Celebrating a Centennial—Leo Szilárd (*1898-1964*)

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"I was born a scientist. I believe that many children are born with inquisitive minds and I suppose that I became a scientist because in a way I remained a child." — ***L. Szilárd***

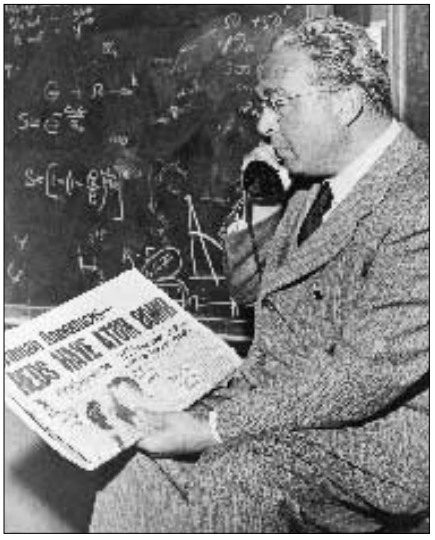
In the long list of gifted Hungarian scientists and mathematicians active in the first half of this century,[1] the name of Leo Szilárd rises to the top. This year we celebrate the centennial of his birth.

The teacher who will inject historical context into the conventional textbook-centered course has an adventure story to share with students. Examining the life of this peripatetic scientist who never really settled anywhere, living out of a suitcase in hotels around the world, and who liked to do his thinking in a bathtub, will certainly enhance a classroom presentation of the big ideas of science. Szilárd's extraordinary life dramatically illustrates that science is a human endeavor, a journey of mystery and discovery.

Any recounting of the life of Szilárd—physicist, inventor, nuclear engineer, nuclear disarmament advocate, and apostle of experimental biophysics—must leave something untold. But a list of even a few of his friends and co-workers—Teller, Wigner, von Neumann, Gabor, Planck, Einstein, von Láue, Weisskopf, Landau, Schroedinger, Fermi, Chalmers, Bethe—assures us that Szilárd was "in the center of things," and we begin to understand why his lifelong friend Eugene Wigner could say that Szilárd "never committed the sin of being boring."

Born in Budapest just a hundred years ago, Szilárd's life and studies were often interrupted by illness, war, and politics. He left Hungary for Berlin in 1919 after being told that his name was on the list of students suspected of being communists. In Germany he studied with Einstein, von Láue, and Planck, graduating from University but having attended no lectures. He was more interested in sitting in on seminars given by staff and graduate students. As Gabor later recalled, "Szilárd's chief activity was talking to friends. Leo wanted to discuss everything, and pass on his ideas by word rather than by writing." When Planck recommended that he take more courses in theoretical physics, Szilárd answered, "I only want to know the facts. I will invent the theories myself."

He didn't like the topic suggested for his doctoral dissertation, so he took an extended Christmas vacation, "loafing" as he put it, to think of something "completely" new. During a three-week period he wrote a paper on a new theory of thermodynamic fluctuations that laid the foundation of information theory. He gave it the provocative title, "Decrease of entropy in a thermodynamic system by the intervention of intelligent beings." After showing it to Einstein and being encouraged by his approval, Szilárd gave it to his advisor, von Láue, who reluctantly read it. Next morning he telephoned Szilárd, "Your manuscript has been accepted as your thesis for the Ph.D. degree."



Leo Szilárd with *Chicago Herald Tribune* from September 1949.
Photo from AIP Emilio Segrè Visual Archives, courtesy Argonne National Laboratory

While in Berlin Szilárd lived in the Faculty Club with two suitcases packed, ready to go at any time. To escape the antisemitism in Germany, he left for Vienna, missing the new Nazi control at the border by only one day. Later he remarked, "You don't have to be cleverer, you just have to be one day earlier." His next stop was London, where he became interested in biology but was diverted to the study of radioactivity. When he read Lord Rutherford's comment that "Anyone who looked for a source of power in the transformation of atoms was talking moonshine," Szilárd responded to the challenge. "If an

LEO SZILARD CENTENARY — INTERNATIONAL SEMINAR
in the Aula of Eötvös University, Budapest, Monday, 9th of February, 1998

Leo Szilárd, inventor of the nuclear reactor, initiator of the movement for not using the atomic bomb, recipient of the *Atoms for Peace* award, "the consciousness of human kind," was born in Budapest on the 11th of February 1898. On the occasion of the centenary, the *Eötvös Physical Society* and the Eötvös University, in cooperation with the *American Physical Society*, the *Hungarian Academy of Sciences*, and the *Pugwash Movement*, is organizing a conference on the work and impact of Szilárd.

authority declared something impossible, this always irritated me." He soon became an expert in producing neutrons and knew how to slow them down using paraffin. Unfortunately, he needed about 2000 pounds sterling to buy radium and beryllium, but was unable to obtain this large sum of money. He believed that America might be a more fertile soil to cultivate extraordinary ideas.

Story told to Szilárd by a friend and later included by Szilárd in a letter to Stalin as part of the scientist's ongoing effort to get the superpowers to talk to each other:

Shortly after armistice was announced in 1918, a Hungarian troop, not realizing that the war had ended, rode out on patrol in the Carpathian Mountains. As they emerged from the forest, they found themselves face to face with a Russian patrol. The two officers in charge grabbed their guns and were frozen in this position for some time. Suddenly, the Russian officer smiled and saluted. "To this day," my friend told me, "I regret that it was not I who saluted first."

He sailed for the United States on January 2, 1938, and obtained an assistantship at Columbia University. He took residence at King's Crown Hotel in New York City. After settling in, Szilárd had a chair elevated in the lobby so he could talk to anyone interested in his ideas and in listening to his wisdom. Then in January of 1939 Niels Bohr landed in New York, bringing with him the news of uranium fission accomplished by Hahn and Strassmann in Germany. The Hungarian conspiracy of Wigner, Teller, and von Neumann, mobilized by Szilárd, switched into high gear. Szilárd, working with Zinn, discovered that uranium fission results in the emission of several neutrons; Fermi and Anderson discovered the neutron multiplication effect. Together, Szilárd, Wigner, and Teller persuaded Einstein to write a letter to President Roosevelt regarding the potentially destructive power of nuclear energy. As a result, the President authorized a secret program known as the Manhattan Project, the purpose of which was to develop a nuclear bomb before the Nazis did. In February 1940, Szilárd summarized his ideas and research results and wrote a paper on nuclear chain reactions. It was accepted for publication by *The Physical Review*, but Szilárd asked that publication be deferred "because of the nature of the subject." The report was declassified only in November 1946.

After the attack on Pearl Harbor in December 1941, Fermi went to the University of Chicago with the task of producing a nuclear reaction; Szilárd moved there in 1942. In Chicago Fermi organized the work, Zinn built the pile, Wigner did the theoretical evaluation, and Szilárd gave free advice. At the first man-made, self-sustaining chain reaction on March 29, 1943, Szilárd shook hands with Fermi and said, "I think this day will go down as a black day in the history of mankind."

Leo Szilárd, left, with Ernest O. Lawrence outside an American Physical Society meeting in Washington, DC, April 27, 1935.
Photo from AIP Emilio Segrè Visual Archives, courtesy Science Service

After the defeat of Japan, he became obsessed with nuclear arms control and the prevention of war, saying, "The first use of plutonium was in the form of a bomb which destroyed a city. The next use of plutonium might be the same again. While the first successful alchemist was God, I sometimes wonder whether the second successful alchemist may not have been the devil."

Szilárd's originality and imagination, and the determination never to say what was expected of him, gave rise to a trail of anecdotes. Nobel laureate James Franck suggested that "[We should] keep Szilárd in a freezer and pull him out when new ideas are needed." He held 17 patents, among them an improved refrigerator system using a magnetic compressor without moving parts that he designed in collaboration with Einstein. He discussed the idea of an electron microscope and linear accelerator in the early thirties. His later patents include one that anticipates the cyclotron (1929), the idea of nuclear chain reaction (1934), sterilization by ionizing radiation (1937), the chemostat for breeding bacteria (1951), and the famous Fermi-Szilárd pattern for the nuclear reactor (1944).

Szilárd worked in biophysics in the fifties and sixties, and tirelessly promoted disarmament. He met with Kruschev in 1960 and gave the Soviet leader a razor as a present, promising a continuing supply of blades "until the outbreak of the war." Kruschev responded characteristically by saying, "If there is a war none of us will shave." The meeting made front-page news and had one very significant outcome—a hot line was established between President Kennedy and First Secretary Kruschev as a line of communication to prevent a nuclear holocaust due to misunderstanding.

Reference

1 A. Stinner, "The Hungarian phenomenon," *Phys. Teach.* **35**, 518 (December 1997).