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Old Dominion University/BIOL294-Genetics/Rinehart-Kim/Romanov Project

Internet Resources

You may use other Internet sources here, but please cite any sources that you use unless they are one of the following.

http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0004838 *(You should be able to access the entire article. You may need to copy and paste the site address.)*

http://www.ncbi.nlm.nih.gov/pubmed/20557352 *(You won't be able to access the entire article, but the abstract will give you important information.)*

http://www.nature.com.proxy.lib.odu.edu/ng/journal/v9/n1/pdf/ng0195-9.pdf (Please note that this is a PDF of an article.)

History

1. Nicholas II was the last czar to hold power in Russia. How long had the Romanov family been in power in Russia?
   "For over 300" the Romanovs ruled Russia through a monarchy.
2. Nicholas II abdicated the throne. Who took power then?
   Nicholas II abdicated power to his brother, Grand Duke Michael Alexandrovich but soon after 1917 during the Bolshevik revolution, Vladimir Lenin seized power.
3. Describe what happened to Nicholas II and his family after he abdicated the throne?
   Nicholas and his family were exiled to Yekaterinburg, Russia where they were later executed out of fear.
4. One of the reasons that the family of Nicholas II was executed (vs. just imprisoned) was because there was a fear that the White Russian Army would save them. Who was the White Russian Army?
   The white Russian army was comprised of loyalist that backed the monarchy. Members included in this party were typically wealthy lords who owned land and military units.

Hemophilia

One of the pedigree charts found at the end of this assignment comes from the Module powerpoint lecture notes.

5. How was Alix, the wife of Nicholas II, related to Queen Victoria of England? (Look at the pedigree chart very carefully.)
   Alix was the grand daughter of Queen Victoria and daughter of Alice.
6. On what chromosome is the gene that, when mutated, causes hemophilia, and how does this contribute to its inheritance pattern?
   Both Queen Victoria and Alix are designated as being carriers for hemophilia. The gene that becomes mutated is the X chromosome. Because the disease is X-recessive, females that are carriers transfer their X chromosome to the baby. And if the baby is a boy, it will only get the recessive X mutation, leading to inheritance through sex.
7. What does it mean to be a carrier for a disease?
   To be a carrier, you would need to have the recessive trait but not homogenously. So for females they can have Xx and be a carrier without the disease.
8. Why aren't males considered *carriers* for hemophilia?
   Males only have one X chromosome so if they inherit the short stick of a recessive x chromosome from the mother, they are stuck with it.
9. In a couple of sentences, describe the physiology of the disease hemophilia. (Yes, I know it is severe bleeding because the blood cannot clot. But WHY can't the blood clot? Be *very* specific.)
   Hemophilia is the lack of coagulation factors in the blood. Either the clotting proteins are dysfunctional or missing all together. This falls under the ribosomes and transcription of RNA to produce proteins capable of clotting
10. What type of hemophilia (A or B) is (probably) represented in the pedigree chart?
    From the second source, it was said that the mutation was hemophilia B.
11. Describe the mutation (at the molecular level) that apparently caused hemophilia in Alix, (and probably all of the European families that had hemophilia). Be *very* specific.
    The wife of Nicholas II was Alix. Alix was a carrier of the disease and therefore had the configuration Xx. She did not exhibit symptoms of the disease as the disease is X-linked recessive.
12. How could the mutation you described in #12 result in a faulty gene product? Be *very* specific in your description.
    In order for the recessive trait to show any dominance, it would need two xx chromosomes. The recessive x is while be copied but will be outweighed by the dominant X chromosome.

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13. The Romanov's son, Alexis, had hemophilia. Describe how Alexis genetically acquired hemophilia. (Use a Punnett square. You can either draw a table or line up the genotypes.)

When Xx is crossed with XY and Alexis being a male, he would either receive XY or xY. So he must be a xY if he was positive for the mutation.

14. Using a Punnett square (again, draw a table or line up the genotypes), explain why only males in the pedigree chart have hemophilia. (Choose at least one of the males represented in the pedigree chart, and show his parents in the Punnett square.)

King Leopold was a hemophiliac of xY. He was son of queen Victoria which had Xx. Crossing an Xx with XY, we either get XY or xY. Leopold was unfortunate with the genetic lottery.

15. Is it possible for a female to inherit hemophilia, and, if so, how?

In order for a female to inherit it, a mother needs to either be a hemophiliac or a carrier and the father must be a hemophiliac. Females receive an X from both parents while Males only receive X from the mother.

16. Some historians speculate that Alexis' hemophilia condition could have led to the Russian Revolution. Explain. ***You should look up the faith healer Rasputin and read about his relationship to the Romanov family.***

Rasputin was a faith healer sent in by Nicholas II to heal their son Alexis. Rasputin used his connections and influence over many political figures. This made the public weary and questioned the ones in power.

Molecular Analysis of People in a Mass Grave

17. Two "graves" were discovered near Yekaterinburg, Russia. When were these graves discovered, and how many bodies were found in each grave?

The larger grave was found in 1991 with 9 bodies and the second grave was found in 2007 with 2 bodies.

18. What type of testing was done to confirm sex and familial relationships among the remains found in the mass grave? If you use an abbreviation, write it out and define what it is.

Nuclear DNA testing of the five STR markers were conducted to determine the sex and familial relationships of the bodies. STR stands for short tandem repeat and can act as a marker for forensic analysis.

19. HRH Prince Philip, the Duke of Edinburgh, provided mitochondrial DNA used to identify Alix and her three daughters. HRH Prince Philip, the Duke of Edinburgh, is married to Queen Elizabeth II of England. Wait, isn't Queen Elizabeth II related to Queen Victoria? So why was ***Prince Philip's*** mitochondrial DNA used? (To help you answer this question, look at the second pedigree chart.)

Prince Phillips DNA was used because they had a closer connection the executed Romanov family. Queen Elizabeth most common ancestor was Queen Victoria. Phillip was a grand nephew to Alix making him more related. Also mitochondrial dna is passed through the mother so Elizabeth would have never received the correct mtDNA.

20. Who was missing from the mass grave (the one with the most skeletons)?

Anastasia or Maria were missing from the mass grave.

Molecular Analysis of People in a Mass Grave, cont.

21. The Duke of Fife and Princess Xenia provided mitochondrial DNA used to identify Nicholas. One of these is a female and another is a male. Does that matter? What general statement can you make about their genetic relationship to Nicholas and Alexandra?

It would matter. The Duke and Princess share a strong genetic relationship. However, only Princess Xenia shared a mitochondrial DNA with Nicholas as they both had the same mother.

22. What was discovered in the mitochondrial DNA of Nicholas that was not identified in either the Duke of Fife or Princess Xenia?

They found a single point heteroplasmy at position 16169. This differed from both the duke and princess.

23. What is the term given to the existence of two (or more) genetically different mitochondria in the cell?

Heteroplasty is the term given for the existence of two or more genetically different mitochondria in the cell.

24. What three types of DNA were used to test the remains found in a second grave? Again, if you use an abbreviation, write it out and define what it is.

Mitochondrial DNA testing, Autosomal STR testing, and Y-STR testing. STR as previously stated, "STR stands for short tandem repeat and can act as a marker for forensic analysis."

25. Of the three types of DNA you listed in the previous answer, which one would have been used specifically to identify Alexis and why?

They initiated Y-STR testing because of the exact match to the relatives.

26. Was Anastasia in the grave in which Alexis was found?

It is a mystery that no one truly knows if it is Anastasia or Maria.

Who Wants to Be Anastasia?

Apparently, about 200 people have wanted to be Anastasia and have claimed to be her! One of the most famous imposters was a woman named Anna Anderson (Manahan).

27. Give a brief history (2-3 sentences) of Anna Anderson-both her claims and what is thought to be true.

Anna Anderson was a polish factory worker that went under the name Anna Anderson. In fact, her actual name was said to be Franziska Schanzkowska.

28. Where in the US did Anna Anderson eventually settle and why?

Anna moved to Charlottesville, Virginia where she married a history professor in 1968.

29. What were the sources of Anna Andersons's nuclear DNA?

The sources of DNA were derived from hair and intestine samples.

30. What were the sources of Nicholas' and Alix's nuclear DNA?

The sources of Nicholas' and Alix's were skeletal bone samples.

31. What type of analysis was done on DNA from Anna Anderson, Nicholas, and Alix?

mtDNA and STR analysis were done for all three.

32. Anna Anderson's mitochondrial DNA was compared to the mitochondrial DNA of what two "other" people?

Anna's mtDNA was compared to Carl Maucher's DNA and to the Duke of Edinburgh.

33. A hypervariable region of the mitochondrial DNA was analyzed. Define a hypervariable region.

A region of a genome that is made of a variable number of repeated sequences.

34. What were the conclusions from the mitochondrial DNA comparisons?

Anna Anderson was in fact, not Anastasia and was in fact a polish worker named Franziska Schanzkowska.

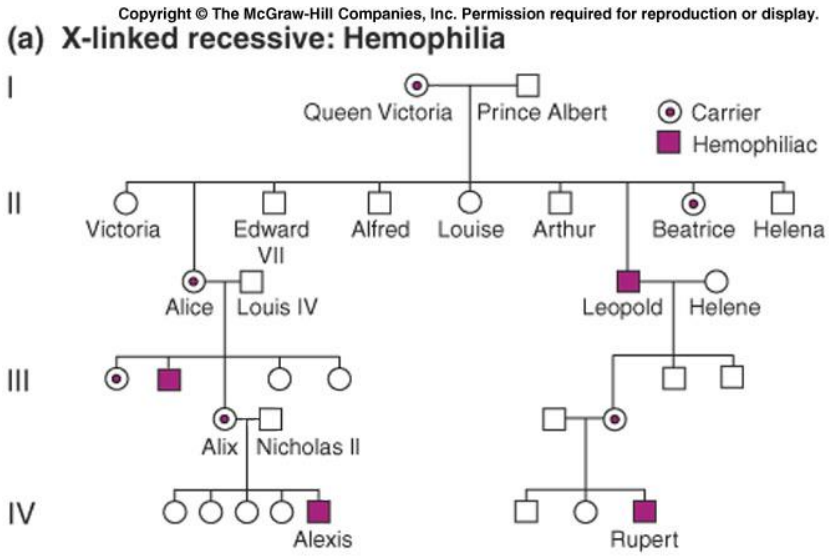
35. The article which describes the analysis of Anna Anderson's DNA was published in 1995.
When were all of Nicholas' and Alix's children finally accounted for?

In 2007 the last grave was found and accounted all children. There is not enough clarity to determine the identities of the remains.

36. What was the most surprising thing that you learned from doing this assignment?

I learned a bit more on the forensics side of genetics. I didn't know too much about the STR and mitochondrial analysis so it was intriguing to read about.

Are you still interested in the life of the last Tsar of Russia and his relationship to British royalty? The headline for the following article showed up on my Internet browser earlier this year. While I can't vouch for it as it did not appear in a peer-reviewed journal, it might be interesting reading for you.
https://www.townandcountrymag.com/society/tradition/a31028924/windsors-romanovs-relationship-last-gathering-true-story/



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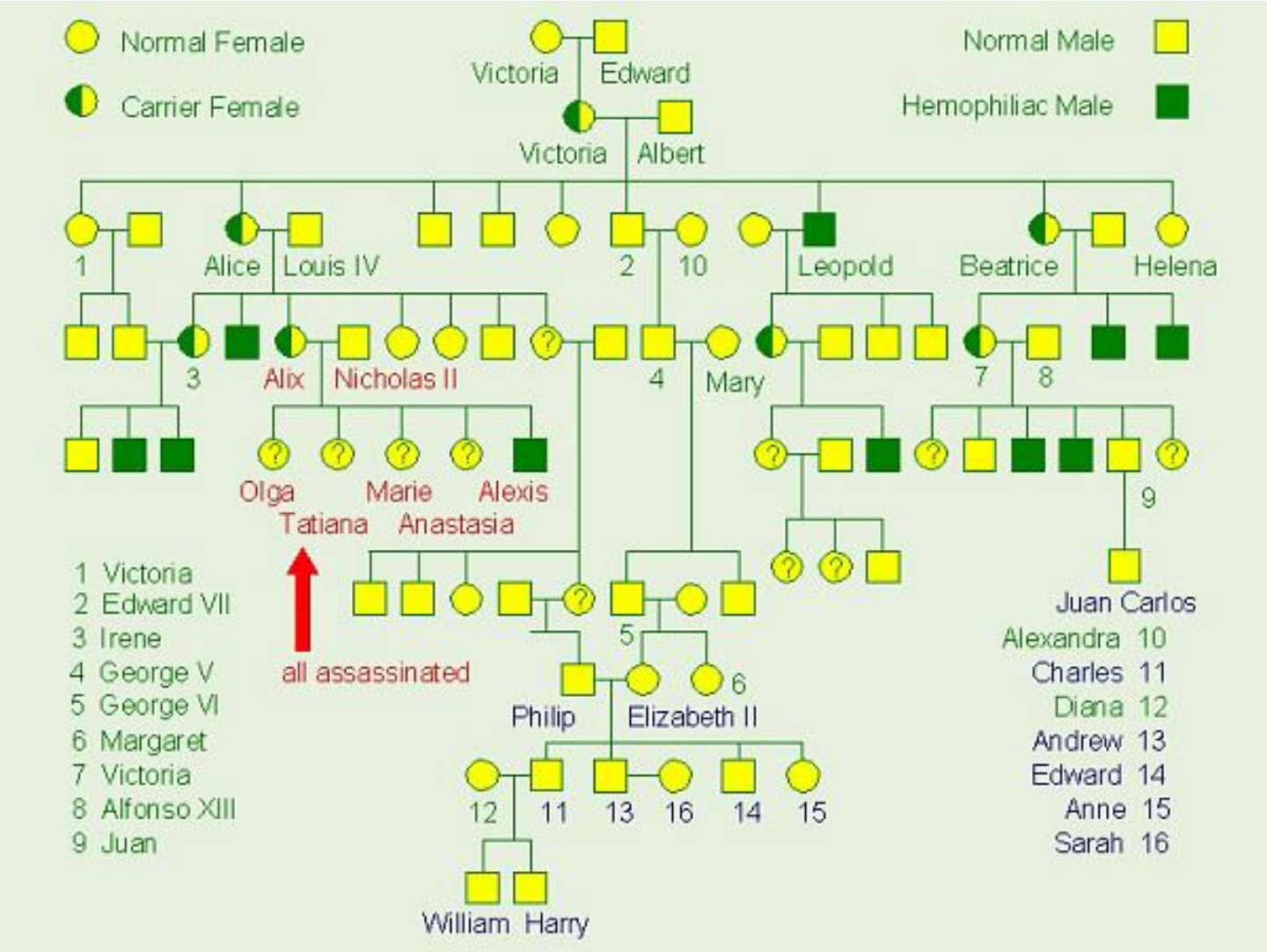

Source for the pedigree chart above: Janet Stein Carter, Biology Instructor at Clermont College, University of Cincinnati