

# *The Blinding Light*

August 6, 1945 started as a clear, hot summer day in Hiroshima, a city on the agriculturally-rich delta of the River Ota in the southwest part of Honshu Island, in Japan. At 8:15 in the morning sirens sounded throughout the city after apparent enemy planes were sighted high in the sky. Then a blinding light was suddenly seen, often described as a huge lightning bolt. Some survivors reported a series of flashes. This was followed by the sound of a deafening blast, and then by powerful, scorching winds that would not ease and burned the skin and flesh of everyone in their wake. Within minutes, huge fires raged throughout the city. Hiroshima was a mass of burning flesh, metal, and wood.

The culprit was the atom bomb—the first atomic bomb aimed at unsuspecting, civilians: well over 150,000 of them. The bomb, made of a rare isotope of uranium, called uranium 235, which had been refined and purified from ore over the course of two years in an operation at various locations in the United States, centrally controlled from Los Alamos, New Mexico, and known as The Manhattan Project, was dropped over the center of Hiroshima from the American warplane the *Enola Gay*. The nation's most advance strategic bomber had been constructed expressly for this mission. Fifteen of them had been equipped to carry atomic bombs for this and possibly subsequent operations.

In the night of August 5-6, 1945, the *Enola Gay* took off from the large U.S. airbase on Tinian Island in the Marianas, accompanied by two other B-29s, one of which was to take pictures of the bombing. After about 6 hours of flight, they arrived over

Hiroshima, at 8:15 am, at an altitude of 32, 000 feet. When the *Enola Gay* was over the center of the city, Colonel Tibbets gave the order, and the atomic bomb, nicknamed the “Little Boy” was dropped.

The *Enola Gay* quickly reversed direction and sped away to avoid radiation damage to its crew. Little Boy fell for almost a minute through the air, and when it descended to an altitude of 1,900 feet, by design its fuse detonated, setting off a small conventional explosive within the large bomb, which sent one piece of uranium 235 to meet a second piece, nesting perfectly one inside the other. When this happened, the total combined mass of uranium in one place exceeded the minimum necessary to cause a *chain reaction* of uranium fission. The spontaneous fission—or splitting in half—of untold numbers of uranium atoms in a chain reaction caused the horrendous explosion. A tiny amount of mass was thus converted into an immense amount of energy, which created the huge blast. This explosion 1,900 feet above Hiroshima destroyed the city—and it also opened the nuclear age in which we live.

People who were within a mile of the detonation area were completely vaporized. In one case, a person left us his shadow etched through the intense radiation on the remnants of a wall. All buildings within a radius of a mile of the blast were pulverized by the explosion. And fires raged on throughout the entire city.

Setsuko Nishimoto recalled what happened. She lived in a village several miles outside the city. Her husband didn’t want to go to work on that day. Reluctantly, he joined his fellow villagers who left on ox carts for Hiroshima, where they were employed in demolishing an old building.<sup>i</sup>

“I was in the lavatory of my house when it happened,” she recalled, “I thought it was a flash of lightning, and next there was a noise, an enormous *Bang!* The house went pitch dark. The sliding doors and screens went down, there was an enormous blast of wind, and the wall fell right out. When I looked over toward Hiroshima, I saw a black cloud rising up.”<sup>ii</sup>

All around, in the direction of Hiroshima, Setsuko saw flames rising. It seemed that the whole city was on fire. She worried about her husband, but—not comprehending the immensity of what she had just witnessed—assumed that he was now redirected with his work crew to putting out the flames of Hiroshima. In the afternoon a person with a loudspeaker was moving through the village announcing: “Hiroshima is completely destroyed!” During the night survivors of the blast were being evacuated to the Yutani factory and tended to by medical crews.

Setsuko went to search for her husband. The “huge crowd of people,” she recalled later, “were charred and terrible to watch.”<sup>iii</sup> People had most of their clothes torn and burned off their bodies. Their faces were so swollen that their eyes could not be seen. Their hands and feet were swollen from fire and radiation burns. Another woman described seeing a man that was so badly burned that “his skin looked like cellophane and was hanging off.”<sup>iv</sup>

Setsuko did not find her husband. But even for those who did manage to find their relatives, there was no happy ending. All succumbed to the effects of radiation, and died. A week later, Setsuko burned with a 105 degree fever. Her hair fell out at the slightest touch. She had a severe case of radiation poisoning, as did many others who were not at the epicenter of the explosion but whom the radioactive waves nevertheless

reached. Some survived, but they suffered from agonizing pain throughout their remaining years.

It is estimated that the Enola Gay incinerated nearly 150,000 individuals in Hiroshima and at least 100,000 more died from radiation damage.<sup>v</sup>

Three days after the bombing of Hiroshima, the United States dropped the “Fat Man” on the Japanese city of Nagasaki. It was bigger than the first bomb—and this one had a plutonium core. In the second attack, 75,000 people died and many more followed suit from radiation sickness and cancer in subsequent years.

The rate of cancer in Hiroshima and Nagasaki has been shown to be strongly and directly correlated with the total amount of radiation absorbed by residents of these two cities, and to rise sharply the closer a person was to the location to the explosion.<sup>1</sup> And as the novelist Kenzaburo Oe has said, surviving victims of the atomic bombs carry “the terrible burden of learning to live with their illness and preparing to die.”<sup>vi</sup>

Hiroshima and Nagasaki showed the world the kind of devastation that science can wreak—an airplane-carried device capable of wiping out an entire city. It was a huge leap from the power of, and the required effort involved in developing, conventional bombs.

What led to this terrible outcome? What preceded the devastation of these two Japanese cities? And what was the role of science? How did a coloring agent that for centuries seemed benign become the cause of such immense destruction? And what led to its transformation into an agent of uncontrolled explosive power?

There have been other books that covered the building of the atom bomb. There have been books that scrutinized the decision to drop the bomb. This is a different book.

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<sup>1</sup> Y. Tsutomu, et al., *Journal of Radiation Research* 28 (1987), 156-71.

My goal is to make accessible for the reader the science behind this singular development. Most books about the atom bomb have been written at the height of the Cold War, when we faced off our Soviet counterparts in a game of deterrence. Whoever had the bigger bomb, went the logic, could scare off the other. Now beyond the Cold War, we can think of nuclear power differently – not as a wholly destructive agent, but as a source of energy—which, some day, could be made safe—that may satisfy our growing thirst for industrial, commercial, and household power while helping protect our planet from overheating. We may also learn to control the present phase of nuclear weapons proliferation—now that the old Soviet threat has almost disappeared—and ensure that the specter of nuclear holocaust is forever lifted.

But nuclear fission has a more complicated and interesting history. What did the scientists who in the aggregate discovered radioactivity and atomic fission seek? What was the perceived power of uranium before it was harnessed toward destructive ends? Did the scientists intend to create a doomsday weapon, or were they simply pawns in the increasingly grotesque political theater in play? Could the horror of the atomic bomb have been averted?

How did scientists first come up with the idea that an atom can split, producing a large amount of energy? What could possibly have led researchers and thinkers to assume that the atom was not an immutable piece of matter, solid as a rock, but rather something malleable that can, under the right conditions, be turned into a totally different kind of entity: heat, light, electricity, or a shock wave—all of them forms of *energy*? It was a sequence of unlikely scientific discoveries of the properties of the humble grey

element uranium, which gathered momentum over a period of several decades, and reached a fever pitch on the eve of war.

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<sup>i</sup> Kanda, Mikio, ed. *Widows of Hiroshima: The Life Stories of Nineteen Peasant Wives*. Translated by Taeko Midorikawa. New York: Saint Martin's Press, 1989, p. 5.

<sup>ii</sup> Mikio Kanda's interview with Setsuko Nishimoto, in Kanda, Mikio, ed. *Widows of Hiroshima: The Life Stories of Nineteen Peasant Wives*. Translated by Taeko Midorikawa. New York: Saint Martin's Press, 1989, p. 5.

<sup>iii</sup> Mikio Kanda's interview with Setsuko Nishimoto, in Kanda, Mikio, ed. *Widows of Hiroshima: The Life Stories of Nineteen Peasant Wives*. Translated by Taeko Midorikawa. New York: Saint Martin's Press, 1989, p. 6.

<sup>iv</sup> Mikio Kanda's interview with Tsuruyo Monzen, in Kanda, Mikio, ed. *Widows of Hiroshima: The Life Stories of Nineteen Peasant Wives*. Translated by Taeko Midorikawa. New York: Saint Martin's Press, 1989, p. 21.

<sup>v</sup> Kanda, Mikio, ed. *Widows of Hiroshima: The Life Stories of Nineteen Peasant Wives*. Translated by Taeko Midorikawa. New York: Saint Martin's Press, 1989, p. xiii.

<sup>vi</sup> Oe, Kenzaburo. *Hiroshima Notes*. New York: Marion Boyars, 1995, p. 23.