ERICO FERMI
Adapted and Shortened for Student reading

If the 19th century was the century of chemistry, the 20th was the century of physics. Enrico Fermi, a supremely self-assured Italian-American born in Rome in 1901, co-invented and designed the first man-made nuclear reactor, starting it up in a historic secret experiment at the University of Chicago on Dec. 2, 1942. In the famous code that an administrator used to report the success of the experiment by open phone to Washington, Fermi was "the Italian navigator" who had "landed in the new world."

He had personally landed in the new world four years earlier, with a newly minted Nobel Prize gold medal in his pocket, pre-eminent among a distillation of outstanding scientists who immigrated to the U.S. in the 1930s to escape anti-Semitic persecution in Hitler's Germany and Mussolini's Italy — in Fermi's case, of his Jewish wife Laura.

Fermi and his team almost found nuclear fission in 1934 in the course of experiments in which, looking for radioactive transformations, they systematically bombarded one element after another with the newly discovered neutron. They missed by the thickness of the sheet of foil in which they wrapped their uranium sample; the foil blocked the fission fragments that their instruments would otherwise have recorded. It was a blessing in disguise. If fission had come to light in the mid-1930s, while the democracies still slept, Nazi Germany would have won a long lead toward building an atom bomb. In compensation, Fermi made the most important discovery of his life, that slowing neutrons by passing them through a light-element "moderator" such as paraffin increased their effectiveness, a finding that would allow releasing nuclear energy in a reactor.

If Hitler had not hounded Jewish scientists out of Europe, the Anglo-American atom bomb program sparked by the discovery of fission late in 1938 would have found itself shorthanded. Most Allied physicists had already been put to work developing radar and the proximity fuse, inventions of more immediate value. Fermi, who emigrated from Germany, formed the heart of the bomb squad. In 1939, still officially enemy aliens, Fermi co-invented the nuclear reactor at Columbia University. Fermi, still mastering English, dubbed this elegantly simple machine a "pile."

The work moved to the University of Chicago when the Manhattan Project consolidated its operations there, culminating in the assembly of the first full-scale pile, CP-1 in 1942. It was the size of a two-car garage — a flattened graphite ellipsoid 25 ft. wide and 20 ft. high, weighing nearly 100 tons. On Dec. 2 the State Department announced that 2 million Jews had perished in Europe and 5 million more were in danger.

Fermi proceeded imperturbably through the experiment, confident of the estimates he had charted with his pocket slide rule. At 11:30 a.m., as was his custom, he stopped for lunch. The pile went critical in midafternoon with the full withdrawal of the control rods, and Fermi allowed himself a grin. He had proved the science of a chain reaction in uranium; from then on, building a bomb was mere engineering. He shut the pile down after 28 minutes of operation. Wigner, a co-designer wrote, "For some time we had known that

we were about to unlock a giant. Still, we could not escape an eerie feeling when we knew we had actually done it."

From that first small pile grew production reactors that bred plutonium for the first atom bombs. Moving to Los Alamos in 1944, Fermi was on hand in the New Mexican desert for the first test of the brutal new weapon in July 1945. He estimated its explosive yield with a characteristically simple experiment, dropping scraps of paper in the predawn stillness and again when the blast wind arrived and comparing their displacement.

Fermi had argued against U.S. development of the hydrogen bomb when that project was debated in 1949, calling it "a weapon which in practical effect is almost one of genocide." His counsel went unheeded, and the U.S.-Soviet arms race that ensued put the world at mortal risk. But the discovery of how to release nuclear energy, in which he played so crucial a part, had long-term beneficial results: the development of an essentially unlimited new source of energy and the forestalling, perhaps permanently, of world-scale war.

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