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Pedigree Worksheet

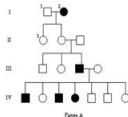
You can look at a pedigree and determine whether traits are dominant or recessive, and you can also tell if it is sex-linked or autosomal. A sex-linked recessive characteristic is determined by an allele that is carried only on the X chromosome. The shorter Y chromosome does not carry an allele for a sex-linked trait. Since there is only one X in his genotype, XY, a male who carries a particular recessive allele on the X chromosome will have the sex-linked condition. A female who carries a recessive allele on one X chromosome will not show the condition if there is a dominant allele on her other X chromosome. She will express the recessive condition only if she inherits two recessive alleles – one from each parent. Her chance of inheriting the condition are thus greatly reduced.

One sex-linked trait is hemophilia, a condition in which the blood does not clot properly. Most people who have hemophilia are men. View the pedigree below and interpret the diagram to answer the questions.

A. Interpreting a human pedigree. (30 points)

Use Figure A to answer the questions below.

- Number all individuals on the pedigree at the top of each page.
- In a pedigree, a squiggle represents a mating. If it is *darkened* he has hemophilia. If it is *not darkened* he has normal clotting.
 - How many males are there? _____
 - How many males have hemophilia? _____
- A circle represents a female. If it is *darkened*, she has hemophilia; if open she is normal.
 - How many females are there? _____
 - How many females have hemophilia? _____
- A marriage is indicated by a horizontal line connecting a circle to a square.
 - How many marriages are there? _____
- A line perpendicular to a marriage line indicates the offspring. If the line ends with either a circle or a square, the couple had only one child. However, if the line is connected to another horizontal line, then several children were produced, each indicated by a short vertical line connected to the horizontal line. The first child born appears to the left and the last born to the right.
 - How many children did the first couple couple in row I have? _____
 - How many children did the first couple couple in row II have? _____
- Level I represent the first generation, level II represents the second generation.
 - How many generations are there? _____
 - How many members are there in the fourth generation? _____
- The genotype of the males in a pedigree for sex-linked inheritance are easy to determine since normal blood clotting (N) is dominant and hemophilia is recessive (n). Since these alleles are on the X chromosome only, a male represented by a clear square will have the genotype X^N. A darkened square will be Xⁿ. Label *under* each individual on the pedigree.
 - What is the genotype for Individual I1? _____ Phenotype? _____
 - What is the genotype for Individual I2? _____ Phenotype? _____
 - What is the genotype for the first female made in generation II? _____ Phenotype? _____
- Females with hemophilia have an easy genotype to identify. They are all XⁿXⁿ. Both recessive alleles must be present for a female to have hemophilia. If one dominant allele is present (X^NXⁿ), the individual would be normal for clotting.
 - How many females have the genotype X^NXⁿ? _____
- Females who do not show the trait for hemophilia may be homozygous dominant (X^NX^N) or heterozygous (X^NXⁿ). A heterozygous female is called a carrier. Examination of offspring can often determine which genotype the parent has. If any child (son or daughter) has hemophilia, then the female must be heterozygous. If her son has hemophilia, he has genotype Xⁿ. He inherited the Y from the father and the other allele of his genotype (Xⁿ) had to come from the mother. If a daughter has hemophilia (XⁿXⁿ), she inherited an Xⁿ from each parent, thus making the genotype for the normal mother X^NXⁿ.
 - What would be the genotype for the female who marries into the family in generation III? _____



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