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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?

The Romanov family held power in Russia for around 300 years or three centuries.

2. Nicholas II abdicated the throne. Who took power then?

He abdicated his crown to his brother, Grand Duke Michael Alexandrovich. But ultimately The Bolsheviks took control of Russia.

3. Describe what happened to Nicholas II and his family after he abdicated the throne?

Nicholas II entire family was executed by Bolshevik troops however, there were rumors that his daughter Anastasia had survived and escaped the attack.

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 were a confederation of anti-communist forces that fought against the communist Bolsheviks known as the reds during the Russian Civil War.

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 granddaughter of Queen Victoria of England.

6. On what chromosome is the gene that, when mutated, causes hemophilia, and how does this contribute to its inheritance pattern?

The chromosome that the gene that causes hemophilia is located on the X chromosome and the disease is X-linked recessive. So, for males they only have one copy of the X chromosome and inherit the X chromosome from there mother. Both Queen Victoria and Alix are designated as being carriers for hemophilia.

7. What does it mean to be a carrier for a disease?

Only a female can be a carrier for the disease because they have two X chromosomes. So, in order for a female to be a carrier one of their X chromosomes express the mutation for hemophilia while the other chromosome does not.

8. Why aren't males considered *carriers* for hemophilia?

Males will either express hemophilia or not because they only have one copy of the X chromosome. Since they only have one copy of the X chromosome, they cannot be considered carriers because if they have hemophilia mutation it will be expressed because it is an X-linked disorder.

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 a disease in which the blood has a hard time being able to clot. Without the blood being able to clot it causes to bleed severely even from the slightest of injuries. Hemophilia was passed through majority of the royal families. For this mutation to cause a faulty gene product it would have to code for a different amino acid and a different kind of protein. Also, if the gene had not been spliced properly Then it would result in an improper fold that would lead to an improper function in the gene. So basically, hemophilia just causes problems with blood clotting because an improper protein is coded for.

10. What type of hemophilia (A or B) is (probably) represented in the pedigree chart?

Hemophilia B is most likely represented in the pedigree chart.

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 mutation that caused hemophilia in Alix was a substitution mutation on exon 4, gene F9. This mutation causes a nitrogenous base to be swapped out for a different one. This could have caused a change in the amino acid sequence which caused the disease.

12. How could the mutation you described in #12 result in a faulty gene product? Be *very* specific in your description.

For this mutation to cause a faulty gene product it would have to code for a different amino acid and a different kind of protein. Also, if the gene had not been spliced properly Then it would result in an improper fold that would lead to an improper function in the gene.

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.)

	X^H	Y
X^H	X^HX^H	X^HY
X^h	X^HX^h	X^hY

Alexis inherited hemophilia because his mother was a carrier and it passed down to him.

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.)

	X^H	Y
X^H	X^HX^H	X^HY
X^h	X^HX^h	X^hY

The male I choose as a representative was Alexis and his parent Alix (mother and carrier) and Nicholas (father and normal male). The reason why only male's express hemophilia in this pedigree chart is because in each generation only one of the parents either express the mutation or are a carrier for the mutation while the other parent is normal and for males, they only have one X chromosome which is inherited from the mother so she would have to be a carrier for her son to express hemophilia for females the mother would have to be a carrier or express hemophilia while the father would have to express hemophilia and there are not parents like that in the pedigree charts. So, in the pedigree charts found at the bottom only the males will the express hemophilia because they only have one X chromosome while females have two X chromosomes which makes it much harder for females to express hemophilia.

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

Yes, it is possible, but it is a lot harder for a female to get hemophilia due to it being an X-linked disease. The mother would have to be a carrier or express the mutation meaning both of her X chromosomes have the mutation and the father would have to have the hemophilia mutation on his X chromosome for a female to get hemophilia she has to inherit two mutated X chromosomes one from each parent.

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.***

Alexis family sought out the help of Rasputin who had been a faith healer. Rasputin had been using his status and connections to influence a lot of governmental affairs. He used it mainly for his own self interests. This could have made the public weary and question the Romanovs which had been in power and could have started the Russian revolution.

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?

Around 5 family members and 4 servants were found in the first grave. The remaining 2 bodies were found in the second grave.

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 STR markers were used to confirm the sex of the people in the grave as well as to establish the familial relationship among those found in the mass grave. Forensic DNA testing was done using mitochondrial DNA (mtDNA), autosomal STR, and Y-STR testing was done on the remains found at the second grave.

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.)

Because mitochondrial DNA is inherited from the mother, HRH Prince Philip mitochondrial DNA was used because Prince Philip is the grandnephew of Alexandra (Alix). Because they all share a common maternal ancestor, they would all share mitochondria DNA, which is passed almost unchanged from mother to children. So that is why his mitochondrial DNA was used.

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

Tsarevich Alexi and one of his sisters were found to be missing by identification from the 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?

No, it does not matter if they have the same common maternal ancestor since mitochondrial DNA is inherited from the mother. I can make a statement that they have the same mitochondrial DNA as Nicholas. Nicholas and Alexandra were closely related, they were second cousins.

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

They discovered that the heteroplasmy at the point 16169 differed in ratio when compared to his brothers. His brother happened to have more T than C while he had the opposite.

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

The term given is heteroplasmy which means there is more than one genetically different mitochondrial in a 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.

The three types of DNA that were used to test the remains found in the second grave were mtDNA (mitochondrial DNA), autosomal DNA, and Y-STR (a short tandem repeat on the Y-chromosome).

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?

The Y-STR (a short tandem repeat on the Y-chromosome) because only males have a Y-chromosome female do not have a Y-chromosome thus this could be used to identify Alexis because he is a male.

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

No, she was not.

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 claimed to be the missing princess, Anastasia. It was thought to be that she had been lying or that she had been Francis Schanzkowska.

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

Anna Anderson settled in Charlottesville Virginia because she married an American history professor, J.E. Manahan.

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

They had used a sample of Anna Anderson's tissue. This was part of her intestine that had been removed during her surgical operation.

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

They did nuclear and mitochondrial DNA test on the nine bone samples of the family.

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

DNA/genetic analysis also known as DNA fingerprinting.

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

Anna Anderson's mitochondrial DNA was compared to the mitochondrial DNA of the Romanovs and Karl Maucher.

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

A hypervariable region is a location within a nuclear DNA in which the base pairs of nucleotides are repeating or are having substitutions.

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

The DNA was compared to the Romanovs and their relatives. Through these comparisons they found that itdid not match that of the Duke of Edinburgh or of the bones. This then confirmed that Anna Anderson had not been related to the

Romanov's. However, the DNA did end up matching Karl Maucher showing that they were maternally related and that she was Schanzkowska.

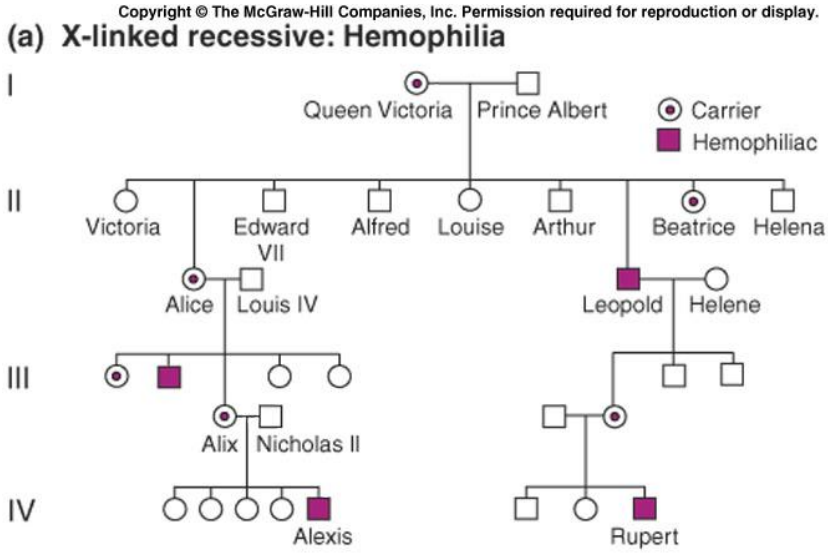
35. The article which describes the analysis of Anna Anderson's DNA was published in 1995. When were all of Nicholas' and Alix's children finally accounted for?

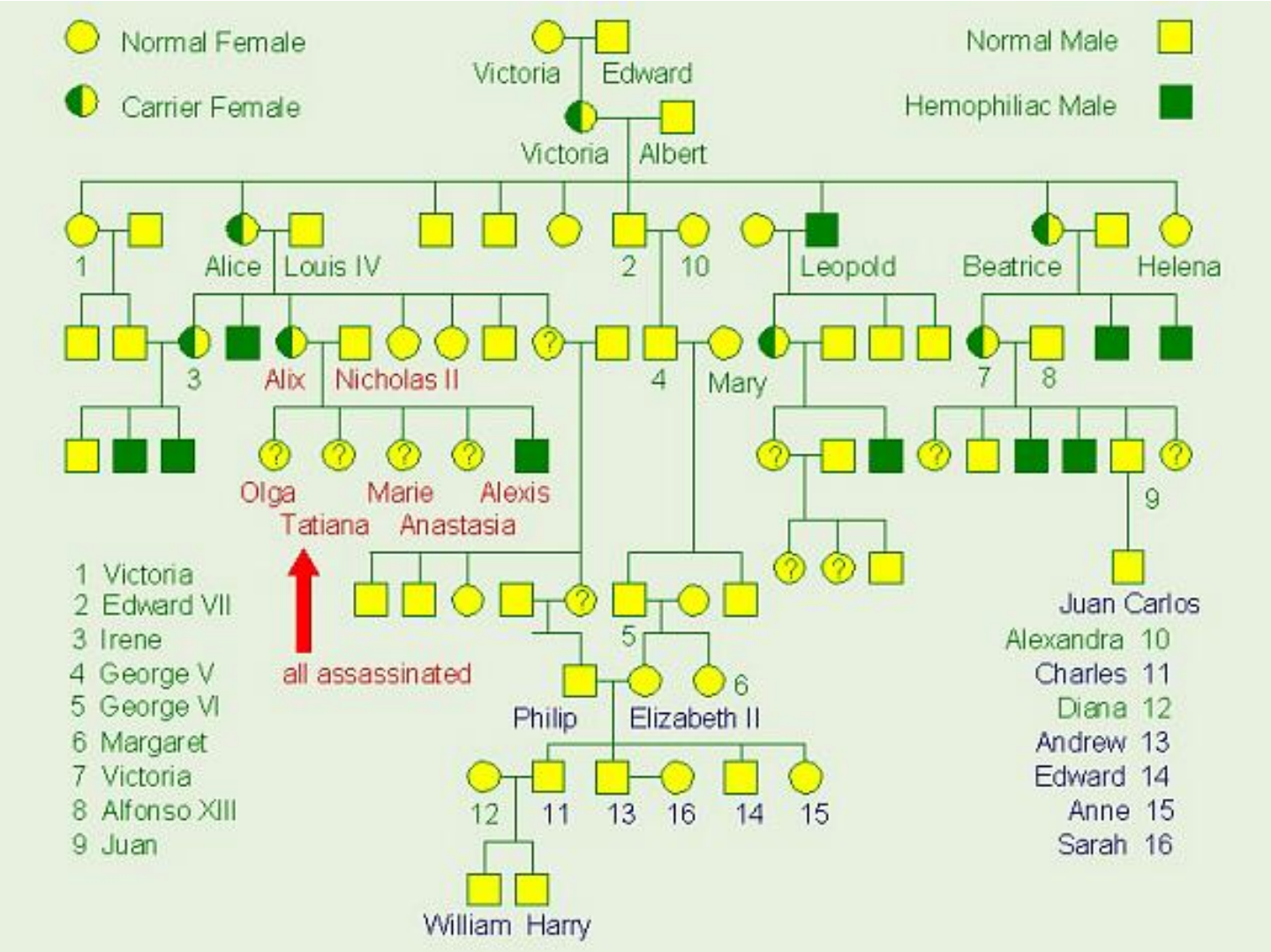
They were found in 2007.

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

I did not realize how closely related a lot of the royal families really are which really surprised me. Also, I did not realize how many people claimed to be Anastasia, but I guess it does make since because there was money involved.

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/





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