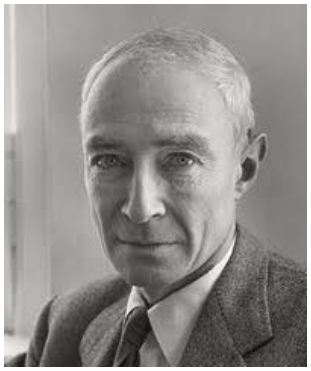
J.R. Oppenheimer



J. Robert Oppenheimer (1904-1967) was an American theoretical physicist and professor of Physics in University of California, Berkeley. Also known as "father of the atomic bomb", he was the administer of the Manhattan project during World War II. Compendiums of the substance of his life, his intellect, his patrician manner, his leadership of the Los Alamos National Laboratory, his political affiliations and post-war military/security entanglements, and his early death from cancer, amount to a highly compelling story.

Source: ias.edu

His early life and education

Born on April 22, 1904, in New York City, J.R. Oppenheimer was the son of a German immigrant, Julius Oppenheimer, who had made his fortune by importing textiles in the city. He grew up in a Manhattan apartment adorned with paintings by van Gogh, Cézanne, and Gauguin. His mother, Ella Friedman, was a painter whose family had been in New York for generations. His younger brother, Frank, also became a physicist.

Oppenheimer as a kid; Source: weebly.com

Oppenheimer was initially educated at Alcuin Preparatory School; in 1911, he entered the Ethical Culture Society School. Oppenheimer was a versatile scholar, interested in English and French literature, and particularly in mineralogy. His correspondence with the New York Mineralogical Club was so advanced that the Society invited him to deliver a lecture- not realizing that Robert was a twelve-year-old boy. He completed the third and fourth grades in one year, and skipped half the eighth grade. During his final year, he became interested in chemistry.

After his graduation, he suffered an attack of colitis while prospecting in Joachimstal during a family summer vacation in Europe. This caused him entering the Harvard College after a year. During the year of his illness, his parents arranged him to stay at New Mexico with his high school teacher Herbert Smith, where he recovered merrily and grew to love horseback riding and countryside.

Oppenheimer enrolled at Harvard in September 1922. Oppenheimer majored in chemistry, but Harvard required science students to also study history, literature, and philosophy or mathematics. He compensated for his late start by taking six courses each term and was admitted to the undergraduate honour society Phi Beta Kappa. In his first year, he was admitted to graduate standing in physics on the basis of independent study, which meant he was not required to take the basic classes and could enrol instead in advanced ones. He was attracted to experimental physics by a course on thermodynamics that was taught by

Percy Bridgman. He graduated summa cum laude (with the highest distinction) in three years, excelling in a wide variety of subjects. He then decided to pursue the field of physics.

In 1924, Oppenheimer was informed that he had been accepted into Christ's College, Cambridge. He wrote to Ernest Rutherford requesting permission to work at the Cavendish Laboratory, which was then accepted as he got to work under the Nobel laureate. The laboratory had an international reputation for its pioneering studies on atomic structure. At the Cavendish, Oppenheimer had the opportunity to collaborate with the British scientific community in its efforts to advance the cause of atomic research. There he realized that his talent was for theoretical, not experimental, physics, and he accepted an invitation from Max Born, director of the Institute of Theoretical Physics at the University of Göttingen, to study with him in Germany.

Oppenheimer made friends in Göttingen who went forward to achieve great success, including Werner Heisenberg, Pascual Jordan, Wolfgang Pauli, Paul Dirac, Enrico Fermi, Neils Bohr and Edward Teller. He had the good fortune to be in Europe during a pivotal time in the world of physics, as European physicists were then developing the ground-breaking theory of quantum mechanics. He was a student with a lot of questions and never afraid to ask any. He obtained his Doctor of Philosophy degree in March 1927 at the age of 23. Oppenheimer published more than a dozen papers at Göttingen, including many important contributions to the new field of quantum mechanics. He and Born published a famous paper on the Born–Oppenheimer approximation, which was an important contribution to quantum molecular theory.

Oppenheimer as a PhD student in Göttingen, Germany; Source: wikimedia

Life after formal education

Paul Dirac, Robert Millikan and J. Robert Oppenheimer (from left to right); Source: calisphere

In the 1920s the new quantum and relativity theories were engaging the attention of science. That mass was equivalent to energy and that matter could be both wavelike and corpuscular carried implications seen only dimly at that time. Oppenheimer's early research was devoted in particular to energy processes of subatomic particles, including electrons, positrons, and cosmic rays. He also did ground-breaking work on neutron stars and black holes. Since quantum theory had been proposed only a few years before, the university post provided him an excellent opportunity to devote his entire career to the exploration and development of its full significance. In addition, he

trained a whole generation of U.S. physicists, who were greatly affected by his qualities of leadership and intellectual independence.

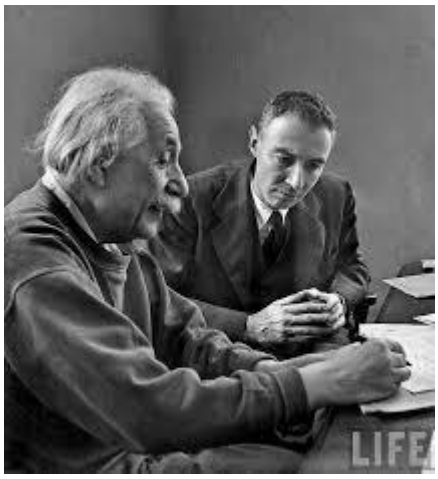
After short visits at science centres in Leiden and Zürich, he returned to the United States to teach physics at the University of California at Berkeley and the California Institute of Technology. He divided his time between Pasadena and Berkeley, attracting his own circle of brilliant young physics students. “His lectures were a great experience, for experimental as well as theoretical physicists,” commented the late physicist Hans Bethe (1906–2005), who would later work with Oppenheimer at Los Alamos. “In addition to a superb literary style, he brought to them a degree of sophistication in physics previously unknown in the United States. Here was a man who obviously understood all the deep secrets of quantum mechanics, and yet made it clear that the most important questions were unanswered. His earnestness and deep involvement gave his research students the same sense of challenge. He never gave his students the easy and superficial answers but trained them to appreciate and work on the deep problems.”

Oppenheimer and Lawrence at the 184-inch cyclotron in University of California, Berkeley; Source: atomicheritage

At Berkeley, he became good friends with Ernest Lawrence, one of the world’s top experimental physicists and the inventor of the cyclotron. Lawrence named his second son after Robert.

The Manhattan Project

The rise of Adolf Hitler in Germany stirred his first interest in politics. After the invasion of Poland by Nazi Germany in 1939, the physicists Albert Einstein, Leo Szilard, and Eugene Wigner warned the U.S. government of the danger threatening all of humanity if the Nazis should be the first to make a nuclear bomb. Oppenheimer then began to seek a process for the separation of uranium-235 from natural uranium and to determine the critical mass of uranium required to make such a bomb. In August 1942 the U.S. Army was given the responsibility of organizing the efforts of British and U.S. physicists to seek a way to harness nuclear energy for military purposes, an effort that became known as the **Manhattan Project**. Oppenheimer was instructed to establish and administer a laboratory to carry out this assignment. In 1943 he chose the plateau of Los Alamos, near Santa Fe, New Mexico, where he had spent part of his childhood in a boarding school. Because of his leadership in this project, he is often referred to as the “father” of the atomic bomb.



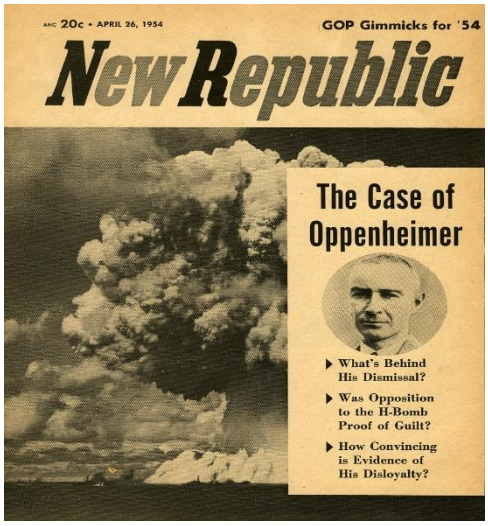
Einstein and Oppenheimer during the Manhattan project; Source: longreads

With the first successful detonation of a nuclear device, also known as the Trinity test, scientists working under Oppenheimer then developed two distinct types of bombs: a uranium-based design called “the Little Boy” and a plutonium-based weapon called “the Fat Man”. With both designs in the works at Los Alamos, they became an important part of U.S. strategy aimed at bringing an end to World War II.

After the atomic bombings in Hiroshima and Nagasaki, Japan, that eventually ended the war and witnessing the destruction, Oppenheimer argued against the project's further development. He resigned from the post later the same year.

Life after World War II

When the war ended, the government set up the Atomic Energy Commission (AEC) to replace the Manhattan Project. The AEC was charged with overseeing all atomic research and development in the United States. As Chairman of the General Advisory Committee, Oppenheimer opposed the development of the hydrogen bomb. Known as the "Super Bomb," the hydrogen bomb was a thousand times more powerful than the atomic bomb. This opposition resulted in made up accusations that he was a communist supporter and a treason to the United States. After getting his security clearance revoked and humiliated, he lost his position in the AEC on 29 June, 1953.



Source: paulingblog.wordpress

Starting in 1954, Oppenheimer lived for several months of the year on the island of Saint John in the U.S. Virgin Islands. There he spent most of his time sailing. He was increasingly concerned about the potential danger that scientific inventions could pose to humanity. He joined with Albert Einstein, Bertrand Russell, Joseph Rotblat and other eminent scientists and academics to establish what would eventually, in 1960, become the World Academy of Art and Science.

Oppenheimer's concern for the general public's lack of scientific understanding, and the difficulty of conveying the content of scientific discoveries as well as the exhilaration of the creative act of discovery to even educated lay people, led to several popular essays on science. He delivered the Reith Lectures on the BBC in 1953, and these were published under the title "Science and the Common Understanding."

Deprived of political power, Oppenheimer continued to lecture, write and work on physics. He remained the director of IAS (Institute of Advanced Study) till 1966, then became a faculty of Natural Sciences. He toured Europe and Japan, giving talks about the history of science, the role of science in society, and the nature of the universe. In September 1957, France made him an Officer of the Legion of Honour, and on May 3, 1962, he was elected a Foreign Member of the Royal Society in Britain. At the urging of many of Oppenheimer's political friends who had ascended to power, President John F. Kennedy awarded Oppenheimer the Enrico Fermi Award in 1963 as a gesture of political rehabilitation. A little over a week after Kennedy's assassination, his successor, President Lyndon Johnson, presented Oppenheimer with the award, "for contributions to theoretical physics as a teacher and originator of ideas, and for leadership of the Los Alamos Laboratory and the atomic energy program during critical years".

Death

Oppenheimer was a chain smoker who was diagnosed with throat cancer in late 1965. After inconclusive surgery, he underwent unsuccessful radiation treatment and chemotherapy late in 1966. He fell into a coma on February 15, 1967, and died at his home in Princeton, New Jersey, on February 18, aged 62.

A brilliant mind

J. Robert Oppenheimer, from the beginning, was awkward. He was a mind full of questions and answers. He had an extraordinary grasping capacity and at the same time, love for nature.

J. Robert Oppenheimer receiving Enrico Fermi Award; Source: bbvaopenmind

Throughout his life when he suffered from depression, he often said that he needed physics more than friends. When he got the friends that shared similar intellectual levels with him, he enthusiastically conducted seminars and heated discussions. He knew what would be better for the world and what wouldn't. After the inception of scientists and military working together, Oppenheimer represented the shift away from the idea that scientists had their "head in the clouds" and that knowledge on such previously esoteric subjects as the composition of the atomic nucleus had no "real-world" applications.

Loved and admired by his students, he knew the potential that the future generations have and what could they do with the data that exists in different forms in nature. To quote him,

There are children playing in the streets who could solve some of my top problems in physics, because they have modes of sensory perception that I lost long ago.