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NICHOLAS AND ROBERT HALÁSZ

LEO SZILÁRD, THE RELUCTANT FATHER OF THE ATOM BOMB

I

In July, 1939, three outstanding Hungarian physicists set out in a second hand car owned by Edward Teller, the youngest of the team, for a cabin on Long Island Sound, near New York City. In that cabin, Albert Einstein was spending the summer. It was Leo Szilárd who initiated the trip, just after his successful experiment with the first chain reaction in uranium atoms. He was prompted to visit the great scientist, with whom he had worked on a patent in Berlin, by alarming information brought to America, by Dr. Niels Bohr. Bohr had visited Germany and found out on reliable authority that German nuclear scientists were at work on splitting uranium atoms.

This information induced Szilárd to look for ways of urging the U.S. government to embark without delay, and in the greatest secrecy, upon an atomic research programme guided by a single purpose: to make the atomic bomb. The right people must be persuaded of the deadly urgency of the task; funds of an undetermined but certainly immense amount would have to be appropriated, and all this with no guarantees of success.

Obviously, there was only one man who had the authority and the power to do this: President Roosevelt. Szilárd drafted a letter to the President. But it had to be signed by a man commanding supreme prestige sufficient to impress the President to disregard the army, which had in the past rejected suggestions by scientists to conduct research into atomic bomb possibilities. There was only one such man: Albert Einstein.

Eugene Wigner, the third member of the team, a childhood friend of Szilárd's and an "old" American, who had immigrated in 1930 and was teaching theoretical physics at Princeton, succeeded in locating Einstein's summer hideout. The place seemed deserted, with everyone at the beach on that hot day. Finally, a young boy directed them to the cabin, not responding to the famous name of the summer resident, but to his description as a kindly old man with a long grey mane.

Einstein immediately grasped the importance and the urgency of the letter. He signed it. This was the "Einstein–Szilárd letter" dated August 2nd, 1939, which led to the U.S. development of the atomic bomb. And here began the formation of the "Hungarian Galaxy" with such stars as Theodore Kármán, whose research in aero- and hydrodynamics led to the development of the jet plane; John von Neumann, who constructed the first computer, without which the atom bomb would have been delayed at least a year; and the three passengers in Teller's car.

What enhanced Szilárd's brilliance in the Galaxy was not only the broad perspective his initiatives opened and the great significance of his scientific accomplishments, but also his relentless insistance on the moral and social responsibilities of scientists for the consequences of their research. On this principle, he organized the nuclear scientists and initiated political action to prevent an nuclear arms race and nuclear war.

Leo Szilárd was born in 1898 in Budapest into an upper-middle class family. His father, Lajos Szilárd, an electrical engineer, prepared his two sons tyrannically for ambitious careers in technology, which he considered the highroad to success. His mother, Thekla Vidor Szilárd—known for her sense of humour—tried to mitigate the well-intentioned but stern absolutism of the father.

Leo studied at the Budapest Royal State High School of Science (főreáliskola) near their residence in the City Park Alley. He showed an early talent for technical ideas, some practical, some bizarre, and amused himself and his family by carrying out various experiments at home. One anecdote, told by his sister, Rózsi, reveals two of his very characteristic attitudes, then and later: pretence made him angry and he could explain baffling things with incredible simplicity.

He was 13 years old when his younger brother, Béla, contracted scarlet fever and had to be isolated. Leo set up a simple wireless communication system between the boy's sickroom and the parlour. His sister admired this feat and asked Leo about the principle upon which the wireless telegraph worked. Leo became angry.

"Why," he asked, "do you think you know what makes the wire telegraph work?"

"I don't know, but I can imagine it," she answered.

"You think you can imagine it, because you assume that the message runs in the wire."

Rózsi admitted that she believed just that.

"But," Leo said, now softened, "a clever man (Marconi) has found that the message does not run in the wire at all. He simply removed the wire—and the message has run without it ever since."

In 1916, his last year in high school, Leo won the award for mathematics. In the same year he won the first national contest for students in physics, established by the Hungarian Academy of Sciences.

After high school, Leo enrolled in the Institute of Technology (Műegyetem) in Budapest, in deference to his father's wish that he become an engineer. The First World War interrupted his studies, and he was drafted into the Austro-Hungarian army with the rank of second lieutenant—but saw no action due to the revolution in 1918, which put an end to his country's participation in the war. The Austro-Hungarian Monarchy fell to pieces.

Those in power in Hungary in her shrunken, impoverished state, after the lost war, adopted discriminatory laws; the admission of Jews into the institutions of higher learning was restricted. The political and social pressures inevitably caused waves of emigration from Hungary. Actors, directors and producers migrated to Germany, England, and, eventually to Hollywood at a time when, before the advent of the sound films, language difficulties were no particular handicap. A second wave of scientists went to German universities, only to move further West a decade or so later when Hitler came to power. The foremost of these scholars later were to dazzle the West with their leadership in developing the atomic and hydrogen bombs. They were Hungarians and Szilárd was one of them.

Young Szilárd was considered an eccentric for disregarding conventions. What he disliked was self-serving pretence, empty or superficial talk on serious subjects, but he enjoyed playful, grotesque fantasies resting on solid premises. He embarrassed schoolmates with ideas formulated with provocative bluntness. He was also handsome, with a distinctive head crowned with a leonine mane.

Szilárd continued his studies at the Technische Hochschule in Berlin in 1920. The greatest physicists in the world lived and worked in Germany at that time—giants such as Albert Einstein, Max Planck and Max von Laue. Szilárd's thesis for his doctorate on oscillation phenomena, submitted in 1922, attracted their attention for its originality and insight. Einstein worked on Szilárd's idea of a device for pumping liquid metals, solving an engineering and refrigeration problem. They took out a joint patent on the invention. Szilárd became *Privatdozent* at the University of Berlin in 1929. This was a decorous title that brought in little money. He lived on remittances from his father in a typical furnished room

for students in Berlin–Charlottenburg. His situation thoroughly changed in 1929, when Max von Laue made him his only assistant at the Institut für Theoretische Physik, an appointment that brought Szilárd great prestige among scientists, and also a considerable income.

The year 1929 was crucial for his career as an outstanding scientist. He published a paper in Berlin on a theory of information issuing from telecommunication. "In this paper Szilárd was really pioneering in the unknown territory, which we are now exploring in all directions," Léon Brillouin wrote in 1962. His approach to problems not even in existence was characterized by another scientist, Ralph E. Lapp, who noted: "Leo Szilárd, a Hungarian born physicist had a flair for stabbing in the dark and coming up with ideas for new ventures."

The sinister spring of the economic depression in Germany, the Nazi movement, made Szilárd pessimistic of future political developments in that country. He intended at that time to switch to biology and made inquiries in England to reputed biologists concerning the ideas he planned to pursue in that discipline. He received encouragement and useful advice from them.

But a powerful inspiration deterred him from his plan in 1931. He read a novel, the impact of which set a definitive pattern of his life. The literary and the scientific imagination have a common source, and Szilárd's susceptibility to a novel that combined the two offshoots of fantasy grew out of his own pastime of writing science fiction tinged with melancholy and pity, sifted through gentle humour, over the conflicting drives in human nature. The book was H. G. Wells' *The World Set Free*. It foresaw the liberation of atomic energy, giving mankind an immeasurable new natural force. Wells predicted in this novel that the new force, rather than being used to improve human life, would enhance the power of one group over another; atom bombs would be made, nuclear war waged, and, by the end of the novel, all the cities of the world were in ruins. Upon the Armageddon, the scientists of the world rose and assumed power for a world government.

Szilárd was deeply moved by this vision of destruction and redemption, and visited Wells in London in 1932. The illustrious author dealt at length on his theory of how the world might be saved from such devastation. In his opinion, the only way was to form an open conspiracy by scientists who could appropriate power through their knowledge of atomic secrets and force the rest of the world to accept a world government.

It was now clear to Szilárd that he must work with no illusions about the difficulties of liberating atomic energy, but also make sure that it be used for the good of humanity.

With the assistance of a young English physicist, T. A. Chalmers, he immersed himself in nuclear research at England's Clarendon Laboratories. Their work resulted in two discoveries published by and discussed at the International Conference on Physics in London, 1934, which brought Szilárd an Oxford Fellowship.

It inspired Szilárd to formulate one of the epoquemaking ideas of the century. He produced, in 1934, the first scientific description of chain reaction in the atom: neutrons may be released by fission, and these may be used further, to split atoms.

Aware of the significance of the idea, but also the consequences resulting if disclosed to the Axis powers, Szilárd decided to take out a secret patent, limiting access to the discovery. A secret patent in Britain could be granted only to a British authority, so Szilárd had it assigned to the British Admiralty. Because of his care, these findings were not made public until 1949, long after the first atomic bombs had fallen over Hiroshima and Nagasaki.

Meanwhile, Szilárd pursued a new plan of a very different nature with equal energy and dedication. As soon as he settled in

England for good, he began to organize a committee of scientists and influential men of means to rescue Jewish scholars and others with unpopular political beliefs from Germany. He was advised that Sir William Beveridge was the right man to head the committee; Szilárd went to Vienna where Beveridge was attending a conference, and impressed him with the urgency of the plan. The next year, Beveridge initiated the Academic Assistance Council, for which Szilárd provided a list of scholars to be helped and placed in professorships or laboratories, or given other assistance. About 100 scholars came to England with this Committee's assistance. "Practically everybody who came to England had a position," Szilárd wrote with satisfaction; adding, "Except me."

F. G. Donnan, the British physical chemist most active in these rescue operations, eventually discovered that Szilárd had been overlooked. "We thought that Szilárd was a rich Hungarian aristocrat," he apologized, in admiration of the selflessness with which Szilárd devoted himself to helping others.

In January 1938, Szilárd came to the United States. A year later, in March 1939, his career as a scientist reached a zenith, first for making the atom bomb, later for his campaign to establish nuclear peace. This is how he described the first event:

"Dr. Walter Zinn and I, working on the seventh floor of the Pepin Building at Columbia University, completed a simple experiment. Everything was ready, and all we had to do was to lean back, turn a switch, and watch the screen of a television tube. If flashes of light appeared on the screen, it would mean that neutrons were emitted in the fission of uranium, and that in turn would mean that liberation of atomic energy was possible in our lifetime. We turned the switch, we saw the flashes, we watched them for about ten minutes—and then we switched everything off and went home. That night I knew that the world was headed for trouble." At the same time and in the same Pupin building of Columbia University, another team headed by Enrico Fermi experimented in nuclear fission which established chain reaction in the uranium atom. The news of it induced Szilárd to start a collaboration with Fermi to arrive at a conclusive result in the experiments.

It was characteristic of Szilárd that he took the initiative by a letter to Fermi although he worked in his neighbourhood. He advised the great Italian physicist to use a radium-beryllium photoneutron source instead of radium-beryllium. Fermi accepted the advice and set out to launch a huge experiment. This work involved considerable physical work which Fermi enjoyed but Szilárd disliked as a waste of time he could put to better use. As was his habit, Szilárd sent a very gifted graduate student to do the job. He himself continued to give extremely valuable advice in letters to Fermi. In one of them he called upon Fermi to use carbon to slowing down neutrons which led to substantial developments.

II

A long silence followed the sending of the Einstein–Szilárd letter. Nothing was known of its impact on President Roosevelt, and there was no way of finding out. Actually, Roosevelt established a secret advisory committee that included representatives of the army and navy. The fear that the Germans would make the first atom bomb was agonizing to Szilárd. Also, he was deeply interested in further research—whether sustained chain reaction in uranium was possible. He occasionally hoped that the experiment might be made, but fail, doubting mankind's ability to cope with the new power that should emerge. Only in wartime could one expect the U.S. government to invest so much in such a project. But in 1941, America was at war, and things began to happen. Szilárd was put to work in the

Chicago branch of the atomic research programme (The Manhattan Project), being appointed Chief Physicist of the Metallurgical Laboratories. He served as such from 1942 to 1945, and the 30 papers he submitted to the project on many aspects of nuclear development testify to the intensity of his participation during this period. At the same time, he constantly travelled around the United States with scientists in a continuing dialogue on his—and their—discoveries and problems. The unexplained arrivals and departures of this scientific trouble-shooter often puzzled his fellow scholars.

"A brilliant, paradoxical lonely man of ideas and sudden action... a powerful intelligence which shunned the commonplace," thus Eugene Abramovitch saw him. "He is... a very peculiar man, extremely intelligent. I see that is an understatement. He is extremely brilliant and he seems somewhat to enjoy... startling people," Enrico Fermi described Szilárd, his collaborator at the making of the first atomic reactor, "a man with an astounding amount of ideas." Another Nobel Prize winner, James Franck said once that it wouldn't be a bad idea to put Szilárd in deep freeze and defrost him when they run into a tough problem.

It was only natural that a man with this abundance of ideas would easily give up even a most cherished one as soon as he recognized that it did not hold after. Friends who, long after an argument, came to tell him of having been converted to his idea often elicited a curt remark that it was unfortunately a mistake.

Szilárd cultivated an impression of mystery. General Leslie Groves, director of the Manhattan Project, found Szilárd's superabundance of sparkling ideas disquieting and undisciplined. Groves thought him difficult to cooperate with—which he attributed to Szilárd's having missed learning how to play baseball in his youth. This, the General thought, would have taught him teamwork.

As work on the atom bomb progressed, and the war in Europe turned in favour of the Allies, the potential peacetime uses of the atom began to preoccupy Szilárd's energies. He communicated his anxieties to his colleagues at the Manhattan Project and tried to find support for his Wellsian concept of international control of atomic energy. In this he was not too successful. Several of his colleagues refused to accept responsibility for the results of their research; among them was Szilárd's younger compatriot, Edward Teller, who wrote: "Scientists must find a modest way of looking into an uncertain future. The scientist is not responsible for the law of nature. It is his job to find out how these laws operate."

But Szilárd continued his efforts to prepare the open conspiracy that Wells had written of—and this was to be the age of his most heroic activity in behalf of mankind.

Szilárd reminded his colleagues working on the atomic project that they had rushed to do so under the threat that Germany might precede America in producing the atom bomb. Germany now (in the spring of 1945) was about to be knocked out of the war; what was the use of their further participation in the project? His contention was that the bomb should not be used in the war against Japan. The original danger, which brought the atomic programme into existence, was ended.

Szilárd also pointed out that individual Germans would be prosecuted for German war crimes because they had not raised their voices in protest. How much more guilty the scientists in the United States would be, who were in a position to protest without risk to life and liberty?

He decided to write a memorandum to President Roosevelt using the pretext of suggesting direct communication between the Administration and scientists to seek information on the aims of future U.S. atomic research. The memorandum pointed out the danger of an nuclear arms race with

the Soviet Union, should the control of future developments of atomic energy not be put under some international authority. Again, he asked Einstein to intimate to the President the competence of Dr. Szilárd, and to remind him that the letter of 1939 had been their joint undertaking.

Roosevelt died before seeing the memorandum, but a copy reached President Truman. He reportedly read it, but directed through a secretary that Szilárd should see James Byrnes, a close friend of Truman's, on the matter. Byrnes was at his home in Spartanburg, South Carolina. Szilárd asked Dr. H. C. Urey (a chemist who later won the Nobel Prize) to join him, and they met with Byrnes in South Carolina.

Byrnes read the document very carefully, but from the discussion that followed it became evident that there could be no meeting of minds. The memorandum grew out of a fear that there would be an arms race between the United States and the Soviet Union if control of atomic energy were not vested in an international forum. The scientists advised that the bomb not be used on Japan, or that its use be at least delayed. These arguments made no impression on Byrnes for two reasons. One he disclosed at his meeting with the two scientists—the Administration believed that the Soviet Union had no uranium. This Szilárd immediately countered with the information that there was uranium in quantities in Jachimov, Czechoslovakia, which the Red Army was then entering. The second reason Byrnes had for keeping the secret of the atomic bomb from others was only disclosed later. President Truman had asked the heads of the Manhattan Project for their opinion as to how long it might take for the Soviet Union to make the bomb. The answer received was: seven to fifteen years, certainly, sufficient time for the United States to create an international balance of power to its own convenience—given her monopoly on atomic power.

Byrnes' way of thinking alarmed Szilárd, with its hints that there would be no U.S. negotiated agreements with the Soviet Union on post-war problems. The future Secretary of State gave substance to his fear when he stated that American military might would probably be a far more effective means of getting Soviet troops out of occupied countries than diplomacy.

Szilárd had worried over an aspect of atomic energy that bears witness to his extraordinary foresight. Ralph E. Lapp wrote in his book, published in 1968:

"I have in my files one of Szilárd's earliest memoranda, dated Aug 14, 1945, one paragraph of which reflects his concern about the postwar hazard of civilian power development. Szilárd implicitly assumed that the control problem would be virtually impossible if nuclear power were to proliferate around the world."

He refrained from voicing his fear that civilian power reactors could always be put to use making plutonium and thus possibly atom bombs. This would have put him in the position of supporting those opposed to extending atomic energy to other countries. On the other hand, he was well aware that this hazard was to be a strong argument for United States–Soviet cooperation in controlling nuclear energy, and he did not fail to use it in his dealings with the authorities in the United States and in the Soviet Union.

His interview with Byrnes convinced Szilárd of one thing: that the bomb's detonation at least once was necessary to prove its success. Without this no Congress would vote further funds for atomic research.

He decided that the campaign should hereafter change its track, advocating a nuclear "demonstration" to notify Japan of what she could expect if she refused to end the war by surrendering. Szilárd initiated a movement among atomic scientists for a petition to this effect. All the leading scientists, and many important biologists, signed it. It was to be forwarded to President Truman at the Potsdam Conference. He

never received it. On August 6, the atom bomb fell on Hiroshima.

This phase of the battle was over.

But now another battle was shaping up, involving how the United States would use the bomb in the post-war world—the temptation would be to fashion a world to her liking, even by launching a "preventive" war. With the world polarized between the Soviet Union and the West led by the U.S.' monopolizing the nuclear arsenal, the atmosphere was tense.

Szilárd now became the most daring spokesman of a sort of open conspiracy of scientists. He and his colleagues believed international control of atomic energy was the only means of preventing an arms race or a nuclear war. It was up to them to control development of atomic energy in the future; catastrophe was the alternative.

The battle was mounted both in Congress and in public, immediately after the war. A Pentagon-inspired bill in Congress (the May–Johnson bill) would have left control of the development of atomic energy with the military. The bill was railroaded through the House Armed Services Committee after a one-day sham hearing.

Szilárd succeeded in alerting the public and Congress as well on this issue. The Committee, under pressure of public opinion, was compelled to hold further hearings.

Szilárd, appearing at the hearing himself, faced a hostile Committee. Representative Thomason of Texas attacked him sharply, insinuating that he was reluctant to cooperate with the War Department by granting it his patent rights on a number of inventions (he had already assigned the rights on description of the nuclear chain reaction with the British Admiralty); he had shown indifference to the possible death of up to forty million Americans through atomic warfare by publicly agitating for the disclosure of atomic secrets (by giving a share to the Soviet Union in the international control mechanisms). Szilárd remained unyielding. He submitted that the United States would be at a disadvantage in an atomic arms race—the necessary defense measures (relocating from 30 to 70 million citizens away from industrial centers and rebuilding important industrial plants underground) he estimated far more expensive and burdensome to the U.S. economy than to the Soviets, whose industry was already relatively dispersed.

A member of the Committee suggested that means might be found to intercept bombs before reaching their targets as an alternative; but Szilárd said that another counter-defense would quickly be found.

Following the hearings, Szilárd attended a meeting in the Town Hall, New York City, in November 1945, and stated that negotiations with the Soviet Union on preventing an arms race and on control of atomic energy were vital, but were being frustrated by the United States' continuing to manufacture and store atomic bombs.

He keenly felt at this time the awkwardness of his position as a freshly naturalized U.S. citizen publicly attacking the Army leadership of his adopted country at the height of its power. To compensate for this, he turned more aggressive. "He bewildered and angered the Congressmen who interrogated him." (New York Times). He charged that the military management of the atomic project had caused serious delays in the making of the bomb. A more enlightened British policy had enabled British scientists in 1941 to give the U.S. important information it lacked. "Had we in the U.S. followed the British example and learned their conclusions in 1940, we most likely would have had bombs ready before the invasion of Europe. But the excessive secretiveness of the military impeded communication even between departments of the Project. It made (it) impossible for American scientists to discuss with Canadian scientists plutonium techniques. The Canadians developed a process superior and more efficient than the American."

This part of the Szilárd campaign was successful; the entire staff of scientists active

in the atomic programme was galvanized by the controversy over civilian versus military control of the atom, and the issue received a thorough airing in the press. The May–Johnson bill was replaced by the Senate McMahon Bill which put the control of the programme firmly in the hands of civilians; a Congressional Atomic Energy Committee in each House would take over the development of the atom from the Army.

During the Cold War period, Szilárd remained completely dedicated to the task of the peaceful uses of the atom and did his best to counter the polarization of power as he saw it developing in the world, both in his role as scientist and as a citizen. He was one of the leaders of the movement advocating neutrality of the so-called "Third World" at a time, when John Foster Dulles was insisting that neutrality in the contest between freedom and slavery was "immoral." And he took the initiative for arms limitation and control between the United States and the Soviet Union, even worked out an elaborate plan for mutual limitation of use of atomic weapons, should war break out between the atomic powers.

After the Second World War II Szilárd lived in permanent apprehension, though of varying intensity, of a new war, and deemed this danger present during the Berlin crisis in 1948. He feared the splitting of Germany would eventually lead to an atomic war. This writer was at the home of friends, a family Szilárd frequented, often solving household and bookkeeping problems submitted to him by the lady of the house, when Szilárd insisted in great excitement that she send her two children without delay to Mexico or anywhere out of the country.

His pessimism rested on logic, which is not a preeminent factor in most political situations. The unprecedented polarization of power between America and the Soviets made the rest of the Globe a vast arena for rivalry and confrontation. Usually, two powers in such a situation agree to split the powerless world between themselves. Otherwise it comes to war. That this did not happen was a historical miracle, attributable to the atomic bomb that would have crushed both parties.

A measure of Szilárd's character was that he paid serious and solicitous attention to young people. He always chose young talents as collaborators and showed real generosity in giving them credit. A daughter of a childhood friend of his came to Vienna from Budapest to register at the University. She wanted to study chemical engineering. Szilárd wrote to her to go rather to Germany and invited her to come meet him in Heidelberg where he then, in 1951, was spending some time.

The girl admitted that she could learn more in Germany, but that she was not able to overcome her revulsion of the Germans. She could not live among people guilty of genocide. Szilárd said that he was against collective guilt in principle, but also he felt no animosity toward a people because some, even many of its nationals had committed hideous crimes.

He was quite communicative with this young girl. While he showed her about Heidelberg, praising the noble architecture of the old town, Szilárd said that he used to walk in American cities looking at the tip of his toes, for there was nothing worth seeing and by looking at his feet he could think of something else. At the same time he told the girl that America was a unique country where a freshly arrived immigrant could influence basic decisions of government and people.

Szilárd often resorted to personal diplomacy in his effort to ease the Cold War. In 1951, he approached Soviet nuclear scientists during a visit to the Soviet Embassy in Washington (which he reported to the State Department) and invited them to meet their American colleagues in order to discuss atomic peace. The answer was that the Soviet scientists had followed his activities ever since 1946, when he had written in a

pamphlet entitled *One World or None* (Dexter Masters and Catherine Way):

"My fundamental conviction is that differences between men in general, and scientists in particular, are matters of degree... I do not believe that there are essential differences between Russian and American scientists. International institutions ought to establish close cooperation between scientists and engineers of different countries. The field of atomic energy would be just one of those fields in which large scale enterprises based on collaboration could be established."

The first Pugwash Conference took place in 1957, and, according to the official report of the session "Leo Szilárd took a leading part in these talks." The conference has been held ever since, the meeting place of international science.

In 1961, Szilárd went to Moscow to convince Khrushchev of the utmost importance of an agreement with the American President to establish direct contact between them in emergency situations. He had proposed the same long before in a letter to Stalin before his death.

Khrushchev was, of course, informed about Szilárd and his work but apparently did not attach too much political or practical importance to both, since he squeezed only fifteen minutes into his daily programme for the interview.

Szilárd correctly perceived Khrushchev as a man who enjoyed gadgets and began the interview by presenting him with a particularly ingenious one. This made him so happy that he ignored his crowded schedule and listened to the scientist and politician with increasingly serious attention. Szilárd told him about the vital importance of Soviet–American cooperation in controlling atomic energy, and the attempts of a group of scientists in America to work out together with their Soviet colleagues the technical means of such collaboration.

The interview lasted almost an hour, when Khrushchev offered Szilárd a case of vodka in reciprocation of his gift. Szilárd remarked that he never drank spirits, whereupon the Chairman became cheerful and exclaimed: "I know something better, far better. I'll send you a case of mineral water from the Caucasus I myself use for various gastric troubles."

Returning home, Szilárd saw President Kennedy and reported to him on his conversation with Khrushchev.

The "hot line," as the direct connection between the White House and the Kremlin is now called, may have grown out of his initiative.

III

In the field of pure science, Szilárd lost interest in atomic physics after the war and switched to biology, an interest which he had developed while in London in 1932. Donald Fleming reported on this change in *The Intellectual Migration* (1965), tracing the career of Szilárd and other European scientists.

"Erwin Schroeder, one of the heroes of quantum mechanical revolution, and Leo Szilárd, the man who launched the Bomb, actually turned to biological questions... not only the example but two of the legendary exemplars had passed over from physics to biology. Men with the habit of speedy success in great scientific undertakings had set their seal of approval upon the immediate prospects of biology. It became correspondingly easier to believe that biology would be the next science to be revolutionized."

Szilárd was appointed professor of biophysics at the University of Chicago in 1949, without teaching obligations or any other defined duties. With the assistance of a young physicist, Aaron Novick, he made experiments which cast new light on the process of memory and aging. He produced seven papers on these experiments and their ramifications before 1955, and submitted

three works on biophysics in 1959–1960 to the National Academy of Sciences, published in its proceedings.

Explaining his switch to biology, Szilárd remarked that he had lost interest in physics after it turned into a large scale enterprise. He liked the informal physics of the 1931's when he "could think up an experiment today and do the experiment tomorrow. My neutron source was a little beryllium mixed with radium at the end of a long glass rod. I came into the room and held the source away from my body as well as I could and said: "Well, boys, what experiment do we do next." (*International Science and Technology*, interview, published May, 1969.)

In 1960, Szilárd surprised his friends in New York City by making inquiries about apartments to rent. His sudden concern for home and family coincided with the discovery that he had cancer. He opposed surgery and directed the radiation cure himself. Though never a seeker of publicity for his scientific achievements, he now exploited whatever attention he received due to his illness to further his social and political ideas. The role of a man close to death, wishing to impart the wisdom of a lifetime to his fellow men before departing, appealed to him. When he felt better he invited Edward Teller, his antagonist who had strongly advocated that America keep the atomic monopoly, to join him in a debate that was to be filmed and shown.

It was a strange show on the screen. Szilárd appeared in hospital attire, plump, wavy gray hair on a large head, arguing with crisp short sentences. Teller's unusually thick dark eyebrows rose and sank as if they were symbols of his rambling and foreboding statements. They both spoke with Hungarian accents of different shadings. A Hungarian viewer would not have been surprised to hear the debating physicists slip inadvertently into their mother tongue.

Szilárd's method of debate was to attack his adversaries with sharply formed, paradoxical statements or questions in order to provoke an honest reaction, not to belittle his opponents. "Aggressive as he is in pushing his pet theses... he has never sought the limelight for himself. He may haggle fiercely over details, but he also has a magnificent detachment and an almost saintly freedom from any sense of grievance" (Alice Kimball-Smith, *Harper's Magazine*); "Slightly malicious without being outright offensive," was the phrase with which he characterized himself. Though often ironical, Szilárd was in fact never malicious. All who knew him found the contrast striking between the tense inquisitiveness of his scientism and the benign, sad cast of his face when he relaxed, mirroring his "warm, compassionate heart." His admirers admitted there was a certain arrogance in his intellectual approach. This may have been due to his self-confessed conviction that he had discovered some truths "at least a day earlier than others," but the reason may have lain elsewhere. Szilárd did not care for the support of institutions or governments in working out his projects. Without such support, he felt the need to take the offensive to convince others of the validity and importance of ideas, to win converts for his social actions. In his peregrinations through the 20th century revolutions in science and technology, he knew that the changes he had envisaged would never come from these institutions without the persistent independence of a citizen of the world, as he himself tried to be.

Most of his American acquaintances who did not know him intimately, and very few did, thought of him as a bachelor. Two packed suitcases comprised the basic furniture of his room in the faculty club of the University of Chicago. Szilárd had no interest in possessions; he had a lifetime aversion to developing any lasting ties to any place, or institution—including that of the family. This aversion, in later life, became almost pathetic, but it was rooted in principle: "Leo wasn't a 'good brother' in the usual terms," his sister recalled. "When my husband was gravely ill Leo came to see

us from the other end of the world. He gave us money and took care of us. At the same time, he protested that he was not doing it for a relative. 'I did it for a man in trouble,' he insisted. I would have done it for anybody."

An incident recalled by an early classmate in the Budapest days further illustrates Szilárd's resolve to remain independent: In his youth, he had cut short a courtship before getting seriously involved. He warned the girl categorically that he was against marriage for himself; he had "too many things to do in life."

Nonetheless, Szilárd relented enough late in life to marry, in 1951, Dr. Getrude Weis, a physician and friend from Berlin days—with the understanding, however, that their marriage would not entail a common home. Mrs. Szilárd settled in Denver, Colorado; Leo continued his nomadic existence, roving the country from one end to the other.

Szilárd recovered sufficiently from cancer to embark upon a new peace offensive. He settled at the Dupont Plaza Hotel in Washington, D.C. with his wife, who soon became a collaborator. He visited colleagues and students at universities and research institutes to gain their support for a "peace lobby" in Washington which would support legislation in Congress furthering internaolinal cooperation. He established the "Council for a Livable World" for this purpose. The Council was an immediate success, and contributions poured in from all parts of the country, primarily to finance the campaign of Congressmen who had adopted a peace platform. In 1962, Senator George McGovern was assisted by the funds of this organization. Szilárd was never happier than during these years.

"A sad, gentle mischievous cherub." "A beautiful head—a leonine head on a heavy body," colleagues described him "at the beginning of a new era in the relation between science and statecraft."

Szilárd fought for such an era with all he had, and that was superb, though he knew that it would not come to pass without relentless struggle. But he did not despair of mankind, as H. G. Wells had toward the end of his years.

Public recognition of Szilárd's scientific and political accomplishments came with the Einstein Award in 1958; the Atoms for Peace Award in 1960. He was elected to the National Academy of Sciences in 1961. In 1970, the International Astronomical Union named a lunar crater after Dr. Leo Szilárd.

He published one book of fiction *The Voice of the Dolphins* in 1961; a collection of stories of charming fantasy, gentle humour, and wisdom.

He died in 1964, ten years ago, of a heart attack.

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