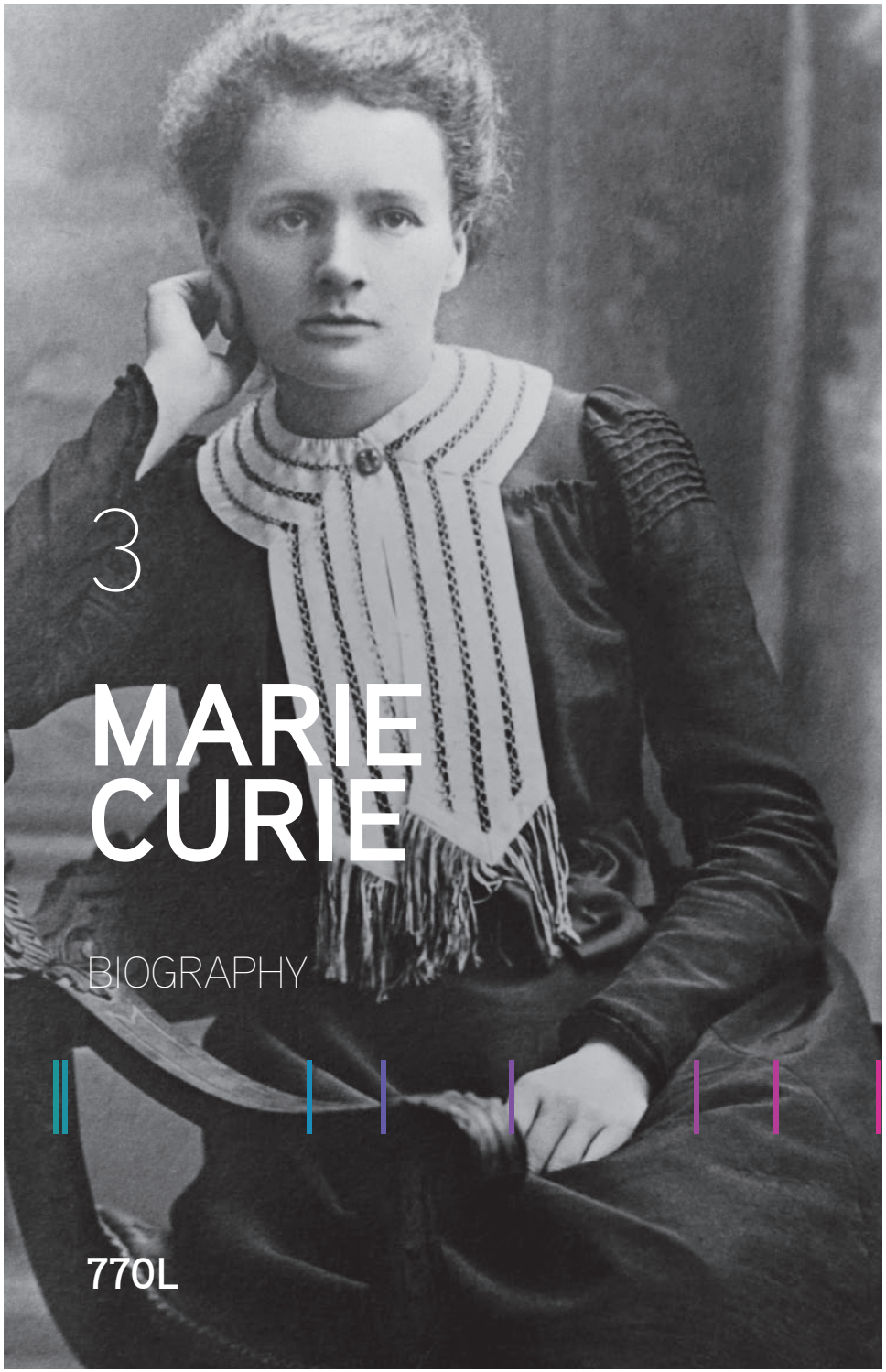

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MARIE CURIE

BIOGRAPHY

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BIG HISTORY PROJECT

Born
November 7, 1867
Warsaw, Poland

Died
July 4, 1934
Savoy, France

MARIE CURIE

CHEMISTRY, PHYSICS & RADIOACTIVITY

By Michelle Feder, adapted by Newsela

In 1897, Marie Curie began a series of experiments in the science of radioactivity. Her work would change the world of medicine, and give us a better understanding of the atom's structure.

Early life and overcoming obstacles

Marie Curie became famous for the work she did in Paris. But she was born in Warsaw, Poland, in 1867, as Maria Sklodowska. She was the youngest of five children. Both of her parents were educators: Her father taught math and physics, and her mother ran a private school for girls. But things took a turn for the worse the year she turned 10. Her mother died, and her father lost his job. Her father rented out their bedrooms, and Maria had to sleep on the floor.

Even as a young girl, Maria was interested in science. Her father kept scientific instruments at home in a glass cabinet. The objects fascinated her. Maria proved herself early as an exceptional student. She wanted to continue her education, but the University of Warsaw didn't admit women. Maria knew she would have to leave Poland to keep studying.

Maria did not want to leave her family or country, but knew it was necessary. She chose Paris because she wanted to attend the great university there: the University of Paris — the Sorbonne. There she would have the chance to learn from many brilliant thinkers.

In Paris

When Maria registered at the Sorbonne, she signed her name as "Marie". She had to work hard to learn French. Of 1,800 students there, only 23 were women. Marie became the first woman to earn a degree in physics from the Sorbonne.

In France she met a scientist named Pierre Curie. On July 26, 1895, they were married. They rented a small apartment in Paris, where Pierre worked as a college professor. Marie continued her studies at the Sorbonne. In September 1897, they had a daughter, Irène.

Meanwhile, scientists all over the world were making huge discoveries. The year the Curies were married, a German scientist named Wilhelm Roentgen discovered what he called "X-radiation" (X-rays). These rays are electromagnetic radiation and can glow like visible light. Certain chemical materials release them under the right conditions. Roentgen accidentally discovered X-rays in his lab. While experimenting, he saw X-rays glowing through black cardboard he'd placed around a tube filled with gas. Roentgen's breakthrough pushed Marie's own work forward.

Other scientists began experimenting with X-rays. The ability of X-rays to pass through solid materials led to the X-ray machine. It can take a picture of what's inside the human body. While studying X-rays, French physicist Antoine Henri Becquerel found that uranium gave off an entirely new form of ray. It was a narrow, invisible beam of energy. Marie Curie wanted to know why. One of her greatest achievements was solving this mystery.

Radiant discoveries

Marie Curie, and other scientists of her time, knew that everything in nature is made up of elements. Elements are pure materials such as gold, uranium, and oxygen. They can't be broken down into other substances, like compounds can. When Marie was born, there were only 63 known elements. Today 118 elements have been identified. At the time she began her work, scientists thought they had found all the elements that existed. But they were wrong.

Marie began testing various kinds of natural materials. One substance was a mineral called "pitchblende." Scientists believed it was made up mainly of oxygen and uranium. But Marie's tests showed that pitchblende produced

much stronger X-rays than those two elements did alone. She began to think there must be one or more undiscovered elements in pitchblende that made it so powerful.

To prove it, she needed loads of pitchblende to run tests on the material. And she needed a lab to test it in. Pierre helped her find an unused shed at the Sorbonne. There, Marie put the pitchblende in huge pots, stirred and cooked it, and ground it into powder. She added chemicals to the substance and tried to separate the elements in it. Every day she mixed a boiling mass with a heavy iron rod nearly as large as herself.

After months of this tiring work, Marie and Pierre found what they were looking for. In 1898, Marie discovered a new element. They named it "polonium," after her native country. Polonium was 400 times more radioactive than any other element. Later that year, the Curies discovered another element. They called it "radium," from the Latin word for "ray." It gave off 900 times more radiation than even polonium. Marie also came up with a new term for this property of matter: "radioactive."

It took the Curies four hard years to separate a small amount of radium from the pitchblende. In 1902, the Curies finally could see what they had discovered. Inside the dusty shed, the Curies watched its silvery-blue-green glow.

Marie presented her findings to her professors. She suggested that the powerful rays of energy the polonium and radium gave off were actually particles from tiny atoms. The atoms were disintegrating inside the elements and giving off energy. At the time, scientists believed that atoms were solid and unchanging. Marie's findings went against that widely held belief. The Curies' research showed that the rays weren't just energy released from a material's surface. Instead, the energy was coming from deep within the atoms. This discovery improved our understanding the structure of the atom.

A woman of distinction

In 1903, Marie received her doctorate degree in physics. It was the first PhD awarded to a woman in France. For their discovery of radioactivity, the couple won the Nobel Prize in physics. Marie Curie was the first woman to receive a Nobel Prize.

After many years of hard work and struggle, the Curies had achieved great fame. But there was one serious problem. Both of them suffered from what was later called radiation sickness. Marie coughed and lost weight; they both had severe burns on their hands. They grew tired very quickly. All of this came from handling radioactive material. At the time, scientists didn't know the dangers of radioactivity.

The Nobel gave the couple a better life. Pierre became a professor at the Sorbonne. Marie became a teacher at a women's college. The Sorbonne still did not allow women professors. The prize came with money, some of which Marie used to help support poor students from Poland.

In 1904, Marie gave birth to Eve, the couple's second daughter. But on April 19, 1906, this happy period came to a tragic end. On a busy street, Pierre Curie was hit by a horse-drawn carriage. He died instantly.

Marie struggled to recover from the death of her husband. The university offered her her husband's teaching job. On November 5, 1906, she became the first female professor in the Sorbonne's history. Around her, a new age of science was emerging.

A chemistry of the invisible

An atom is the smallest particle of an element that still has all the properties of the element. Scientists had believed that the atom was the smallest unit in matter. But the English physicist J. J. Thompson found particles even smaller than atoms — subatomic particles.

British scientist Ernest Rutherford built upon this discovery. In 1899, he found that there were two different kinds of particles coming out of radioactive substances. Radioactivity gave off "beta" rays. These rays traveled at nearly the speed of light. They could pass through thick barriers. Radioactive substances also give off slower, heavier "alpha" rays.

Rutherford discovered that radioactive elements break down. They actually decay into other elements. In the process, they send out alpha and beta rays. The decay theory confirmed Marie's theory that radioactivity happens inside that atom itself.

In 1904, Rutherford came up with the term "half-life." The term refers to how long it takes an unstable element to decay to half of its original amount. This discovery would lead to radiometric dating. Scientists realized they could use "half-lives" of elements to measure the age of materials.

In 1905, physicist Albert Einstein was also studying unstable elements. His calculations led him to believe that very small amounts of matter were capable of turning into huge amounts of energy. This idea would lead to his General Theory of Relativity a decade later.

Thompson called particles smaller than atoms "electrons." These were the first subatomic particles to be identified. Thompson was awarded the 1906 Nobel Prize in Physics in part for the discovery of the electron.

In 1911, Rutherford made another breakthrough about the inside of atoms. He found that they were mostly empty space. But in the center atoms have a dense "nucleus" containing "protons."

Timeline of Curie's life

1867
Born Maria Sklowdowska on November 7 in Warsaw, Poland

1877
Her mother dies, and the family home becomes a boardinghouse

1883
Graduates from high school

1891
Moves to Paris to study at the Sorbonne

1893
Becomes the first woman to earn a physics degree from the Sorbonne

1895
Marries Pierre Curie

1897
Gives birth to first daughter, Irène; begins her work on radioactivity

1898
Announces discovery of radium and polonium

1903
Shares the Nobel Prize in physics with Pierre Curie and Antoine Henri Becquerel

1904
Gives birth to second daughter, Eve

1906
Pierre Curie dies

1911
Receives second Nobel Prize, this time in chemistry

1860 | 1870 | 1880 | 1890 | 1900 | 1910

During the time of Curie

1869
Dmitri Mendeleev devises the periodic table

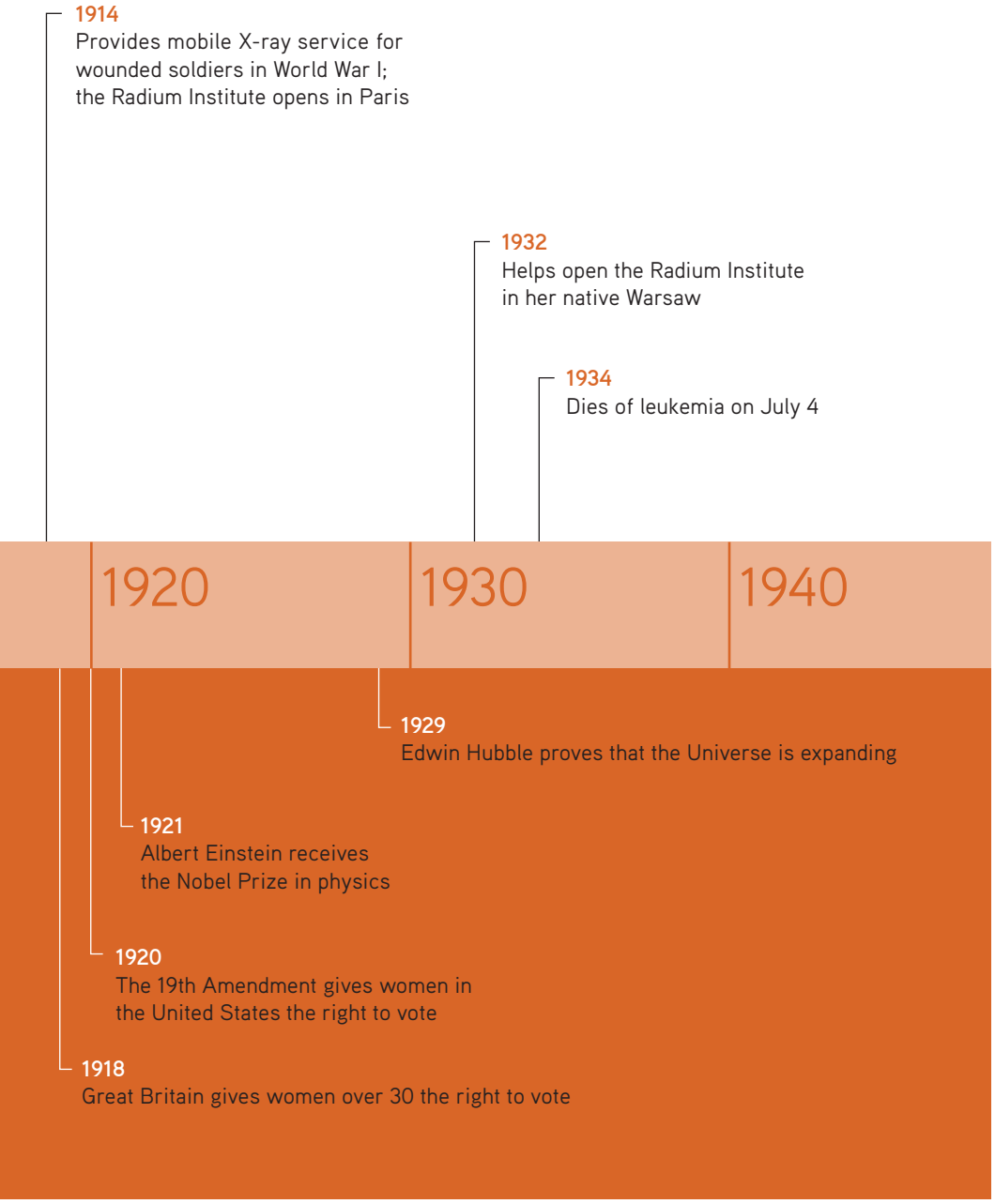
1882
English naturalist Charles Darwin dies

1889
The Eiffel Tower is completed

1901
The Nobel Prize is founded by Swedish inventor Alfred Nobel

1907
Dmitri Mendeleev dies in St. Petersburg, Russia

1914
World War I begins



Marie's isolation of radium was the key to Rutherford's breakthrough. She had created what she called "a chemistry of the invisible." The age of nuclear physics had begun.

A second Nobel Prize

In the years after Pierre's death, Marie juggled her responsibilities as a single mother, professor, and famous researcher. She wanted to learn more about the elements she discovered. And she wanted to figure out where they fit into Mendeleev's table of the elements, the "periodic table." Elements on the table are arranged by weight. To determine the locations for polonium and radium, she needed to figure out their molecular weight. Her research showed that polonium should be number 84 and radium should be 88.

In 1911, Marie was awarded the Nobel Prize for Chemistry. She was the first person to win two Nobel Prizes.

A year later, Marie was visited by Einstein. The two scientists had much to discuss: What was the source of this immense energy that came from radioactive elements? To promote the study of radioactivity, Marie started the Radium Institute, a research center in Paris and Warsaw.

Marie Curie's radioactivity research forever changed the field of medicine. Radium became used in treating cancer. During World War I, she designed radiology cars bringing X-ray machines to hospitals for soldiers wounded in battle. Marie trained women as well as men to be radiologists. In the last two years of the war, more than a million soldiers were X-rayed. Many were saved. Her research laid the foundation for radiotherapy, which uses radiation to destroy cancerous tumors in the body.

Marie Curie died of leukemia in 1934. We now know that radioactivity caused many of her health problems. In the 1920s, scientists became aware of the dangers of radiation exposure: The energy of the rays breaks through the skin. Once inside, it slams into the molecules of cells, and can harm or even destroy them.

A place in the periodic table

In 1944, scientists at the University of California discovered a new element, 96. They named it “curium,” in honor of Marie and Pierre. Today we recognize 118 elements. Ninety-two were formed in nature. The others have been created artificially in labs.

Marie Curie’s legacy cannot be overstated. Poverty didn’t stop her from pursuing an education. Marriage enhanced her life and career. Motherhood didn’t limit her life’s work. At a time when men dominated science and women didn’t have the right to vote, Marie Curie proved herself a pioneering scientist in chemistry and physics.

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Marie Curie in her laboratory in 1905
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