lots of space to work.
- Name and Block in the upper right hand corner of the page.
- Identification of *all* traits and the symbols used to represent each one.
- In an allelic pair, identification of the dominant allele (if there is one).
- Correct identification of the genotypes of all individuals in the problem (to the extent possible using the available information).
- Identification of all possible gametes.
- Punnett squares appropriately set up.
- Punnett squares appropriately filled in.
- All questions answered.
- All questions answered correctly.

Notes: How is the sex of a child determined? What can you do to know the sex of a child? Can you “influence” the sex of your offspring?

Human cells each have ____ pairs of chromosomes (_____ total). If all the chromosomes inside our cells were paired up they would look like this:

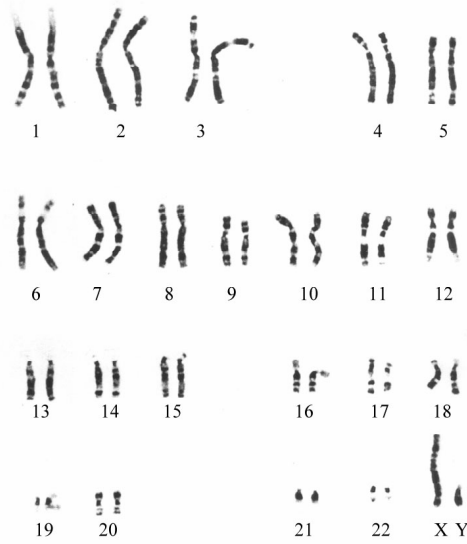


Figure 1

Human cells have 22 pairs of body cell chromosome (autosomes) and 1 pair of sex chromosomes, the X and Y chromosome.

Note that for each pair, the 2 chromosomes look alike except for one pair. One of the chromosomes of this pair is shorter and has a curled end. This pair of chromosomes is called the sex chromosomes. **The long one is called the X chromosome and the short one is called the Y chromosome.**

Female:

Male:

So, back to the question above, what are the chances to get a boy vs. a girl for John and Mary? Let's do a Punnett Square Problem:

Notes: Sex-Linked Traits

Sex-linked traits refer to traits controlled by genes located on the _____ chromosomes. The alleles for sex-linked traits are written as subscripts of the X or Y-chromosomes.

Example:

- a. In 1910, Thomas Hunt Morgan noticed that one male *Drosophila* (a.k.a. fruit fly) had white eyes rather than the usual red eyes. So Morgan crossed a white-eyed male fruit fly with a normal homozygous red-eyed female. GENOTYPE?

b. Punnett Square:

- c. Morgan then allowed the F1 generation of fruit flies to mate with each other to produce offspring in the F2 generation. GENOTYPE? _____

d. Punnett Square:

- e. Morgan noticed that the trait of white eyes appeared only in _____ fruit flies.

- f. So, Morgan hypothesized that the red eye allele was _____ and the white-eye allele was _____.
- g. Morgan also reasoned that the gene for eye color in fruit flies was located on the _____ chromosome and absent on the _____ chromosome.
- h. In heterozygous females since they have _____ chromosomes, the dominant allele for _____ eyes masks the recessive allele for _____ eyes.
- i. In males since they only have _____ X chromosomes, a recessive allele on the X chromosome will be _____ and the phenotype will be a _____ eyed fruit fly.
- j. What would happen if you crossed a heterozygous red-eyed female with a white-eyed male? We will do this together!

3. A certain form of muscular dystrophy is inherited as a sex-linked, recessive gene. Jack has muscular dystrophy. (Neither of his parents has this disease.) Jane, Jack's wife, does not have muscular dystrophy, but her father does. What fraction of their daughters would you expect to have muscular dystrophy? What fraction of their sons would you expect to have muscular dystrophy?

4. Colorblindness is a sex-linked recessive gene. A colorblind woman marries a man with normal vision. She is pregnant. What is the chance that her child will be (a) a girl with normal vision? (b) a colorblind girl? (c) a boy with normal vision? (d) a colorblind boy?

5. (a) Why are men never heterozygous for an X-linked trait? (b) Why must men always inherit an X-linked trait from their mothers? (c) Can a color-blind father pass this allele on to his sons? Explain. (d) Can a normal male ever have a daughter that is color-blind? Explain

Extra Credit #1

Anthony, a colorblind person got married, divorced, and remarried. His and his first wife, Linda, has a colorblind son, a colorblind daughter, a normal son and a normal daughter. He and his current wife, Mary, have four boys and two girls, none of whom is colorblind. Give the genotype of each wife and state whether or not she is colorblind.