1. Hemophilia, a rare condition in humans in which blood is incapable of clotting due to inefficient amounts of clotting factors, is caused by a sex-linked, recessive gene mutation (f) in the FIX gene.

a. Is the mutation found on X or Y chromosomes? Why?

2. Determine if the following genotypes are unaffected (U), directly affected (A), and/or a carrier (C):

   i. X^f X
   ii. X Y
   iii. X^f X^f

   iv. X^Y
   v. X X
   vi. X X^f

3. Are males or females more prone to being affected by hemophilia? Why?

4. A male with hemophilia has a child with a female that is a carrier of the hemophilia mutation. Fill out the monohybrid cross and determine the following:

   a. P1 genotypes: _________________
   b. F1 genotypes: _________________
   c. Can the couple have a male child that is unaffected? _________
   d. What proportion of F1 children are unaffected? __________
   e. What proportion of F1 children are carriers? _________
   f. What proportion of F1 children are affected? __________

5. Two parents unaffected by hemophilia have a child who is diagnosed with hemophilia caused by a mutation in the FIX gene. How is this possible?

6. An unaffected male and female carrier of the FIX mutation have children. Fill out the monohybrid cross and determine the following:

   a. P1 genotypes: _________________
   b. F1 genotypes: _________________
   c. What proportion of children have hemophilia? __________
   d. What proportion of children are carriers? _________
   e. What proportion of children are unaffected? __________

7. If the mutation carrier(s) from Question 6 have children with an unaffected partner, fill out the monohybrid cross and determine the following:

   a. P1: _________________
   b. F1 genotypes: _________________
   c. What proportion of F1 have hemophilia? _________
   d. What proportion of F1 are carriers? _________