

# 4.1

## FROM SCIENCE TO TECHNOLOGY

### DNA PROFILING REVEALS HISTORY

**In July 1918, the last tsar of Russia, Nicholas II, and his family, the Romanovs, met gruesome deaths at the hands of Bolsheviks in a town in the Ural Mountains of central Russia. Captors led the tsar, tsarina, four daughters and one son, plus the family physician and three servants, to a cellar and shot them, bayoneting those who did not die quickly. The executioners stripped the bodies and loaded them onto a truck, which would take them to a mine shaft where they would be left. But the truck broke down, and the bodies were instead placed in a shallow grave, then damaged with sulfuric acid so that they could not be identified.**

In July 1991, two Russian amateur historians found the grave, and based on its location, alerted the government that the long-sought bodies of the Romanov family might have been found. An official forensic examination soon determined that the skeletons were from nine individuals. The sizes of the skeletons indicated that three were chil-

dren. The porcelain, platinum, and gold in the teeth of some of the skeletons suggested that they were royalty. The facial bones were so decomposed from the acid that conventional forensic tests were not possible. But one very valuable type of evidence remained—DNA. Forensic scientists extracted DNA from bone cells and mass-produced it for study using a technique called the polymerase chain reaction (PCR) described in From Science to Technology 4.2.

By identifying DNA sequences specific to the Y chromosome, which is found only in males, the DNA detectives could tell which of the skeletons were from males. Then they delved into the DNA in mitochondria. Because these organelles pass primarily from mother to offspring, identifying a mitochondrial DNA pattern in a woman and children would establish her as their mother. This was indeed so for one of the women (with impressive dental work) and the children.

But a mother, her children, and some companions does not a royal family make.

The researchers had to connect the skeletons to the royal family. Again they turned to DNA. Genetic material from one of the male skeletons shared certain rare DNA sequences with DNA from living descendants of the Romanovs. This man also had aristocratic dental work and shared DNA sequences with the children! The mystery of the fate of the Romanovs was apparently solved, thanks to the help of DNA. The bodies of the two youngest, Alexis and Anastasia, were not found.

DNA profiling is a general term for several techniques that are used to compare the DNA of individuals, to identify them, or confirm or rule out relationships. Applications are many. DNA profiling has proven innocent more than 100 jailed people, and identified the two strains of cultivated grapes that can be bred to yield most popular wine grapes. DNA profiling was also critical in identifying human remains following the attacks of 9/11/01, the tsunami of 2004, and hurricane Katrina in 2005. ■