To know:

- Mendel’s Laws of Heredity (3) and how they apply to inheritance.
- Vocabulary
- Modes of inheritance (4)

Be able to:

- Construct and analyze monohybrid punnett squares (like we did for celebrity punnett squares)
- Construct and analyze sex-linked monohybrid punnett squares (like we did for ALD)
- Construct and analyze dihybrid punnett squares (dihybrid practice)
- Calculate genotype and phenotype percentages from a punnett crossing (we did this for all of them!)
- Construct a pedigree given family info (like we did in muggle or magic)
- Pedigree analysis (identify relationships between individuals, mode of inheritance of the trait/disease and genotype of individuals)

Practice Problems

1. **Monohybrid cross**- Woodrats are medium sized rodents with lots of interesting behaviors. You may know of them as packrats. Let’s assume that the trait of bringing home shiny objects (H) is controlled by a single locus gene and is dominant to the trait of carrying home only dull objects (h). Suppose two heterozygous individuals are crossed. How many of each genotype would be expected if only 4 offspring were produced? Show the crossing and list each expected genotype and probability.

2. **Sex-linked cross**- The bison herd on Konza Prairie has begun to show a genetic defect. Some of the males have a condition known as "rabbit hock" in which the knee of the back leg is malformed slightly. We do not yet know the genes controlling this trait but for the sake of our question, we shall assume it is a sex-linked gene and that it is recessive (X<sup>n</sup>). Now, suppose that the herd bull (the dominant one which does most of the breeding) who is normal (X<sup>N</sup>) mates with a cow that is a carrier for rabbit hock. What are his chances of producing a normal son?
3. Dihybrid cross- Wolves are sometimes observed to have black coats and blue eyes. Assume that these traits are controlled by single locus genes and are located on different chromosomes. Assume further that normal coat color (N) is dominant to black (n) and brown eyes (B) are dominant to blue (b). Suppose the alpha male and alpha female of a pack (these are the dominant individuals who do most of the breeding) are black with blue eyes and normal colored with brown eyes, respectively. The female is also heterozygous for both traits. What are the possible genotypes and phenotypes of the offspring? Show the crossing and list each expected genotype and probability.

4. Pedigree Construction- A normal man (Joseph) marries a woman (Rebecca) who is heterozygous for Huntington’s disease and they have four children. Two of their sons (Adam and Charles) are born healthy without Huntington’s disease. Charles marries a woman without Huntington’s disease and they have a normal daughter. Joseph and Rebecca’s daughter Tasha and their last son (James) both have Huntington’s disease. James marries a non-Huntington’s disease woman whose sister and parents also do not suffer from Huntington’s disease. James and his wife have three children - a normal boy, a normal girl, and a son with Huntington’s disease.

5. Pedigree Analysis- What is the genotype of each individual from the pedigree above? What is the mode of inheritance from the above pedigree?
6. Pedigree Construction: Two normally-pigmented parents have 3 children. The first child (a girl) and their second child (a boy) have normal pigmentation. Their third child (a girl) has albinism. That girl marries a normally pigmented male and they have four children. The first three (two girls and a boy) have normal pigmentation. Their fourth child (a girl) has albinism like her mother.

7. Pedigree Analysis- What is the genotype of each individual from the pedigree above? What is the mode of inheritance from the above pedigree?

8. Pedigree Construction- Queen Victoria married her first cousin, Albert, and had several children. Of her children: (a) One son, Leopold, had hemophilia A. (b) Daughter Beatrice had a daughter, Victoria, who married King Alfonso of Spain and gave birth to 7 children: the oldest and youngest children (boys) had hemophilia A, the second child (girl) had congenital deafness, the 3rd and 5th were healthy girls, the 4th was a stillborn male and the 6th, Juan (a healthy male), became the father of King Juan Carlos of Spain. (c) Daughter Alice had a daughter, Alexandra who married Nicholas II, Czar of Russia and had 4 healthy daughters and a son, Nicholas, who had hemophilia A. (d) Daughter Victoria married Friedrich, emperor of Russia and had healthy children. (e) Son Albert was the grandfather of King George V.

9. Pedigree Analysis- What is the genotype of each individual from the pedigree above? What is the mode of inheritance from the above pedigree?