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Chain Reaction

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BEFORE THE FALLOUT

From Marie Curie to Hiroshima

By Diana Preston

Walker. 400 pp. $27

On a sunny August morning 60 years ago, a young Japanese mother named Futaba Kitayama looked up to see "an airplane as pretty as a silver treasure flying from East to West in the cloudless pure blue sky." As she watched, the plane released an object from its bomb bay that soon exploded into "an indescribable light." It was the device dubbed "Little Boy" -- the first deadly and fearsome display of the true power of the atom. Kitayama saw her own flesh peel off her body. Some 140,000 men, women and children in the city of Hiroshima were killed, either by the immediate blast or, within months, from radiation. It would have taken 3,000 B-29s carrying conventional bombs to equal the might of that single atomic explosion.

Given the enormity of that event -- military, political and historical -- it is not surprising that the quest to unravel the secrets of the atom has been the subject of dozens of books over the years. In Before the Fallout, the British historian Diana Preston draws on many of those works but also adds her own archival research and interviews. While her book provides no startling revelations, Preston artfully distills the key moments of the pre-atomic-bomb era, both scientific and biographic, and weaves them into an absorbing narrative. The result is a concise and very readable overview of the human chain reaction that began in 1896 with the innocent observation that uranium salts could fog a photographic plate and culminated half a century later in the most potent weapon the world had ever seen.

Preston opens her tale in a rundown Parisian courtyard, where the Polish-born scientist Marie Curie spent many months huddled over her cauldrons, processing mounds of pitchblende (a heavy, black ore rich in compounds of uranium) in search of the yet unknown elements that she was sure it contained. It took her more than three years to crystallize a mere tenth of a gram of radium, but after that 1902 achievement, progress came quickly. The purity of her samples, with their high levels of radioactivity, enabled scientists in Europe and America to probe various materials with the penetrating rays and begin dissecting the atom. In 1911, physicists came up with the now familiar model: a tiny nucleus of protons and neutrons, surrounded by orbiting electrons. This newly discovered atomic world soon took on an Alice-in-Wonderland quality, where matter turned out to be frozen energy (as quantified in Einstein's equation E = mc{+2}) and elements that were once considered immutable could disintegrate into a hail of elementary particles.

By 1933, scientists were already speculating about whether nuclear transformations could be explosive, but notable physicists such as Ernest Rutherford and Niels Bohr called such talk "moonshine" and "beyond the reach of experiments." At the time they were right, but Preston lucidly describes how swiftly the situation changed. Just six years later, the Austrian theorist Lise Meitner figured out that a heavy nucleus could split apart like an amoeba dividing into two. It didn't take long for many in the field, such as J. Robert Oppenheimer, to realize that this fission "could make bombs": A single neutron splits a uranium nucleus, which releases more neutrons, which in turn hit other uranium nuclei, triggering a self-sustaining reaction of lethal potential. In 1940, Otto Frisch and Rudolf Peierls gave the British government their secret and influential three-page document, "On the Construction of a 'Superbomb,' " which outlined its feasibility.

Was building the bomb inevitable? Probably. Various pieces of the puzzle were being discerned by scientists in a number of countries around the same time. And wartime pressures forced them to pursue it, if only to create a nuclear deterrent that put fear into their enemies. In the United States, the pursuit was quite aggressive; in Nazi Germany, it was more desultory. In Preston's account, Werner Heisenberg, a leading member of the German team, appears as capricious in the Nazi quest for nuclear weapons as the uncertainty principle he had earlier established in quantum physics. Preston provides just enough scientific details to make us appreciate the complexity of the task, and her portraits of the major players help us understand their motivations, concerns and misgivings.

As she chronicles this race for the bomb, Preston never lets us forget the ultimate tragedy to come. She returns to Hiroshima several times over the course of her book, presenting vignettes of its ongoing life. In the 1920s, the city flourished as both an academic and a manufacturing center. By 1944, she writes, "Bramble shoots were stripped of their prickles and chewed. Reeds from the city's rivers were boiled and eaten." We come to see that the city's inhabitants were deprived and defeated even before the blast.

In the end she asks, "What if?" What if certain scientists had died prematurely? What if the bomb's construction had taken a year longer? What if the bomb had been invented but never used? Such speculations are fascinating, but what lingers are the personal stories: British physicist James Chadwick, imprisoned by the Germans during World War I, using toothpaste containing thorium to carry out jailhouse experiments on radioactivity; Bohr, fleeing Nazi-ruled Denmark, dissolving in acid some gold Nobel medals left to him for safekeeping; the rear gunner of the Enola Gay comparing the plane's steep turn to safety after the Hiroshima bomb drop to "the cyclone rollercoaster ride at the Coney Island amusement park."

"History," writes Preston, " . . . is inherently about people, how they thought, what they did with their thoughts, and how they interacted with the individuals immediately around them." With Before the Fallout, she conveys that history with both style and compassion. *

Marcia Bartusiak teaches science writing at the Massachusetts Institute of Technology. Her latest book is "Archives of the Universe: A Treasury of Astronomy's Historic Works of Discovery."

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