1. 300 years
2. The Bolsheviks
3. The Tsar and his family were held prisoner by the Bolsheviks and were executed in order to avoid a civil war with his loyalists.
4. The White Russian Army was a collection of crown loyalists who hoped to reinstate the Tsar.
5. Alix was the granddaughter of Queen Victoria.
6. The gene that controls hemophilia is on the X chromosome, which means that while women need 2 affected X chromosomes in order to be hemophilic, men only have the single X chromosome. This means women can be carriers, but men can only ever have it or not have it.
7. To be a carrier of a disease means that only one of the two X chromosomes carries the mutation, so they have a 50/50 chance of passing it on to their offspring.
8. Males cannot be carriers for hemophilia because they only have one X chromosome. If that one is mutated, then they are no carriers but are hemophilic themselves.
9. Hemophilia causes the body to not produce enough of the clotting factors VII and IX. This means that the blood cannot clot around an open wound, which leaves it open to continuous bleeding.
10. Hemophilia B
11. The disease was caused by a substitution in the splice acceptor site of exon 4 in the F9 gene responsible for the synthesis of clotting factor IX.
12. The mutation occurred in the splice acceptor site, which separates the exon and intron. The mutation could cause the loss of the exon or inclusion of the intron into the coding sequence. If this happens, it would be catastrophic for the structure of the protein and it would not be able to carry out the same functions.
13. SEE OTHER DOCUMENT
14. SEE OTHER DOCUMENT
15. It is only possible for a woman to inherit hemophilia if she has a hemophilic father and a mother who is either a carrier of the mutation or also hemophilic.
16. The Romanov family was desperate for a solution to Alexis' condition, and found that the spiritual healer Rasputin helped with his condition. Rasputin eventually became very close with the royal family in a way that was unconventional for peasants. After multiple russian failures in battle during WW1, public opinion became extremely unfavorable of Tsar Nicholas II, and many people put the blame for his failures on Rasputin, thinking he has some kind of influence over the royal family and the decisions of the Tsar, and this was used as one of the reasons for the removal of the Tsar by the Bolsheviks.
17. The first grave was a mass grave found during the late 1970's and the remains were DNA tested in 1991. It contained the Tsar and his wife, three of their children, and four of their servants. Another grave was found and tested in 2007 and contained the remains of the other two children of the Tsar.
18. Scientists used mtDNA testing, which means mitochondrial DNA, in order to verify the relation between the Tsarina and her children. This is a common method for measuring the relationship between people because the mtDNA does not exchange information with the father and is passed down in the mother's egg.

19. Scientists used Prince Philip's mtDNA because the earliest common ancestor he shared with Alix and her children was female, meaning that mtDNA had been passed down to him without being modified.
20. The Tsar's son Alexis and one of his daughters, either Anastasia or Maria.
21. Their sex does not matter because they are both maternal relatives to the Tsar.
22. A single point heteroplasmy at position 16169
23. Genetically different mitochondria in a cell are called heteroplasmic.
24. Scientists use mtDNA (mitochondrial DNA), autosomal STR, and Y-STR tests to test the remains in the second grave. STR stands for Short Tandem Repeats, which are repeated sections of the DNA. Autosomal STR tests in the autosome, while Y-STR tests specifically on the Y chromosome.
25. Y-STR, because Alexis was the only male of the five children
26. It could have been either Anastasia or Maria who was in the grave with Alexis.
27. Anna Anderson was a woman who claimed to be the lost daughter of Tsar Nicholas, Anastasia. She worked at a munitions factory in Berlin during WW1 and was injured in an explosion and sent to a mental hospital.
28. Charlottesville, VA because she was invited back by her supporter Gleb Botkin and his friend Manahan, who she married.
29. Her nuclear DNA was recovered from hair samples that were said to have come from her and preserved tissue samples from her intestine.
30. Nicholas' and Alix's nuclear DNA was recovered from their bones.
31. Mitochondrial DNA testing
32. This mtDNA was compared to the mtDNA of Franziska Schanzkowska, who she claimed not to be, and the Duke of Edinburgh who was a maternal descendant of Alix.
33. A hypervariable region is a section of the DNA that has a higher rate of mutation compared to the average and is not well conserved.
34. The DNA analysis concluded that the DNA of both Anna Anderson and Franziska Schanzkowska could not have been related to the Tsarina, and that there was more than a 1 in 300 chance that they were not the same person.
35. The last two children were found in 2007.
36. I found this whole genetic mystery and the long process of getting answers very interesting. I thought that it was surprising that the Soviet government lost the location of the burials, and even more so that a local scientist and his friends kept that secret for more than 10 years!

Works Cited

https://www.cdc.gov/ncbddd/hemophilia/facts.html
https://en.wikipedia.org/wiki/Grigori_Rasputin
https://en.wikipedia.org/wiki/Anna_Anderson