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**History**

1. Nicholas II was the last Romanov to hold power in Russia.  What was his title?

 Tzar of Russia.

1. How long had the Romanov family been in power in Russia?

They were in power for 300 years.

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

The Bolshevik’s

1. What happened to Nicholas II and his family after he abdicated the throne?

Nicholas II and his family were executed by Bolshevik troops.

1. 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?

 They were Anti-Bolshevik Russian forces.

**Hemophilia**

1. How was Alix, the wife of Nicholas II, related to Queen Victoria of England?  (Look at the pedigree chart carefully.)

 Alix was Queen Victoria’s granddaughter.

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

The gene that causes Hemophilia is on the X-Chromosome, because it is X-linked recessive it is most commonly inherited from females. Both Queen Victoria and Alix are designated as being carriers for hemophilia.

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

Being a carrier of a disease means that you have the disease and the ability to pass down the genetic mutation for the disease.

1. Why aren’t males considered carriers for hemophilia?

  There are no genes for clotting factors on the Y chromosome.

1. 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.)
2. What type of hemophilia (A or B) is (probably) represented in the pedigree chart?

 Hemophilia B is represented in their, and most, European families.

1. 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.

Hemophilia B, also known as Christmas disease, is an x-linked inherited disease that results in factor IX deficiency. Factor IX is a vitamin-K dependent single chain glycoprotein that helps the intrinsic system in forming factors X into Xa and VII into FVIII. The lack of these factors results in impaired clot formation leading to bleeding in joints, GI, cardiovascular, and pulmonary systems.

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

As the factor is X-linked, this can result in a faulty genetic code. It is recessive so it would take both parents carrying on the x gene for the

1. 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.)

|  |  |  |
| --- | --- | --- |
|  | XH | X |
| X | XHX | XX |
| Y | XHY | XY |

Alexis acquired hemophilia because his mother, Alix, was a carrier for the gene. The disease is x-linked and if a male inherits the gene, they will display the disease due to the lack of a second X chromosome. Therefore, Alexis acquired the gene on his one X chromosome and was a hemophiliac.

1. 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.)

|  |  |  |
| --- | --- | --- |
|  | 1. XH
 | 1. X
 |
| 1. X
 | 1. XHX
 | 1. XX
 |
| 1. Y
 | 1. XHY
 | 1. XY
 |

When looking at Leopold, the son of Queen Victoria and Prince Albert, in the pedigree chart, it appears that he has the same genetic possibilities as Alexis. Since hemophilia is X-linked recessive, females must have the gene located on both of their X-chromosomes to be able to display the disease, while males are able to display the disease with only one x-chromosome gene, since they only have one x-chromosome. This makes it a bigger possibility for the males to have hemophilia while the females are only carriers.

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

Hemophilia is prominent in men but women can inherit it also and if they do inherit it, it is because either one or both of their X chromosomes are affected

1. Some historians speculate that Alexis’ hemophilia condition could have led to the Russian Revolution.  Explain.

Rasputin was a mystic from Siberia who was said to have helped Alexei heal through hypnotism, however there are very few documented accounts of him doing so. Regardless, Rasputin was believed by both of Alexei’s parents to aid in keeping him well. This was only further emphasized when Rasputin was shot by aristocrats and Alexei’s condition worsened quickly and he along with his family were executed within a year and a half.With the fall of the Romanov family, the Russian Revolution began.

**Molecular Analysis of People in a Mass Grave**

1. Two “graves” were discovered near Yekaterinburg, Russia.  Describe the number of bodies in each grave.

The first grave had 9 bodies (biggest grave). The second grave had 2 bodies.

1. When were these graves discovered?

In 1991 (first grave) and 2007 (second grave)

1. What type of testing was done to confirm sex and familial relationships among the remains found in the mass grave?

STR and Y-STR Testing

1. Genetically, what does STR “stand” for?  Be very specific in your answer.

STR stands for short tandem repeats. These are short sequences of DNA that are repeated several times as a specific chromosomal location.

1. 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 Philip is the only living descendant of Tsarina. Through his mDNA they were able to confirm his relation to her as well as the three daughters.

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

The son of Nicholas II, Alexei, and one of the Tsar’s daughters believed to be either Anastasia or Maria.

1. 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?  Are these people still living?

One being male and one being female does not matter since it is mitochondrial DNA. This does show the relation between them through their maternal relatives however.

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

The point of heteroplasmy in the 16169 gene position that differed in the C to T ratio. Tsr Nicholas’ ratio was C/T.

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

Heteroplasmy

1. What three types of DNA were used to test the remains found in a second grave?

STR/Nuclear, mitochondrial, and ancient DNA

1. Of the three types of DNA you listed in #28, which one would have been used specifically to identify Alexis?

The type of DNA testing that would have been used to identify Alexis would be the Y-STR testing.

1. What was the source of the DNA used to identify Alexis?

Mitochondrial

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

It is known that Anastasia did not survive the execution but it isn’t clear whether it is Maria or Anastasia was in the grave with Alexis.

**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.

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

Anna Anderson was found after jumping into a canal in Berlin trying to kill herself. She was originally called “Ms. Unknown” as she had no idea and refused to tell anybody who she was. She ended up at an asylum where she confided in a nurse stating she was the lost duchess, Anastasia and that started a long string of identifications. However, living relatives of the late duchess claimed she was not Anastasia or had any relation.

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

She eventually settled in NYC where she changed her name to Anna Anderson. Her proclamations of being the grand duchess made her well known in various social circles. However, she continued acting out in ridiculous ways causing her to be committed to another asylum.

1. What were the sources of Anna Andersons’s nuclear DNA?

Her hair and intestine were used as samples prior to her cremation.

1. What were the sources of Nicholas’ and Alix’s nuclear DNA?

Their sources of DNA were from their bone/ skeletal remains

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

Mitochondrial DNA was taken from all three and then they used STR analysis and mtDNA analysis.

1. Anna Anderson’s mitochondrial DNA was compared to the mitochondrial DNA of what two “other” people?

Carl Maucher and to the Duke of Edinburgh (the great nephew of the Tsarina)

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

The location within the D-loop of the mitochondrial DNA in which base pairs of nucleotides repeat

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

They concluded that from the two different samples collected, the hair & intestine, and having done tests at three separate laboratories and their results were in agreement that it suggests came from Anna Anderson herself.

1. 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?

2007