

## Recovering the Romanovs

### ACTIVITY 1

#### The Romanov Family: Screen #4

### Inheritance of a Sex-linked Disorder

#### Directions:

1. Click on the LINKS tab and go to the link for *Sex-linked Disorder*.
2. Go to the "animation" and read through each screen of the animation. You move from one screen to the next by clicking the right and left arrows at the bottom right.
3. Stop when Charles Davenport introduces himself and answer the following questions.

#### Questions

Key: H=normal allele h=hemophilia allele, X=X chromosome Y=Y chromosome

1. Use a Punnett square to show the cross between Tsar Nicholas and Alexandra.



- a. What is the percent chance that one of their children would have the disorder?
  - b. What is the percent chance that only a son would have the disorder?
  - c. What is the percent chance that a daughter would be a carrier of the disorder?
  - d. How is it possible for a family with the same genotypes as the Tsar and Tsarina to have no children with hemophilia?
2. Use two different Punnett squares to show how a female can become a carrier from either her father or her mother.

**ACTIVITY 2**


**The mystery of Anna Anderson: Screen #3**

**The Proof?**


Handwriting Analysis

-  1. Follow the directions on the computer screen. Carefully examine both handwriting samples.  
Do you think the same person wrote them both? \_\_\_\_\_

The Ear Test

-  2. Do the ears match? \_\_\_\_\_  
In your opinion, could they be the same person?  
Explain your answer using evidence from the ear test.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Face Comparison

-  3. Compare the photographs of these five different people with a photograph of the true Anastasia by rolling over each unknown face.  
Complete the following chart by circling Yes or No for each face.

Faces	Does this face resemble Anastasia?	
#1	Yes	No
#2	Yes	No
#3	Yes	No
#4	Yes	No
#5	Yes	No

Write the name or names of those who most closely resemble Anastasia.  
\_\_\_\_\_

Do you think that everyone making this comparison will have the same list of names that you have? Explain your answer.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. Is the evidence you just finished analyzing strong enough for you to say with certainty that Anna Anderson is Anastasia? Explain your answer.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**ACTIVITY 3**

**Science solves a mystery: Screen #3**

**The Bones**

When the Soviet Empire collapsed in 1989, many long held secrets were finally revealed. Among them, was the secret burial location of Czar Nicholas and his family. In 1992, a group of scientists uncovered their remains and made some startling discoveries. Could these bones once and for all solve the great mystery of Anastasia?

Killed along with the royal family were two male servants, the family doctor and a nurse. Altogether, eleven people were murdered that night in Siberia: 6 females and 5 males. The following chart lists who they were and the ages of the children.

**Females**

- Tsarina Alexandra, adult
- Princess Olga, 22 years old
- Princess Tatiana, 21 years old
- Princess Maria, 19 years old
- Princess Anastasia, 17 years old
- Nurse, adult

**Males**

- Tsar Nicholas, adult
- Prince Alexei, almost 14 years old
- Family doctor, adult
- Servant, adult
- Servant, adult

How many skeletons would you expect to find in the grave? \_\_\_\_\_



1. Go to "Count the skeletons."

Click on any bone in the grave to remove a skeleton.



Continue until no bones remain in the grave.

How many skeletons were found in the grave? \_\_\_\_\_

**ACTIVITY 4**

**Science solves a mystery: Screen #5**

**Skeletal Analysis**

-  1. Click on the *Analyze the Skeletons* box and then on skeleton #1.  
 Analyze the bones by rolling over the boxes. Use the key to the right of the screen to determine if the wisdom teeth are present, if rings on the vertebrae are present and if the pelvis is that of a male or of a female. Then circle the correct choices in the chart below.
-  2. Do the same for the other eight skeletons. Use this information and the list from the previous activity of who was murdered to determine whose skeleton is present and whose is missing.

Skeletons	#1	#2	#3	#4	#5	#6	#7	#8	#9
Wisdom teeth present?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes = 22 years and older	No	No	No	No	No	No	No	No	No
Rings on vertebrae?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes = 18 years and older.	No	No	No	No	No	No	No	No	No
Pelvis: male or female?	Male	Male	Male	Male	Male	Male	Male	Male	Male
	Female	Female	Female	Female	Female	Female	Female	Female	Female
Give a possible identity for each skeleton									

**Who is missing?**

**ACTIVITY 5**  
**Screens #8-#11**

**The DNA**

Although historical evidence tells us that the bones found in the Siberian grave are the remains of the murdered royal family, how can the identity of these bones be proven?

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Because there are no direct descendants of the Romanov family and the only surviving relatives are distant, the best way to determine the identity of the skeletons is to use DNA from the mitochondria. (Refer to screen #8 for background information)

Mitochondria are organelles that contain a small circular chromosome. Only the mother passes on her mitochondrial DNA to the children in a family (both her sons and daughters). Mitochondrial DNA remains relatively unchanged for many generations.

Do you have mitochondrial DNA? \_\_\_\_\_ If so, who gave it to you? \_\_\_\_\_



1. Go to screen #11 to *Test Yourself on Mitochondrial DNA*

From whom did the Romanov children receive their mitochondrial DNA (mtDNA)?

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Where did that the person who passed their mtDNA on to the Romanov children get their mtDNA?

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Does Tsar Nicholas II have the same mtDNA as his children? \_\_\_\_\_  
Support your answer with an explanation of what you know about mtDNA.

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2. How can the identity of the skeletal remains be proven?

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**ACTIVITY 6**

**Screens #12-#14**

**The Tsarina's Pedigree - Analyzing the DNA**

 1. Go to screen #12 to *Tsarina's pedigree*

What do the small red objects represent? \_\_\_\_\_

After examining the Tsarina's pedigree, record the name of the most recent living Romanov maternal relative. \_\_\_\_\_

How can this maternal relative aid scientists in confirming that the skeletal remains belong to the Romanov family? \_\_\_\_\_


**The Tsarina's relatives**

In this next activity, you will confirm the identity of the skeletons found in the grave starting with the females.

How many of the females should be related to each other? \_\_\_\_\_


Should those that are related to one another have the same mitochondrial DNA (mtDNA)? \_\_\_\_\_

Explain your answer \_\_\_\_\_  
\_\_\_\_\_

 2. Go to Screen #13 and click on the *Bioservers Sequence Server* link.

Which sequence does not match the others? \_\_\_\_\_

From this result, which of the female skeletons must be related to one another?  
\_\_\_\_\_

 3. Go to Screen #14.

Based on the *Sequence Server* results that compared the mtDNA of the skeletons to the mtDNA of Prince Philip, answer the questions:


What can we conclude about the skeletons? \_\_\_\_\_

What can we conclude about skeleton #9? \_\_\_\_\_

**ACTIVITY 7**

**Science solves a mystery: Screens #15-16**

**The Tsar's Pedigree - Analyzing the DNA**

 1. Go to screen #15 and click on the *Tsar's Pedigree*.

Is there a maternal relative alive who could be used for a mitochondrial DNA comparison?

If so, who? \_\_\_\_\_

**The Tsar**

 2. Go to Screen #16 and click the *Bioservers Sequence Server* link; the differences will again be highlighted in yellow.

Is there a skeleton that matches the Tsar's family? \_\_\_\_\_

If so, which number skeleton is it? \_\_\_\_\_

What conclusion can be made about the male skeletons? \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**ACTIVITY 8**

**Science solves a mystery: Screens #18-#22**

**What about Anna Anderson?**

Could mitochondrial DNA technology be used to reveal Anna Anderson's true identity?  
Explain how this could be done.

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Whose mitochondrial DNA sequence would you expect to match Anna Anderson's sequence if she is really Anastasia? \_\_\_\_\_

**Identifying Anna**



1. Go to the *Sequence Server* and compare Anna Anderson's mtDNA with that of Prince Philip and Carl Maucher.

What do the findings suggest? \_\_\_\_\_

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**Your conclusion:**

Was Anna Anderson really Anastasia?