

Recovering the Romanovs

ACTIVITY 1

The Romanov Family: Screen #4

Inheritance of a Sex-linked Trait

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.

	X^H	y
X^H	$X^H X^H$	$X^H y$
X^h	$X^H X^h$	$X^h y$

- What is the percent chance that one of their children would have the disorder?
There is a 25% chance.
- What is the percent chance that only a son would have the disorder?
There is a 50% chance.
- What is the percent chance that a daughter would be a carrier of the disorder?
There is a 50% chance.
- How is it possible for a family with the same genotypes as the Tsar and Tsarina to have no children with hemophilia?
The chance of having a normal child is 50%. This is true each time a child is born to the family.

2. Use two different Punnett squares to show how a female can become a carrier from either her father or her mother.

	X^H	y
X^H	$X^H X^H$	$X^H y$
X^h	$X^H X^h$	$X^h y$

Carrier Mother x
Unaffected Father

	X^h	y
X^H	$X^H X^h$	$X^H y$
X^H	$X^H X^H$	$X^H y$

Unaffected mother x
Hemophiliac Father

ACTIVITY 2**The mystery of Anna Anderson: Screen #3****The Proof?**

Handwriting Analysis

Do you think the same person wrote them both? _____

Answers will vary.

The Ear Test

Do the ears match?

Answers will vary.

In your opinion, could they be the same person? Support your answer with evidence from the ear test.

Students' answers will vary. However, they should provide data from the Ear Test to support their response.

Face Comparison

Complete the chart by circling Yes or No for each face.

Student answers on the chart will vary.

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

Student answers will vary.

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

No, because you really can't be sure when you are comparing the handwriting, ear and face of a child with that of an adult. Not everyone will agree on the amount of similarity.

ACTIVITY 3

Science solves a mystery: Screen #3

The Bones

How many skeletons do you expect to find? 11

How many skeletons were found in the grave? 9

ACTIVITY 4

Science solves a mystery: Screen #5

Skeletal Analysis

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	Tsar	Family Doctor	Princess Maria	Servant	Tsarina	Princess Tatiana	Nurse	Servant	Princess Olga

Who is missing? **Anastasia and Alexei**

ACTIVITY 5**Science solves a mystery: Screens #8-#11****The DNA**

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

The remains can be identified through DNA analysis.

Do you have mitochondrial DNA? *Yes.*

If so, who gave it to you? *My mother.*

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

They received their mitochondrial (mt) DNA from their mother, the Tsarina Alexandra.

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

This individual (the Tsarina) received her mtDNA from her mother.

Does Tsar Nicholas II have the same mtDNA as his children? *No*

Support your answer with an explanation of what you know about mitochondrial DNA.

Tsar Nicholas received his mtDNA from his mother. Mitochondrial DNA is passed from the mother on to all of her offspring. The father does not contribute any mtDNA to the children.

How can the identity of the skeletal remains be proven?

The identity can be proven by comparing the mtDNA of the skeletal remains to that of the maternal relatives of the Tsarina and the Tsar. The wisdom teeth, vertebrae, and pelvic structure can also be used since mtDNA does not provide any information about the age or the sex of an individual.

ACTIVITY 6**Science solves a mystery: Screens #12-#14****The Tsarina's pedigree - analyzing the DNA**

What do the small red objects represent? *Mitochondria*

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

Prince Philip of England, Duke of Edinburgh.

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

This person would have the same mtDNA as the Tsarina and her children.

How many of the females should be related to each other? *Four.*

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

Explain your answer.

All of them would have received their mtDNA from the Tsarina. This same mtDNA was passed along through the family from mother to children ending in Prince Philip.

Which sequence does not match the others? *Skeleton # 9*

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

Skeletons # 3,5,6 and 7 are related to one another.

What can we conclude about the skeletons?

Skeletons # 3,5,6 and 7 are related to Prince Philip.

What can we conclude about skeleton #9?

This skeleton is not related to the royal family. Inference: the skeleton may be the nurse.

ACTIVITY 7

Science solves a mystery: Screens #15-16

The Tsar's pedigree - analyzing the DNA

Is there a maternal relative alive that can be used for a mitochondrial DNA comparison?

If so, who?

James, Duke of Fife

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

Yes.

If so, which number skeleton is it?

Skeleton # 4.

What conclusions can be made about the male skeletons?

One of the skeletons is the Tsar. The other male skeletons are not relatives.

ACTIVITY 8

Science solves a mystery: Screens #18-#22

What About Anna Anderson?

The same mitochondrial DNA technology can be used to reveal Anna Anderson's true identity. Explain how this could be done.

Scientists could examine her mtDNA and see if it matches the mtDNA of the Tsarina's maternal family line.

Who's mtDNA sequence would you expect to match Anna Anderson's mtDNA sequence if she is really Anastasia?

Anna Anderson's mtDNA should match the mtDNA sequence of the Tsarina and Prince Philip.

What do the findings suggest?

The results indicate that Anna Anderson is not related to Prince Philip and the Tsarina but is related to Carl Maucher.

Was Anna Anderson really Anastasia?

No, she was not.