

# History

Explore the discoverer's biography, including general facts about his life and anecdotes regarding how he made this particular discovery. Also see other significant scientific discoveries built largely on this concept and other real-world applications in history that may not still be relevant.

## Discoverer/Developer

In 1938, a team of scientists including Otto Hahn, Fritz Strassman, and Lise Meitner working together discovered nuclear fission. Otto Hahn (1879-1968) was born in Germany, the youngest of four children. During WWI, he was drafted into a special unit that produced chemical weapons. He was held in England with other German scientists suspected of involvement in the German nuclear project during WWII, and wasn't allowed to leave, even to accept the Nobel Prize. Hahn is known as the founder of the atomic age due to his work on radioactivity. Fritz Strassman (1902-1980) was born in Boppard, Germany. Strassman was passionately against the Nazi regime and hid a Jewish person in his home during WWII. Lise Meitner (1878-1968) was an Austrian Jew who fled to Sweden in 1938 after Hitler was in power. She received most of her education from private tutors, since women were not allowed to attend many universities in Germany at that time. Ludwig Boltzmann, who mathematically defined entropy (disorder) as well as determining a distribution (Boltzmann Distribution) for the speed of molecules in a gas, was one of Meitner's private tutors. She also studied under Max Planck, who proposed that energy could only have discrete values. Element 109 was named after Meitner, Meitnerium.

In 1938, Hahn went to visit Meitner, who had fled from Germany by this time, to talk about future experiments they could perform. In one of these experiments, back in Germany, Hahn and Strassman shot neutrons at uranium atoms and detected barium, lanthanum, and cerium atoms afterward--a very unexpected result. Since they could not explain the result, they wrote a letter to Meitner in Sweden. Meitner hypothesized that nuclear fission had occurred when the neutron had hit the uranium atoms. The 1944 Nobel Prize in Chemistry was awarded to Hahn for discovering fission. All three received the Enrico Fermi Award in 1966 for their work on nuclear fission.

## Use/Application through History

The bombs dropped on Hiroshima and Nagasaki during WWII were fission (nuclear) bombs.

The 1986 Chernobyl meltdown was due to a fission nuclear power plant explosion in Ukraine. This accident was the worst nuclear power plant meltdown ever, and radioactive smoke was sent over a large area of Eastern Europe and the USSR.

The 2011 earthquake and tsunami in Japan damaged the Fukushima Daiichi nuclear power plant, which used fission to generate electricity.

### Real World Application

Discover processes or disciplines in the natural or man-made worlds that employ the concept.

Nuclear bombs work by fission. A core of  $^{235}\text{U}$  is forced to undergo fission when a uranium bullet fires into the core on detonation, forcing the core to critical mass.

Nuclear power plants generate power by fission reactions. Fuel rods enriched with  $^{235}\text{U}$ , an isotope of uranium that can undergo fission, are used to heat water or steam. The water or steam goes on to power a steam turbine. A containment vessel surrounds the reactor so no radiation escapes. In 2008, around 8.5% of U.S. electrical energy was produced by nuclear power plants.

### Vocabulary

Learn important vocabulary for this concept, including words that might appear in assessments (tests, quizzes, homework, etc.) that indicate the use of this concept.

Important Vocabulary	Term	Context
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### Videos

Browse relevant videos from the Journal of Chemical Education's (JCE) Chemistry Comes Alive! library and other video sources.

#### Uranium Fissions

Animation of uranium atoms undergoing fission and progressing into a nuclear chain reaction.

### Computer Animations

Experience computer simulators or animations that illustrate the concept discussed here. Many simulators or animations come with worksheets for use in class.

<http://lectureonline.cl.msu.edu/~mmp/applist/chain/chain.htm>