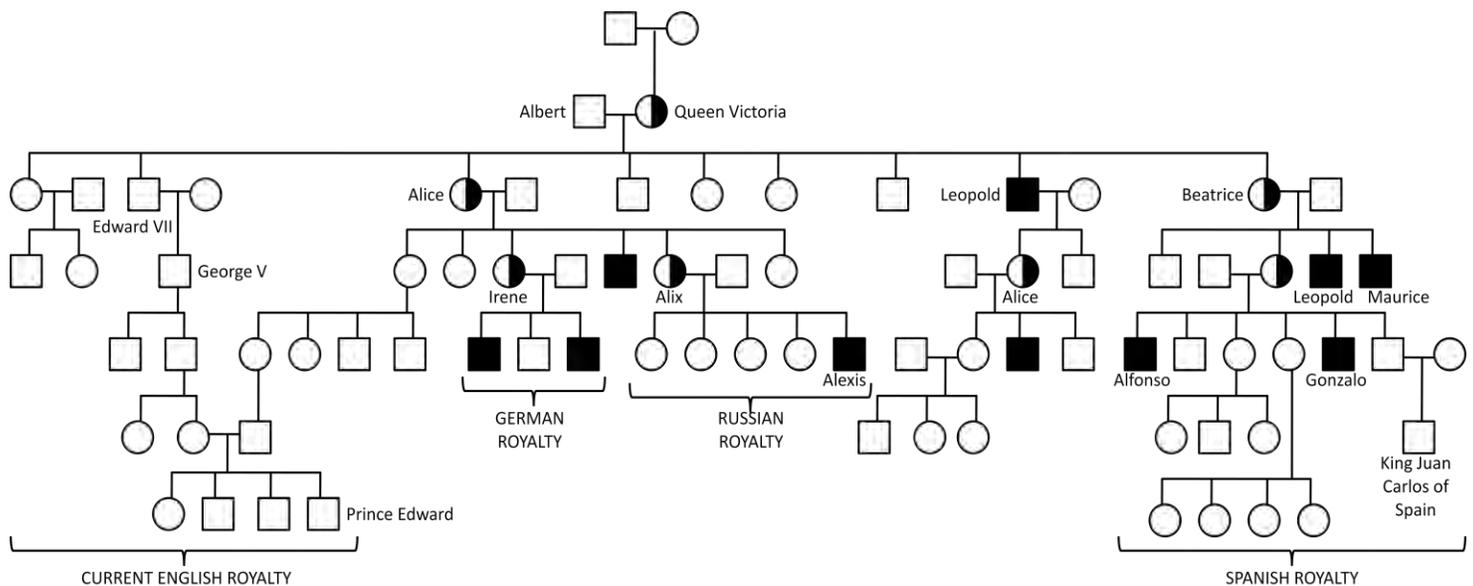


Pedigree Worksheet 3

Hemophilia: THE "ROYAL" DISEASE

Hemophilia is an inherited disorder. Those who suffer from it lack a necessary protein that allows their blood to clot. A classic example of how hemophilia is passed on from generation to generation is found in the royal families of Europe during the 1800's and early 1900's. This pedigree details the inheritance of hemophilia in the descendants of Queen Victoria (1891-1901) of England. Carefully study the pedigree and answer the questions that follow.



1. What is the pattern of inheritance shown by hemophilia in the royal families of Europe? _____
2. Briefly justify your answer for the pattern listed above. Why did you choose this type of inheritance? _____
3. Queen Victoria was the first person that hemophilia could be traced back to, although she did not show it herself. What must her genotype have been? _____
4. Leopold was Victoria's only son affected by hemophilia. What must his genotype have been? _____
5. Currently, none of the royal families of Europe show hemophilia. However, the Spanish lineage could still produce the disease. Why is this statement true? Use any necessary terms to help clarify your position. _____

Name _____ Period _____ Date _____

6. Interestingly, even though hemophilia in the royal families began _____
in England, they were actually the only one of these four families to
NOT be affected by it. If Alice's daughter Alix had accepted a marriage
proposal from George V, this may have changed history greatly. If
we were to rewrite history, pairing Alix and George V together, what
is the probability any of their offspring would have hemophilia?
Use a Punnett square to justify your answer.

7. Instead, Alix accepted a proposal from Tsar Nikolas II of Russia. _____
Looking at the Russian royalty, there are a number of unknown
issues. Both Alix and Nikolas II, along with all five of their children,
were assassinated during the Russian Revolution. It is known that
their only son, Alexis, was a sufferer of hemophilia (therefore Alix
must have been a carrier). None of their daughters expressed the
disease, but they were too young to have had children, so we do
not know if they were carriers. Knowing what you do about
genotypes and inheritance, what is the probability any of their
daughters would have been a carrier for hemophilia?
Use a Punnett square to justify your answer.

8. Although Alexis did have a number of health issues, he may have _____
survived long enough to produce a child. If his wife was
homozygous for normal clotting, what would the probability be
that one of his sons would be a hemophiliac?
Use a Punnett square to justify your answer.

9. As was stated earlier, Queen Victoria was the first person within the English royal family to have an
allele for hemophilia. Propose how this allele might have appeared in Queen Victoria?

10. If we have a male hemophiliac (such as Leopold) marry a normal female, is there any way to have
sons who have hemophilia? Provide a justification for your response.
(Use a Punnett square, if necessary)