Dupf

The Quadrangle Club
The University of Chicago
1155 East 57th Street
Chicago 37, Illinois

May 7, 1956

Dr. Edward Teller
Department of Physics
University of California
Berkeley, California

Dear Teller:

Sorry to write you so many letters. The present one is about the following situation: I shall be transferred in Chicago on the 1st of July to the Institute of Nuclear Studies, and have the title of Professor of Biophysics. The Institute can give me an office but no lab space, and even if I could get lab space outside of the Institute—which I assume I could—I could not build up a good group in biology for the men who would come there would have no chance for promotion.

The Biology Division of Cal Tech (Beadle), the Department of Biophysics of the Medical School of the University of Colorado (Puck), and the Department of Pharmacology of the Medical School of NYU, have been discussing with each other and with me the possibility of asking the National Science Foundation to set up a Roving Research Professorship which would leave me free to pursue my scientific interests anywhere I desired and it would not be limited to these three institutions.

Apparently the officers of the National Science Foundation are interested in creating such a novel institution. The National Science Foundation would however not set up such a "fellowship" for more than five years.

The situation is complicated by the following calamity. If I stay at the University of Chicago and retire at the age of 65, about seven years from now, I would have a retirement income from Teachers Annuity of $113 per month. It is this low because my regular academic employment started in 1946.

Dr. Bernard D. Davis, head of the Department of Pharmacology at the NYU Medical School, and some of my other friends in New York, believe that it might be possible to raise from foundations and private individuals funds to supplement what the National Science Foundation might be able to do, and create some sort of a "fellowship for life." They wish to enlist your help in this matter and you will receive a letter from Dr. Davis in the near future. He discussed with me what he proposes to do, and it sounds all right.

Sorry to bother you with this.

Yours,

Leo Szilard

December 13, 1956.

Dear Dr. Bronk,

I wish to thank you for your very kind letter of December 1. Naturally, I appreciate your offering me appointment as an Affiliate of the Rockefeller Institute and I shall be very glad to accept.

Apart from all other considerations, this appointment solves a minor immediate problem. Luncheon is a very good time for me to discuss informally problems with staff members of the Institute because I need not fear interfering with any experimental schedule! In the long run it would have been a little awkward for me to keep on inviting staff members to lunch and then let them pay for the lunch.

I know how crowded you are for space and I realize that it might be difficult for you to find space for me right now, particularly as long as my visits are sporadic and of uncertain duration.

It was very thoughtful of you to suggest that we might discuss the possibility of some financial compensation as an inducement to spend more time in New York. At present I am receiving my full salary - such as academic salaries are - from the University of Chicago even though the University very generously permits me to come and go as I please. Mine is a "three-quarter-year" contract which permits me to spend one quarter elsewhere in addition to act, any time, as a consultant. Still, it might not be right for me, at present, to go beyond accepting reimbursement for expenses. Mostly I am able to charge transportation cost from Chicago to New York to some meeting or conference, but if I prolong my stay in New York I have to cover my hotel bills through deficit financing. - Any time you care to discuss lowly matters of this sort I shall be delighted to call on you and thus to combine business with pleasure.

With best personal wishes,

Very sincerely yours,

Leo Szilard

E Teller
letter (+o)
May 7, 1956

Similar Info dated Aug 30, 1956 in F 24

CALIFORNIA INSTITUTE OF TECHNOLOGY

Pasadena, California

August , 1956

An Application to the National Science Foundation

For a Grant to Support

A ROVING PROFESSORSHIP FOR LEO SZILARD

[Res. in Theor. + Quant. Biol]

Institutions:

The California Institute of Technology
The University of Chicago
The University of Colorado Medical School
New York University College of Medicine
The Rockefeller Institute for Medical Research

Administrative Direction:

Division of Biology
California Institute of Technology, Pasadena, California

Total Budget and Duration:

$105,857 for five years or $211,710 for ten years

Starting date:

July 1, 1957

Administrative officer to whom payments should be mailed:

George W. Green, Vice President for Business Affairs
California Institute of Technology
Pasadena, California

Rejected April 1957

Approved for the California Institute of Technology:

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G. W. Beadle, Chairman, Division of Biology

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G. W. Green, Vice President for Business Affairs

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L. A. DuBridge, President

Approved for the University of Chicago:

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Approved for the University of Colorado Medical School:

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Approved for New York University College of Medicine:

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Approved for The Rockefeller Institute for Medical Research:

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A Roving Professorship for Leo Szilard

Background:

In 1946, after a distinguished career in physics, Professor Leo Szilard became an active research worker in biology. As such, he has had great influence, not only because of his own research efforts, which were to a large extent made in collaboration with Professor Aaron Novick of the University of Chicago, but also because of his catalytic influence on workers in other laboratories. The evidence submitted with this application makes it abundantly clear that in this respect Szilard is a unique person. The persons primarily responsible for suggesting that this proposal to the National Science Foundation be made*, together with others who support it, are convinced that science will profit greatly if he is made a Roving Professor with freedom to move about among the five participating institutions.

We do not believe that favorable action on this proposal should necessarily establish a precedent for additional appointments of Roving Professors on the basis here outlined. It is a rare person indeed who is qualified to do what we propose Szilard should be encouraged to do. Another person for whom as strong a case can be made may not come along for years.

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* Theodore Puck, University of Colorado Medical School
Max Delbrück, California Institute of Technology
Bernard D. Davis, New York University College of Medicine
Rollin D. Hotchkiss, The Rockefeller Institute for Medical Research

The Proposal:

It is proposed that the National Science Foundation make a five- (or ten-) year grant for the salary and travel of Leo Szilard with the understanding that he will spend from one to four months in each of the five institutions making this proposal, working in collaboration with the persons indicated in his memorandum, with others or alone. He would be given an appropriate appointment and title at each of these institutions.

It is requested that the grant be made to the California Institute of Technology.

Supporting Evidence:

The following attached documents are offered in support of this proposal:

1. Memorandum by Leo Szilard indicating his interest in the proposal and stating his understanding of how the plan would work.

2. Curriculum Vitae of Leo Szilard.

3. A partial bibliography of Leo Szilard listing some of his papers in physics and his publications in biology.

4. Supporting letters from the participating institutions.

Budget:

Annual salary	$ 14,800
Travel and subsistence per year*	2,500
Contribution to TIAA retirement fund, 7-1/2% of salary	1,110
Total annual direct cost	18,410
Indirect cost 15% **	2,761
Total annual cost	$ 21,171
Total for five years	$ 105,855
Total for ten years	$ 211,710

*For explanation of this item, see following sheet

**It was suggested that indirect costs be assigned 7/15 to the California Institute of Technology and 2/15 to each of the other participating institutions.

Estimate of Expenses for Travel and Subsistence

Estimate of transportation expenses on the basis of three return trips per year from coast to coast to be	$ 900
Estimated travel expenses to attend meetings	300
Total annual expenses for transportation	$ 1,200

The amount of subsistence while travelling is estimated as follows: Dr. Szilard may be away most of the year from his home base (Chicago) where he pays rent all year round. Unless he stays in any one place long enough to make other arrangements, he might have to stay at hotels. If, instead of eventually concentrating his activities either mainly on the east coast or the west coast, he should keep on commuting between the two coasts, and particularly if his activities should gradually extend not only to New York and Pasadena but also to Boston and Washington, as well as Berkeley and Palo Alto, then his expenses for hotel accommodations and meals at hotels might amount (on the bases of $12/day for 270 days) to $ 3,240

Transportation in cities away from home base (on the basis of $2. per day for 180 days) might amount to	360
Secretarial services, while away from home base, calculated on the basis of $2. per hour for 100 hours per year	200
Total estimated annual subsistence while travelling	$ 3,800
Grand total for annual travel and subsistence	$ 5,000

On the assumption that it should be possible for Dr. Szilard to economize by travelling by aircoach, by staying with friends rather than staying at hotels, and by gradually concentrating his activities so that fewer cities need to be covered, Dr. Szilard believes it possible that his expenses might be cut to half this total. On this basis the sum budgeted annually for travel and subsistence is $ 2,500

Memorandum by Leo Szilard

Aug 1956

At present I am a member (Professor of Biophysics) at the Enrico Fermi Institute for Nuclear Studies at the University of Chicago. This position, while it may be regarded as very desirable in many respects, does not represent the proper setting for the pursuit of my biological interests.

I take the liberty to submit herewith a memorandum in which I propose to serve as a Senior Research Scientist-At-Large either for five or for ten years.

I understand that under the terms of such a position I would be free to pursue my scientific interests anywhere in affiliation with universities or research institutes. Initially, however, I would be affiliated with the California Institute of Technology, Pasadena, California; the Rockefeller Institute for Medical Research in New York; the Department of Pharmacology of the Medical College of New York University in New York; the Department of Biophysics, Medical School, University of Colorado, in Denver; and the Enrico Fermi Institute for Nuclear Studies at the University of Chicago, Chicago.

In general my research will be in the field of quantitative biology. More particularly, I expect to be concerned with the formation of adaptive enzymes in microorganisms, and the formation of antibodies in spleen cells in vitro, problems connected with the growth of microorganisms and tissue cells in vitro, the growth of viruses in microorganisms, as well as in tissue cells in vitro, and the transformation as well as the transduction of genetic characters in microorganisms.

I would expect initially to cooperate in the Rockefeller Institute with R. Hotchkiss, M. Fox, N. Zinder and Paul Weiss; at New York University with Bernard Davis and Werner Maas; at the University of Colorado with Leonard Lerman and T. T. Puck; at the California Institute of Technology with Max Delbrück and R. Dulbecco; and at the University of Chicago with A. Novick and H. Anker.

In the following I wish to present two points of view that might be relevant in judging the usefulness of my serving as a Senior Research Scientist-At-Large.

(a) At present certain branches of biology in which I am interested are in rapid progress. The problems of protein synthesis, the role of RNA and DNA, and the general problems of self-reproduction, differentiation and aging are rapidly becoming open to attack by means of new techniques. In part, this is due to progress in the field of microbiology and, in part, it is due to progress in the techniques of animal cell cultures,

as well as other fields. This appears to be a situation where it would be of great advantage for anyone interested in general biological laws to be able to shift from one biological material to another, as the problem demands, and to be free from the limitations of using just the few techniques which any one person can master. This ideal is not fully attainable for anyone short of being made head of a research laboratory of some size created de novo, and thus being enabled to assemble, so to speak, from scratch a sufficiently large and varied team, and at the same time being given an administrative setup which leaves the head of the laboratory free of administrative duties in order to enable him to effectively work with such a team. However, as a Senior Research Scientist-At-Large, it might be possible to approximate somewhat this ideal situation (which is probably not fully attainable in the United States). As a Senior Research Scientist-At-Large, it should be possible for me to establish collaboration with a sufficiently large and varied group of scientists scattered across the country in different laboratories, and at the same time I would remain free of administrative duties.

(b) As a Senior Scientist-At-Large, it should be possible for me to acquire intimate knowledge of experiments conducted with a great variety of biological material and diverse techniques, and thereby to be in a position to try to function as a "theoretical biologist." This statement requires a qualification:

Biology has not quite reached the stage which was attained by physics half a century ago when enough facts were established to permit a theoretical physicist to come up with significant insights on the basis of the established facts. Yet in biology we might be very well on the verge of a similar situation, and a few scientists who are so inclined may attempt to act, for a period of time at least, as theoretical biologists. This means that it might be well at present for a few scientists to put less emphasis on their own experiments and spend more time trying to keep in close touch with the experiments of others in the hope of being able to recognize new patterns and to gain insight into some general biological laws that have so far not clearly emerged. It may be that the main difference between theoretical physicists of the past and the would-be theoretical biologist of the present is quantitative rather than qualitative. The would-be theoretical biologist would probably not be able to keep on studying the results of others and thinking about them for a very long stretch of time. Much sooner than a theoretical physicist, he will feel impelled to do further experiments (or to induce someone else to do them) because he will feel the need to cut down the number of possible avenues along which his further thinking may be tempted to wander.

With respect to the issue of whether the fellowship should be given for five or for ten years, I wish to present the following point of view:

If the fellowship is given for ten years, it would take me to the age of 68 years, which is the present retirement age at most universities. On the other hand, if the fellowship is given for five years, I would have to contemplate returning to the University of Chicago when the fellowship lapses. While I understand that the University of Chicago would be agreeable to my returning to it at any time I desire to do so, prior to reaching retirement age, yet should I return to Chicago after a lapse of five years there would arise the question of how to spend the remaining time in a productive manner.

Vol I
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Curriculum Vitae of Leo Szilard

I was born in Budapest, Hungary in 1898. I went through officers' school there during the first World War and studied engineering there.

In 1920 I left Hungary to continue my engineering studies in Berlin. However, the attraction of physics proved to be too great. Einstein, Planck, Von Laue, Schroedinger, Nernst, Haber, and Franck were at that time all assembled in Berlin and attended a journal club in physics which was also open to students. I switched to physics and obtained a Doctor's degree in physics at the University of Berlin under Von Laue in 1922. My thesis (1 - see attached list of publications) showed that the Second Law of Thermodynamics covers not only the mean values, as was up to then believed, but also determines the general form of the law that governs the fluctuations of the values.

Subsequently, I was a research worker in one of the Kaiser Wilhelm Institutes in Berlin and later joined the teaching staff of the University of Berlin (as Privatdozent) where I remained until 1933. Of the papers (1 - 4) published during this period, some are experimental, and some are theoretical. The last one (4) established the connection between entropy and information which forms part of present day information theory.

In 1933 I went to England. I considered at that time becoming a biologist, and A. V. Hill said that he would find a position for me as a demonstrator in physiology. It occurred to me, however, just then that a nuclear chain reaction might be possible if we could find an element that would emit neutrons when bombarded by neutrons. Artificial radioactivity was discovered a few months later by Joliot and seemed to provide an important new research tool in nuclear physics. This decided me to move into nuclear physics.

In the summer of 1934 I started work as a guest in St. Bartholomew's Hospital in London and this work resulted in the establishment of the Szilard-Chalmers Reaction (5) and the discovery that slow neutrons are emitted by beryllium if the beryllium is exposed to gamma rays of radium (6). In 1939, after the discovery of the fission of uranium, the use of these slow neutrons from beryllium made it possible to see that uranium emits neutrons when bombarded by neutrons; the fast neutrons emitted by uranium could be easily distinguished from the bombarding slow neutrons.

In 1935, after a visit to New York, where I spent a few months as research associate at New York University, I accepted a position at the Clarendon Laboratory, Oxford University. During this period I worked in the field of nuclear physics (8-11). In 1938 I came to America under arrangement with Oxford University, which permitted me to spend half my time in the

United States. I was in the United States during the time the Munich Agreement was negotiated. After Munich I decided to stay in the United States on a full-time basis, and I resigned at Oxford.

In January 1939 I learned of the discovery of fission. It seemed important to find out at once if neutrons are emitted in that process, for in that case a chain reaction in uranium had to be regarded as a serious possibility. I therefore asked the permission of Columbia University to work there as a guest and perform an experiment in order to settle this question. This experiment (jointly performed with Walter Zinn) led to the discovery of the neutron emission of uranium, upon which the chain reaction is based (12, 13). The same discovery was made independently at about the same time by Fermi and his co-workers and by Joliot and his group.

In July, 1939, I recognized that a chain reaction might be set up in a system composed of graphite and uranium. Because of the serious consequences of this possibility, it seemed that this was a matter in which the government ought to take an interest. I therefore went to see Professor Einstein to enlist his help in approaching the government. After several consultations, in which E. P. Wigner and Edward Teller participated, Einstein wrote a letter to President Roosevelt; and in response to this letter, the President appointed a committee under the chairmanship of the Director of the National Bureau of Standards.

In February 1940 I described the chain-reacting uranium-graphite system in a paper I sent to the Physical Review (February, 1940). For reasons of secrecy, this paper was not published.

In November of 1940 a government contract was given to Columbia University for the development of the graphite-uranium system, and I became a member of Columbia University's National Defense Research Staff. Early in 1942 our group was moved to the University of Chicago; and on December 2, 1942, the chain reaction system was put into action.

Recently a patent was granted to the Atomic Energy Commission on the chain-reacting graphite-uranium system, jointly in the names of Enrico Fermi and myself.

In 1943 I became a naturalized citizen of the United States.

In October, 1946 I joined the staff of the University of Chicago as Professor of Biophysics in the Institute of Radiobiology and Biophysics. This institute never grew as originally intended, it had a succession of directors, and it was recently dissolved. I remained on the staff of the University of Chicago but have so far not joined any department in the biology division.

Aug 1956

I should perhaps mention here that I have been for a number of years also Visiting Professor in the Department of Biophysics of the Medical School at the University of Colorado.

When in 1946 I was faced with the task of converting myself into a biologist, I teamed up with Dr. Aaron Novick, a physical chemist. I had known him from his work in the uranium project. We both got our training in biology through summer courses, such as Dr. Delbrück's course in Cold Spring Harbor in bacterial viruses, and Dr. Van Niel's course in bacterial biochemistry at Pacific Grove. Dr. Novick and I worked as a team until recently when the Institute of Radiobiology and Biophysics was dissolved.

A list of publications is attached, containing a short description of each paper. When we started out, we tried to understand a striking phenomenon just then discovered by A. Kelner, who showed that bacteria killed by ultraviolet light can be reactivated by shining visible light at them (B1). A detailed analysis of the phenomenon enabled us to interpret it in terms of a "poison" that is produced by ultraviolet light and is decomposed by visible light. This interpretation was at first controversial due to Dulbecco's work on light reactivation of ultraviolet killed bacterial viruses, but has in the meantime become widely accepted. My own interest in the subject waned when I could not convince myself that we were dealing with a phenomenon that serves a useful biological purpose in the life of the bacteria.

Next, we turned our attention to the study of bacterial viruses in the assumption that viruses may prove to be much simpler than bacteria. We obtained some very interesting results (2) but decided to shift after a while to the study of bacteria.

The two phenomena in which we were particularly interested were a) mutations and b) the formation of adaptive enzymes which promised to provide a tool for the study of protein synthesis.

We were dissatisfied, however, with the methods that were available for the study of these phenomena. It seemed to us necessary to study bacterial populations in the growing condition in a stationary state, i.e. we thought we ought to use a continuous flow device. We developed such a device, which we called a "Chemostat." In this particular device the rate of growth of the bacteria can be changed by changing the concentration of one of the growth factors of our choosing which we make the controlling growth factor.

We started out by using the "Chemostat" for the study of mutations and obtained quite unexpected results at the very outset. It turned out, for instance, that the rate at which certain mutations occur does not

change when we change the rate at which the bacteria divide; we could vary the rate of growth within a wide range without changing the rate at which these mutations occurred. We found one family of compounds - purines - which may cause an about tenfold increase in the mutation rate of bacteria without any appreciable killing. And we also found antimutagens, which in very small contractions will fully counteract the effect of purine-type mutagens.

In a bacterial population maintained in the "Chemostat" there occur evolutionary changes (3) and one strain of bacteria is replaced by a mutant strain, which can grow faster in the conditions prevailing in the growth tube of the "Chemostat." We observed successive evolutionary steps of this sort in each experiment of sufficiently long duration and were able to analyze the phenomenon.

Experiments on adaptive enzyme formation performed by means of the "Chemostat" are still in their infancy but it seems that the "Chemostat" will prove to be a necessary tool in that field also.

PARTIAL BIBLIOGRAPHY OF LEO SZILARD*
(with annotations)

A. Physics

(1) Zeitschrift für Physik, 1925, p. 753, 32. This paper extends the application of thermodynamics to the derivation of the laws of thermodynamical fluctuations. It was accepted as dissertation by the University of Berlin.

(2) Zeitschrift für Physik, 1925, p. 688, 33. - jointly with H. Mark. This paper reports experiments which revealed anomalous scattering of X-rays.

(3) Zeitschrift für Physik, 1926, p. 743, 35. - jointly with H. Mark. This paper reports experiments on polarizing X-rays by reflection on crystals.

(4) Zeitschrift für Physik, 1929, p. 840, 35. This paper evaluates the increase of entropy which is connected with operations of an intelligent being on a thermodynamical system if these operations are controlled by measurements of variables which are subject to thermodynamical fluctuations. This paper was accepted as Habilitationschrift by the University of Berlin.

(5) "Chemical Separation of the Radioactive Element from its Bombarded Isotope in the Fermi Effect" -- jointly with Chalmers. Nature, p. 462, 134, 1934. This paper demonstrates a generally applicable process (Szilard-Chalmers reaction) for the concentration of a radioactive element produced by neutrons if the element has to be separated from a mass of a stable element with which it is chemically isotopic.

(6) "Detecting Neutrons Liberated from Beryllium by Gamma Rays," p. 494, 134, 1934. Nature.
This paper describes the discovery of radium-beryllium photo neutrons which, being of low energy, represent a useful tool in nuclear research. They were universally used later in the discovery and investigation of neutron emission of uranium on which a chain reaction is based.

(7) "Liberation of Neutrons from Beryllium by X-Rays" -- jointly with a group of six others, p. 880, 134, 1934. Nature. Using x-rays in place of gamma rays the threshold for the emission of photo neutrons from beryllium is determined by varying the voltage of an X-ray tube and is found to be somewhat above 1.5, and well below 2 m.e.v.

(8) "Radioactivity Induced by Neutrons" -- jointly with Chalmers, p. 98, 135, 1935. Nature. In this paper a neutron induced radioactive period of about 3-1/2 hours is reported in Indium which does not fit in with the explanations found for other radioactive periods. In a later paper it is shown that it is due to an excited Indium nucleus which is isomeric with stable indium nucleus 115.

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*Some of Szilard's most important works still remain unpublishable, for reasons of national security.

(9) "Absorption of Residual Neutrons," p. , 136, 1935. Nature. This paper reports the discovery of neutron resonances at low energies, gives an estimate of their energies, and states that the energies can be measured by observing the absorption of the residual neutrons in boron or lithium.

(10) "Gamma Rays Excited by Capture of Neutrons," p. 323, 139, 1937 -- jointly with Griffiths. Nature. This paper reports on the observation of gamma rays emitted by a number of odd elements which are strong neutron absorbers. The counts observed per absorbed neutron were found to be 15 per cent identical for all these elements.

(11) "Radioactivity Induced by Nuclear Excitation" -- jointly with Goldhaber and Hill, p. 47, 55, 1939. Phys. Rev. In this paper the previously reported period in indium is investigated and the conclusion is reached that it is due to nuclear excitation of the stable indium isotope 115.

(12) "Instantaneous Emission of Fast Neutrons in the Interaction of slow Neutrons with Uranium" -- jointly with Zinn, p. 799, 55, 1939. Phys. Rev. In this paper the discovery of the neutron emission of uranium is reported. It is estimated that two neutrons are emitted per fission. The neutrons from uranium are made visible on an oscillograph screen. As primary neutrons, radium-beryllium photo neutrons were used which, because they are slow, can be easily distinguished from the fast neutrons emitted by uranium. This discovery which was made independently by Fermi in the same year indicated the feasibility of a sustaining nuclear chain reaction.

(13) "Emission of Neutrons by Uranium" -- jointly with Zinn. p. 619, 56, 1939. Phys. Rev. Detailed report of above mentioned experiments, number of neutrons per fission measured as 2.3.

(14) "Neutron Production and Absorption in Uranium" -- jointly with Anderson and Fermi. p. 284, 56, 1939. Phys. Rev. This paper reports an investigation on the chain reaction qualities of a uranium-water system. It is estimated that 1.5 neutrons are emitted for every thermal neutron which is absorbed by uranium.

Dr. Szilard's part in bringing about of the first nuclear chain reaction; in the design of the first nuclear reactor (atomic pile) are described, insofar as these matters can be made public; in the Official Report: Atomic Energy for Military Purposes, Henry D. Smythe, 1945, Princeton University Press, pages 34, 47, etc.

B. BIOLOGY

(17) A. Novick and Leo Szilard - EXPERIMENTS ON LIGHT-REACTIVATION OF ULTRA-VIOLET INACTIVATED BACTERIA. Proceedings of the NATIONAL ACADEMY OF SCIENCES. Vol. 35, No. 10, pp. 591-600.

(18) Aaron Novick and Leo Szilard - VIRUS STRAINS OF IDENTICAL PHENOTYPE BUT DIFFERENT GENOTYPE. Science, January 12, 1951, Vol. 113, No. 2924, pp. 34-35.

(19) Aaron Novick and Leo Szilard - EXPERIMENTS WITH THE CHEMOSTAT ON SPONTANEOUS MUTATIONS OF BACTERIA. Proceedings of the NATIONAL ACADEMY OF SCIENCES. Vol. 36, No. 12, pp. 706-719, December, 1950.

(20) Aaron Novick and Leo Szilard - DESCRIPTION OF THE CHEMOSTAT. Science, December 15, 1950. Vol. 112, No. 2920, pp. 715-716.

(21) Aaron Novick and Leo Szilard - EXPERIMENTS ON SPONTANEOUS AND CHEMICALLY INDUCED MUTATIONS OF BACTERIA GROWING IN THE CHEMOSTAT. Cold Spring Harbor Symposia on Quantitative Biology. Vol. XVI, 1951.

(22) Aaron Novick and Leo Szilard - ANTI-MUTAGES. Nature, Vol. 170, p. 926, November 29, 1952.

(23) Aaron Novick and Leo Szilard - EXPERIMENTS WITH THE CHEMOSTAT ON THE RATES OF AMINO ACID SYNTHESIS IN BACTERIA. Dynamics of Growth Processes. Princeton University Press, pp. 21-32, 1954.

(24) Maurice S. Fox and Leo Szilard - A DEVICE FOR GROWING BACTERIAL POPULATIONS UNDER STEADY STATE CONDITIONS. Journal of General Physiology 39, p. 261-6, 1955.

The first of these papers (#17) investigates a phenomenon discovered by A. Kelner after the war, who showed that bacteria "killed" by ultraviolet light can be revived by shining visible light on them. Experiments designed to analyze the phenomenon are described in this paper; they lead to the conclusion that the ultraviolet light produces a "poison" which can be inactivated by light and that this "poison," if present when, subsequent to irradiation, the bacteria divide, will cause both death and mutations.

The second paper (#18) describes the discovery that, when a bacterium is infected simultaneously with two related viruses which differ from each other both in genotype and phenotype, the virus population emerging from the bacterium contains a class of viruses which have the genotype of one and the phenotype of the other.

The papers #19 to #23 describe a new way of studying bacteria by maintaining a bacterial population in a stationary (exponentially growing) state indefinitely and controlling the growth rate by controlling the rate of supply of an essential growth factor. An apparatus is described in these papers which will conveniently accomplish this and which is designated as the Chemostat.

In studying mutations in bacteria or the formation of adaptive enzymes in bacteria inaccurate, and therefore misleading results are frequently obtained by studying bacterial cultures in flasks in which the number of bacteria increases exponentially and today the use of the Chemostat appears to be indispensable.

In studying mutations in bacteria or the formation of adaptive enzymes in bacteria inaccurate, and therefore misleading, results are frequently obtained by studying bacterial cultures in flasks in which the number of bacteria increases exponentially and today the use of the Chemostat appears to be indispensable.

In the papers #19 to #22, the Chemostat is used in the study of mutations. It turns out that the rate at which mutations occur in a growing bacterial population under the conditions studied is not proportional to the rate at which cell division occurs, rather the mutation rate is constant per unit time independent of the rate at which the culture is growing. There is found one group of compounds, all purine derivatives, of which caffein is one, which greatly increases the mutation rate without having an appreciable killing effect on the bacteria.

There is another group of compounds described in these papers, all of them ribosides of purines which in small quantities will completely counteract the action of the above mentioned purine type mutagens and also reduce the rate of spontaneous mutations.

In paper #23, the Chemostat is used to study the biosynthesis of amino acids in bacteria and the regulatory mechanisms which are involved in it. The bio-synthetic apparatus of the bacteria respond to amino acid concentrations in the medium, which are exceedingly low. For instance, a bacterium which can make arginine and will do so if there is no arginine in the medium, will stop making arginine if an arginine concentration of 10^{-9} ga/ce is maintained in the medium in the Chemostat. (Novick and Szilard - unpublished.)

One way of studying such regulatory mechanisms is based on the use of a mutant which is blocked in the synthesis of an amino acid--in our case Tryptophane--and which pours out into the medium a "precursor" of that amino acid. Paper #23 utilizes such a mutant. In the absence of Tryptophane in the medium, a precursor of Tryptophane is poured out by the mutant into the medium at a rate which is independent of the growth rate of the bacteria. In the presence of Tryptophane this "precursor" is <u>not</u> poured out by the bacteria. It is conceivable that this indicates a general phenomenon of regulation through a negative feed-back of the final product at one of the <u>early</u> steps of the metabolic pathway leading to Tryptophane.

In paper #24, there is described a device called a breeder. In this device bacteria may be grown in a continuous flow of nutrient. The flow of the nutrient is controlled by the turbidity of the bacterial culture and the growth is not limited by a growth factor, as is the case in the "Chemostat."

This device was developed in order to study mutations in bacteria under conditions of growth at the maximal rate, and such a study was carried out by Maurice S. Fox.

CALIFORNIA INSTITUTE OF TECHNOLOGY
Division of Biology

August 13, 1956

Mr. William Consolazio
The National Science Foundation
Washington 25, D. C.

Dear Mr. Consolazio:

I write this in support of the proposal that the National Science Foundation grant the funds necessary to appoint Professor Leo Szilard a Roving Professor with the understanding that he will spend time at each of the five institutions named in the application, i.e., California Institute of Technology, The University of Chicago, The University of Colorado Medical School, New York University College of Medicine, and The Rockefeller Institute for Medical Research.

The idea evolved from a suggestion made by Ted Puck that we ought to explore the possibility of some kind of an inter-institutional appointment for Szilard -- that only in this way could his unique characteristics be most useful to science. Max Delbrück of this laboratory lent his enthusiastic support. The Faculty of the Division unanimously approved the plan outlined in the accompanying application. I then checked with Robert F. Bacher, Chairman of the Division of Physics, Mathematics and Astronomy, and with Linus Pauling of the Division of Chemistry and Chemical Engineering. The physicists and chemists here are equally in favor of having Szilard spend a fraction of his time at the Institute. It is therefore abundantly clear that support for the plan is widespread at the Institute.

I do not believe this proposal should be considered in terms of the precedent it is likely to set for NSF. I don't believe another person for whom such an appointment would be appropriate is likely to come along for many years. I therefore feel there is no need to worry about a flood of proposals for similar grants. Maybe you'll get them but I feel reasonably sure you'll find very, very few to which you'll want to give encouragement.

I sincerely hope the National Science Foundation will find a way to make the "Szilard experiment."

Sincerely yours,

G. W. Beadle
Chairman

UNIVERSITY OF COLORADO
MEDICAL CENTER

4200 East Ninth Avenue
Denver 20, Colorado

July 23, 1956

Dr. G. W. Beadle
Biology Division
California Institute of Technology
Pasadena, California

Dear Doctor Beadle:

This letter for transmittal to the National Science Foundation indicates our expectations with respect to Dr. Leo Szilard's contributions and responsibilities to this department, under the proposed arrangement for his appointment as a Scholar and Visiting Professor.

Dr. Leo Szilard possesses one of the most versatile and keenly analytic minds of our generation. His ability logically to dissect problems and to consider new and unconventional approaches to their solution is a scientific asset of enormous value.

We are expecting Dr. Szilard's specific contributions to the program of the Department ofBiophysics to involve the following functions:

a) One of the main interests of this department lies in the general field of bacterial genetic processes and bacterial viruses. This area represents one of the foremost opportunities for application of molecular analysis to the problem of biological replication. The models currently developing from work in this area are fundamental in their own right; in addition, they furnish a system which can guide genetic studies in mammalian cells, which now have become accessible to investigation by quantitative techniques like those hitherto confined only to microorganisms. The department has an excellent group of younger scientists at the assistant professorial level who are pursuing problems in bacterial genetics and bacteriophage. However, with the turning of my own energies to problems of mammalian cell biology, there is need for mature advice from an older person actively interested in bacterial and virus replication. These younger men possess good training, drive, and real creative ability. They and their students would profit greatly from regular access to a person with the scientific maturity and intimate acquaintance with the field, which Dr. Szilard possesses, to criticize, stimulate, and assist in guiding their efforts. While we foresee that Dr. Szilard's contribution here will be mainly in the supply of guidance, criticisms, and suggestions, we hope it will be possible to provide facilities for him to undertake some experimental work himself in this area, if the occasion should arise.

b) Dr. Szilard's participation in departmental research seminars will be of great value in our training program. His ability to stimulate, challenge, and inspire graduate students is especially effective in a program like ours that is small and, to an appreciable extent, informal. His orien-

tation toward science and its problems is one which coincides completely with the philosophy of this department; i.e., an emphasis on clearness of thinking and simplicity of operations, so as to achieve maximally definitive answers, with a minimum of manipulation and complex procedure. Both the faculty and the students can learn a great deal from Dr. Szilard, and we look forward to an arrangement that will make possible continuing opportunity for participation with him in discussions and seminars.

c) For some time it has been our hope to be able to add to the lines of this department's program a study in biological regulatory and integrative mechanisms. Such investigation would have to be of limited scope and involve new and simple approaches consistent with the scale of the department's facilities. The time at which such an activity could start would be strongly dependent on progress made in the other programs, and on the availability of additional space and scientific personnel. Dr. Szilard has always had an absorbing interest in these problems, and has made critical conceptual contributions which have anticipated development of modern Information Theory. If our plans for this particular type of expansion reach fruition, Dr. Szilard would be of enormous assistance in the formulation of such an activity.

In addition to these specific activities in the Department of Biophysics, Dr. Szilard could contribute a great deal to many areas of this University. The faculties of the Physics Department, the High-Altitude Observatory, and many of the bio-medical departments will undoubtedly take advantage of the opportunity to consult with him regularly about their programs. His influence could have widespread effects throughout this scientific community.

Dr. Francis Manlove, Director of the Medical Center, approves of these arrangements, and is so indicating in a separate covering letter.

Sincerely,

/s/ Ted Puck

Theodore T. Puck, Ph.D.
Professor and Head
Department of Biphysics

THE UNIVERSITY OF CHICAGO

July 30, 1956

To: Dean Warren C. Johnson

From: Harry Kalven, Jr.

Dear Dean Johnson:

I have now had an extended conversation with Dean Harrison on the Szilard matter and thought it might be useful if I reported the general substance of it to you.

As you will recall, the proposal concerning the lifetime Roving Fellowship for Szilard involved three points. The first went to whether the University would grant Szilard the necessary leave to accept a five year fellowship if one were offered by the National Science Foundation, and whether it would agree to be a co-sponsor with four other institutions under such a proposal. Mr. Harrison saw no difficulties whatsoever in this, and assured me the University would cooperate fully. He said the University would be quite willing to receive the funds from the National Science Foundation and administer them if that were otherwise convenient. It would be equally agreeable to it to have the grant go to one of the other institutions. He also suggested that it might be appropriate to have Szilard's appointment kept in force, and to have him assigned without pay to the fellowship in contrast with his taking a formal leave of absence for five years.

The second step of the proposal went to the willingness of the University to receive and administer funds to be applied to an extension of the fellowship arrangement at Szilard's retirement. Mr. Harrison again saw no difficulty in this and again assured me of the fullest cooperation of the University. He cited the case of Dr. Franck as a precedent, and indicated the University had been quite happy with the Franck arrangement. As you know, in that case the Fels Foundation agreed with the University to pay Franck's salary for life and the University has annually reappointed Franck for another year under this arrangement. He indicated further that the exact financial arrangements could, without any inconvenience, be made to suit the individual case and the wishes of the donors.

As to the third part of the proposal, he was least encouraging. He thought it most unlikely that the Board of Trustees would approve the University's making a direct contribution to the post retirement fellowship, and discussed persuasively the many difficulties he saw in this as a matter of general University policy. He did indicate,

however, that in case of hardship, the University might agree to continue its contribution to Szilard's annuity during the five year period of the National Science Foundation fellowship, but only if the fellowship grant itself could not be made to cover this.

Perhaps most important was the fact that Mr. Harrison expressed an extremely sympathetic interest in the overall matter and a very considerable appreciation of Szilard's special talents and contributions. I think, therefore, that we can be confident of the utmost cooperation from the administration in carrying out the details of the National Science Foundation fellowship, and in exploring the possibilities of extending it, through the acquisition of outside funds, to a lifetime fellowship.

May I once again express my warmest thanks for your generous help and interest in this matter.

Cordially,

Harry Kalven, Jr.

July 6, 195

Mr. William Consolazio
National Science Foundation
Washington 25, D.C.

Dear Bill:

I am writing in support of an application to be made by Dr. George W. Beadle, for a grant that would provide a Roving Professorship or its equivalent for Dr. Leo Szilard.

As I visualize the scheme, it would leave Dr. Szilard free to distribute his time as he saw fit in whatever institutions might interest him from time to time. It is naturally expected that he would spend an appreciable amount of time each year at each of those institutions which are concerned with initiating the project: namely, the Division of Biology at Cal Tech, the Department of Biophysics at the University of Colorado Medical College, and the Department of Pharmacology at New York University College of Medicine, of which I am chairman. As far as our department is concerned, we have found Dr. Szilard's visits very stimulating, and we hope that he would continue to appear from time to time as a consultant advising us on our scientific problems. Moreover, if he should wish to settle for a considerable period at NYU I would be delighted and I am confident that we could provide space for him. However, our work has more of a biochemical than a biophysical orientation, and I hardly expect that we would be seeing very much of him. My interest in supporting this project is therefore based primarily on the belief that Szilard's present situation is not very satisfactory and a Roving Professorship would offer a better chance for the full exercise of his remarkable talents.

This is a peculiar arrangement. But Szilard is a peculiar person, and I believe this is the best possible solution for him. In recent years he has engaged extensively in visiting other laboratories, where he has been most generous in giving thoughtful and deep attention to the work in progress. He has a unique ability to grasp instantly the most varied problems, to seize upon their significant aspects, and to apply to them unusual imaginative and critical powers. These visits have often led to valuable new experiments and have given to many young biologists a much enhanced sense of the distinction between significant and trivial problems. The Roving Professorship we are trying to arrange would regularize such peripatetic activities and would at the same time provide the opportunity, if his interests so directed, for an extended period of work at a single Institution.

If I can be of any further assistance please do not hesitate to let me know; I expect to be at the Marine Biological Laboratory in Woods Hole until late August.

Sincerely,

Bernard D. Davis
Chairman, Pharmacology

The Rockefeller Institute for Medical Research
66th Street and York Avenue
New York 21, N.Y.

June 14th, 1956.

Dr. George W. Beadle
Division of Biology
California Institute of Technology
Pasadena, California

Dear Doctor Beadle:

I would like to express our willingness on behalf of the Rockefeller Institute for Medical Research to have Dr. Leo Szilard fulfill a part of his propsed functions as Scientist-at-large at this institution. We have discussed the purposes and requirements of the plan and feel that within the framework of our whole Institute we shall be able to provide a background for this activity and facilities as they may within reason be needed from time to time.

Sincerely yours,

/s/ Rollin D. Hotchkiss

Rollin D. Hotchkiss

Original 3bs 14

Metallurgical Laboratory
P.O. BOX 5207
CHICAGO 80, ILLINOIS

BUTTERFIELD 4300

May 15, 1946

Dr. Leo Szilard,
Metallurgical Laboratory,
Chicago, Illinois

Dear Dr. Szilard:

I acknowledge the receipt of your letter of May 9 and I regret to say that no offer will be made to you to continue your work after June 30, 1946 with the University of Chicago under contract with the Manhattan District.

May I take this opportunity to express the appreciation of the Metallurgical Laboratory for your very valuable contributions to its success. Your foresight and initiative were largely responsible for obtaining support for the original atomic energy program, and your work on piles and your vision for new types of piles have been important in the development of the research program of the Laboratory.

I know that you will find interesting work to do in which you will continue to work for the safety and welfare of the nation and I wish you every success in it.

Sincerely yours,

Farrington Daniels

Farrington Daniels, Director
Metallurgical Laboratory

FD:db

U. of Chicago:
April 7, 1942

Appl. Retalling Lab.
$550/month

Visl. Res. Assoc. Dpt. Physics
for 5 months, beg. Feb 1, 1942
Resigned March 31, 1942

1. Leviathan < N.Y. 12-25-1931

Bremen < N.Y. 5-4-1932

2. Olympic < N.Y 2-21-1935 (22?)

✓ Majestic < N.Y 5-23-1935
S.H. 6-1-1935 (5-31-1935)

3. ✓ Queen Mary < Southampton, 3-31-1937
N.Y. 4-5-1937

Aquitania < 5-12-1937 N.Y.

4. ✓ Franconia < S.H 12-24-1937
N.Y 1-2-1938

5 Canada 7-3-1938 ~~1-5-1938~~ 7-5-1938

HOTEL Del Charro
2380 TORREY PINES ROAD, LA JOLLA, CALIFORNIA 92037 • TELEPHONE 454-6134

ARTHUR L. FORBES
Manager

MAR 4 1969

March 1, 1969

Dear Matt:

please forgive the delay in sending this. Bernie Feld has both the Manual and Norick introductions. See whether you'd like to attach a third one. These "pre-prints" is all we have found so far - do you think there are more?

Love,
Trude

(A-36) D

January 25, 1957

Vaccination of the Delayed Type

By Leo Szilard

By "vaccination of the delayed type" we shall mean a vaccination of an individual against an infectious agent (virus, bacterium, etc.) by injecting the killed infectious agent (or its surface antigens) in circumstances in which the injection evokes strong delayed type hypersensitivity to the surface antigens of the infectious agent. Pappenheimer and his co-workers have shown[1] for diphtheria toxoid and egg albumen that delayed hypersensitivity ensues against any one of these two antigens if a mixture of the antigen and an excess of the specific antibody is injected intradermally (or, together with an adjuvant, subcutaneously). I assume that delayed hypersensitivity can be evoked in this manner also against the surface antigens of infectious agents, such as polio virus, influenza virus, typhoid bacteria, etc.

It appears to me likely that the reactions which manifest themselves in the phenomenon of delayed hypersensitivity exist in nature because these very same mechanisms are involved in the defenses of the body which are active at the infected site. Thus hypersensitivity of the delayed type against the surface antigens of the infectious agent should reduce the severity and the duration of the infection. If this assumption is correct, then we must conclude that we ought to resort to "vaccination of the delayed type" in the case of diseases where ordinary vaccination with the killed infectious agent does not afford maximum protection.

In the case of polio, for instance, ordinary vaccination with a killed virus (Salk vaccine) produces circulating antibodies. In case of

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(1) Uhr, J. W., Salvin, S. B., and Pappenheimer, A.M., Jr., Journal of Experimental Medicine, Vol. 105, p. 11 (1957).

a subsequent polio infection of the intestinal tract, there is a rapid rise in the titre of the circulating antibody. Therefore, such a vaccinated individual is immune against polio in the sense that the infection cannot spread from the intestinal tract via the blood circulation to the brain. But such a vaccination does not confer on the individual resistance against the infection of the intestinal tract itself. The intensity and duration of the infection is the same for such a vaccinated individual as it is for individuals who had not been previously exposed to the virus in any way. This is in contrast to individuals who had been infected with live polio virus and who on a subsequent infection of the intestinal tract with polio virus show a resistance to this infection inasmuch as the virus will remain alive for a shorter period of time in the intestinal tract and will be shed for a shorter period of time by the intestinal tract.

We surmise that the same kind of resistance to the intestinal infection which is manifested by such persons could be conferred on an individual (who may have been rendered immune by ordinary vaccination - Salk vaccine) by giving him a polio vaccination of the "delayed type". This does not involve the use of live polio virus and could be accomplished by injecting intradermally (or together with an adjuvant subcutaneously) killed polio virus mixed with an excess of the specific antibody.

Such a vaccination of the delayed type with the killed infectious agent might prove useful also in the case of influenza and typhoid fever. It might prove useful in general in all those infections of mucous membranes in which ordinary vaccination (that leads to circulating antibodies but not to delayed type hypersensitivity) does not afford maximum protection.

February 5, 1957

On the Possibility of Detecting "Transformation" of Somatic Cells of Mammals or Birds.

By Leo Szilard

If skin is transplanted from rabbit A to rabbit B, the transplanted skin is sloughed off after a period of apparent healing. If subsequently another skin transplant is made from rabbit A to rabbit B, this second skin transplant does not survive as long as does the first transplant. We may express this fact by saying that the first transplant has induced "intolerance" in rabbit B against some genetically determined specific substances of rabbit A, to which we may refer, somewhat sloppily, as "antigens" - in quotes. What is the nature of these "antigens"?

It has been recently shown by Billingham, Brent and Medawar[1] that intolerance against skin of a strain A of mice can be induced in mice of strain CAB by injecting into CAB mice extract made from nuclei of spleen cells of A mice, and they have further shown that the active agent in these cell extracts is destroyed by desoxyribonuclease. The authors interpret this result by assuming that, if skin is transplanted from A mice

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(1) Dr. R. E. Billingham, Dr. R. Brent and Professor P. B. Medawar, F.R.S., Nature, Vol. 178, p. 514 (1956).

to CAB mice and induces intolerance against a subsequent transplantation, the "antigens" of A mice which are responsible for producing this intolerance are substances that are destroyed by desoxyribonuclease, and are therefore presumably nucleo-proteins or nucleic acids. They write:

"So far as we are aware, only one hypothesis can accommodate these findings: that the antigenic substances responsible for skin transplantation immunity are desoxyribonucleo-proteins endowed with antigenic and therefore with genetic specificity. This hypothesis is made likely by our evidence, but the evidence falls short of proof."

We wish to point out here the possibility of another hypothesis which would appear to be <u>even more likely</u> and which is as follows:

The extract prepared from nuclei of spleen cells of A mice (in which the active agent can be destroyed by the addition of desoxyribonuclease) induces intolerance in CAB mice against a subsequent skin transplant from A mice not because this extract contains the "antigens" of A mice but rather because this extract - if injected into CAB mice - is capable of causing a certain number of cells of injected CAB mice to produce the relevant "antigens" of A mice. If this hypothesis is correct, then we would deal here with a phenomenon strictly analogous to that known as bacterial transformation. In bacterial transformation

nucleic acid extracted from a strain of bacterium, A, is taken up by a different strain of bacterium, B, and this nucleic acid induces a certain fraction of the bacteria to produce specific antigens of strain A.

In the circumstances one feels impelled to devise a different sort of experiment that might be adequate to detect whether transformation of somatic cells of mammals or birds can, in fact, be accomplished by injecting nucleic acids of one individual into another individual. The principle of an experiment that might accomplish this purpose is as follows:

We shall assume that rabbit B and rabbit A have different blood groups and that rabbit B carries no natural iso-antibodies against the red cell antigens of rabbit A. An extract may then be prepared from spleen cell nuclei of rabbit A which contains the nucleic acids and nucleo-proteins but as far as possible very little else. We would regard it as evidence for having accomplished "transformation" if we can show the following:

(a) The purified desoxyribonucleic-acid-containing fraction which is prepared from cell nuclei of rabbit A is treated with desoxyribonuclease and injected into rabbit B. There appear no antibodies against the red cell antigens of rabbit A in the serum of rabbit B.

(b) When the treatment with desoxyribonuclease is omitted, the injection of the extract is followed by the appearance of antibodies in the serum of rabbit B against the red cell antigens of rabbit A.

(c) The purified desoxyribonucleic-acid containing fraction prepared from cell nuclei of rabbit A is treated with desoxyribonuclease. Subsequently, the desoxyribonuclease is destroyed and a purified desoxyribonuclease acid containing fraction, prepared from cell nuclei of rabbit B, is added -- to serve as an adjuvant in lieu of the destroyed cell nuclei of rabbit A. This mixture is then injected into rabbit B. No antibodies against red cell antigens of rabbit A appear in the serum of rabbit B.

If an extract prepared from spleen cell nuclei of rabbit A is indeed capable of forcing a small but appreciable fraction of the cells of rabbit B (say, a total of about one million cells) to produce red cell antigens of rabbit A, then rabbit B could be expected to respond by the production of antibodies specific for these antigens. Such circulating antibodies, if present, can be demonstrated by modern, sensitive, methods that permit the detection of very small quantities of type specific antibodies.

Arrangements are now being made for carrying out experiments of this type.

Should it turn out that transformation can, in fact, be effected in mammals (and the technique discussed above could also show whether transformation can be effected in birds), then there is a remote possibility that transformation might provide the basis for a "cure" for a class of rare hereditary diseases. In these diseases -- galactosemia, phenolpyruvic oligophrenia, hemophilia, etc. -- a defective gene is responsible for the absence of a specific protein in its functional form. Conceivably injecting into the patient DNA taken from nuclei of the spleen of a healthy individual repeatedly and in sufficiently large quantities might transform a sufficient fraction of the cells of the patient to remedy the disturbing manifestations of the defect.

From Salk
(Sylvia Hodson)
10-9-69

Leo Szilard was born in 1898, in Budapest, Hungary, and obtained his Degree of Dr. Philosophy in Physics at the University of Berlin in 1922. In his Doctor's dissertation, he demonstrated the connection between the Second Law of Thermodynamics on the one hand and the relation of entropy and probability on the other. He became a privatdozent for Physics at the University of Berlin in 1925. His Habilatations-schrift is often quoted these days because it first established the relationship between entropy and "information," subsequently rediscovered by Shannon.

In the years following 1922, he worked experimentally at the Kaiser-Wilhelm-Institutes in Berlin-Dahlem in the field of x-ray research.

While a refugee from Hitler Germany in London, in 1933, he became interested for the first time in nuclear physics. Working for a two-month period during vacation-time in 1934, at the St. Bartholomew Hospital in London, he discovered, jointly with a staff member of the Hospital, Dr. Chalmers, the disintegration of beryllium by the gamma rays of radium. They found that if beryllium is exposed to gamma rays of radium, it is disintegrated and that slow neutrons are emitted in this process. This radium-beryllium neutrons source played subsequently an important role in the history of the chain reaction, as will be described below.

During the same two-month period, they also discovered what is now called "Szilard-Chalmers Reaction" which permits the separation of a radio-isotope from the stable isotope from which it is produced through neutron capture.

While in England, Szilard became associated with the Clarendon Laboratory at Oxford where he worked in the field of nuclear physics. In 1938, Szilard was in the United States at the time of the Munich Crisis and, at that time, he resigned his position at Oxford and remained in the United States.

While still in England, he had recognized the possibility of a self-sustaining nuclear chain reaction that might be maintained if an unstable element could be found that would emit two neutrons for each neutron captured, and he had derived the general laws governing such a chain reacting system.

He learned in January 1939 of Otto Hahn's discovery of the fission of uranium. Hahn showed that uranium breaks into two heavy, charged, fragments when it captures a neutron. Szilard immediately thought of the possibility that neutrons might be emitted in this process and that a self-sustaining nuclear chain reaction might be set up in some system containing uranium. At once he borrowed $2,000 from personal friends, rented a gram of radium and made a radium-beryllium neutron source out of it. He thought that, if such a slow neutron source was used to bombard uranium with neutrons, then the neutrons emitted in the fission process could be distinguished from the primary neutrons because they could be expected to have a much higher energy than the neutrons from the primary source. He teamed up with Walter Zinn at Columbia University and they demonstrated, on March 3, 1939, that about two neutrons were emitted in the fission of uranium for each neutron captured in this process. The same discovery was made independently and about the same time by Anderson-Fermi at Columbia University as well as Halban and Joliot in Paris.

Subsequently Szilard then worked as a guest of Columbia University until the end of June. During that period, Fermi and Szilard teamed up and carried out jointly with Herbert Anderson an experiment which showed that uranium-water system came close, but not close enough, to being able to maintain a self-sustaining chain reaction.

In July, 1939, Szilard recognized that a uranium-graphite system was much more favorable in this respect than the uranium-water system and that it was likely that a chain reaction could be set up in such a system. He was aware of the military possibilities inherent in this development and realized also that a world war was impending. Szilard communicated his results and his apprehensions to Albert Einstein and these communications resulted in a letter written by Einstein to President Roosevelt, dated August 2, 1939.

In February, 1940, Szilard sent a paper to Physical Review appraising the possibility of maintaining a self-sustaining chain reaction in the uranium-graphite system and concluding that self-sustaining chain reaction should be possible in this system. At the Government's request, the publication of this paper was withheld.

In November, 1940, A government contract was given to Columbia University for developing the Fermi-Szilard System and at that time, Szilard became a member of the Columbia University National Defense Research Staff. In January, 1942, Fermi and Szilard moved to Chicago to continue their work under contract with the Government in the so-called Metalurgical Laboratory of the University of Chicago. The first self-sustained chain reaction was set up at Chicago on December 2, 1942. The Patent issued to the AEC is the first patent issued in the United States in this general field and names Fermi and Szilard as Joint inventors.

Szilard stayed with the Metalurgical Laboratory of the University of Chicago with the rank of "Chief Physicist" until the end of the war and then resigned to accept a position as Professor of Biophysics on the regular staff of the University of Chicago. This was a Research Professorship attached to the Institute of Radiobiology and Biophysics, which was one of the three research institutes created after the war by the University of Chicago. This Institute was later dissolved, and Szilard was transferred to the Staff of the Enrico Fermi Institute for Nuclear Studies as Professor of Biophysics. He holds this position at present.

While at Chicago, Szilard developed jointly with Aaron Novick a method for studying mutations, induced enzyme formations and other phenomena in growing bacteria cultures, which is known as "The Method of the Chemostat." His work and interests centered on problems relating to mutations and induced enzyme formation in bacteria, antibody formation in mammals, and the general problem of protein synthesis.

CURRICULUM VITAE

Name: Leo Szilard

Date and Place of Birth: February 11, 1898; Budapest, Hungary

Marital Status: Married; no children

Education:

1917-1919 Institute of Technology, Budapest

1919-1920 Institute of Technology, Berlin

1920-1922 University of Berlin, Ph.D. in physics

Positions Held:

1922-1925 Research in x-ray, Kaiser Wilhelm Institute, Berlin.

1925-1933 Privatdozent for physics, University of Berlin

1933-1934 Research in nuclear physics, St. Bartholomew Hospital, London, England

1935-1938 Research in nuclear physics, Clarendon Laboratory, London

1939-1942 Research in atomic energy, Columbia University, New York

1942-1946 Chief Physicist, Metalurgical Laboratory, University of Chicago

1946-1964 Professor of Biophysics, University of Chicago, Enrico Fermi Institute, Chicago

1963-1964 Non-Resident Fellow, The Salk Institute for Biological Studies, San Diego

Honors (Awards):

1959 Atoms for Peace Award

List of all positions starting with most recent:

1964 April 1 – May 30: Resident Fellow, Salk Institute

1963 ? Prof. Emeritus, U. of Chicago

1956 July 1 – Prof of Biophysics, Inst. of Nuclear Studies, U. of Chicago

1935 ? ? Res. Assoc., NYU

Clarendon Lab.

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IN AMERICA

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1961—1968

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Clara M. Elder, of Portland, Me., Aug. 5, 1872. Studied law; admitted to the Me. bar, 1872, later to Mass. bar and U.S. cts.; retired from practice in Boston, 1899; trial magistrate, Mes. civ. and criminal jurisdiction; historian, writer on birds, plants and natural phenomena; illustrator and mag. contbr. Mason (32°, Shriner). Author: Prose Pastorals, 1887; Homestead Highways, 1888; Maine Pioneer Settlements, 5 vols., 1909; Indian Wars of New England, 3 vols., 1910; Early Voyagers to New England, 1910; A Relation of the Pioneer Settlements of Maine, 1910. Home: Cambridge, Mass.†

SYMONDS, Percival Mallon, educator; b. Newtonville, Mass., Apr. 18, 1893; s. Joseph Ainsworth and Addie Kendall (Mallon) S.; A.B., Harvard, 1915; A.M., Columbia, 1920, Ph.D., 1923; m. Johnnie Pirkle, Dec. 25, 1922. Tchr., Punchard High Sch., Andover, Mass., 1915-17, Worcester Acad., 1917-18; asst. Inst. Edml. Research, Tchrs. Coll., 1921-22; prof. edn. and psychology, U. Hawaii, 1922-24; asso. in edn. Tchrs. Coll., Columbia, 1924-25, asst. prof. edn., 1925-28, asso. prof., 1928-34, prof. 1934-58, prof. emeritus, 1958—, chmn. div. theory and techniques of measurement and research, 1933-37, head dept. research methods, 1937-42; vis. prof. edn. U. Cal., Los Angeles, summers 1938, 39, 41; U. Wis., summer 1944, U. Miami, 1945. Served in Ordnance Dept., U.S. Army, doing statistical work in ballistics, Aberdeen proving grounds, 1918. Assessment Sch., Office of Strategic Services, U.S. Govt., 1945. Diplomate, fellow Am. Psychol. Assn. (pres. edml. psychology div. 1947-48). Fellow Am. Orthopsychiat. Assn., A.A.A.S. (sec. Q, 1937-39), Soc. for Projective Techniques, Rorschach Inst.; mem. Am. Edml. Research Assn. (pres. 1956-57), Soc. for Research in Child Devel., Soc. for Psychol. Study Social Issues, N.Y. State Psychol. Assn. (charter), N.Y. Soc. Clin. Psychologists, Assn. for Family Living, Eastern Psychol. Assn., Phi Beta Kappa, Sigma Xi, Phi Delta Kappa, Kappa Delta Pi, Conglist. Clubs: Appalachian Mountain, Marshall Chess. Author: Measurement in Education, 1927; Ability Standards for Standardized Achievement Tests in High School, 1927; The Nature of Conduct, 1928; Tests and Interest Questionnaires in the Guidance of High School Boys, 1930; Diagnosing Personality and Conduct, 1931; Mental Hygiene of the School Child, 1934; Psychological Diagnosis in Social Adjustment, 1934; Measurement of Personality Adjustments of High School Pupils (with C. E. Jackson), 1935; Education and Psychology of Thinking, 1936; Psychology of Parent-Child Relationships, 1939; Dynamics of Human Adjustment, 1946; Dynamic Psychology, 1949; Adolescent Fantasy, 1949; Dynamics of Parent-Child Relationships, 1949; Ego and the Self, 1951; Dynamics of Psychotherapy, Vol. 1, 1956, Vol. 2, 1957, Vol. 3, 1958; What Education Has to Learn from Psychology, 1958; From Adolescent to Adult, 1961; Psysychology of the Teacher (manuscript), 1960. Contbr. to edml. and psychol. jours. Mem. editorial bd. Jour. Edml. Psychology; Jour. Edn. Research; Psychol. Monographs; Sociatry, Personality; Nervous Child. Mem. Riverside Church (N.Y.). Home: 106 Morningside Dr., N.Y.C. 10027. Died Aug. 6, 1960; buried Greenwood Cemetery, Salem, Mass.

SYMONS, Noel S., lawyer; b. Buffalo, Dec. 25, 1897; A.B., Princeton, 1919; LL.B., George Washington U. Admitted to D.C. bar, 1922, N.Y. bar, 1923; now partner firm Vaughan, Brown, Kelly, Turner & Symons, Buffalo. Mem. Am., N.Y. state, Erie County bar assns., Internat. Assn. Ins. Counsel. Home: 39 Argyle Park. Office: M & T Bldg., Buffalo 14202. Died 1965.*

SYPHER, Josiah Rhinehart, lawyer; b. Liverpool, Perry Co., Pa., April 12, 1832; grad. Union Coll., 1858; read law with Thaddeus Stevens, Lancaster, Pa.; admitted to bar, 1862; was war corr. New York Tribune in the war of the rebellion; since the war has practiced law in Phila., his spity. being copyrights, trade marks and patents. Author: Pennsylvania Reserve Corps; History of Pennsylvania; History of New Jersey; etc. Address: 1429 Chestnut St., Philadelphia.†

SYVERTON, Jerome T., physician, educator; b. Courtenay, N.D., Mar. 29, 1907; s. John and Thea (Nelson) S.; A.B., U. of N.D., 1927, B.S., 1928; M.D., Harvard, 1931; m. **Mildred Sloulin, June 26, 1932;** children—Jane, Gail, Laurie. Instr. in bacteriology, Univ. N.D., 1928; interne and asst. resident in medicine, Duke Univ. Hosp., 1931-32; asst. pathology and bacteriology, Rockefeller Inst. Med. Research, 1932-34; vis. asso. prof. pathology and bacteriology, Vanderbilt Univ., April-Oct., 1942; instr. bacteriology, Univ. of Rochester Sch. Medicine and Dentistry, 1934-37, asst. prof., 1937-39, asso. prof., 1939-47; prof. microbiol. and head dept., La. State U., Sch. Medicine, 1947-48; prof. and head of department of bacteriology U. of Minnesota since 1948. Mem. microbiol. panel Office of Naval Research, 1946-50; cons. surgeon gen. USPHS, 1950—, as mem. virus, rickettsial and microbiology study sects., 1950-55, National Adv. Allergy and Infectious Diseases Council, 1957-61, adv. panel on viruses and cancer Nat. Cancer Council, 1959—; mem. scientific advisory board consultants Armed Forces Institute Pathology, 1960—. Served in Med. Corps, U.S.N.R., 1941-47; **active duty April 1944-Jan. 1946 with appointment as vis. investigator Hosp. Rockefeller Inst., Apr.-Nov., 1944; fgn. duty Naval Med. Research Unit 2 in Pacific theater to Jan., 1946. Recipient Lilly award for Research in** Bacteriology and Immunology, 1938; Commonwealth Fund Award in Support of Creative Work, 1957. Diplomate Nat. Bd. Med. Examiners. Mem. A.M.A., American Academy of Microbiology, also Society Am. Bacteriologists, Soc. Clin. Investigation, Soc. Exptl. Pathology, Am. Assn. Immunol.; Am. Soc. Tropical Med., Am. Epidemiol. Soc., Tissue Culture Association Central Society Clinical Research, New York Academy of Science, A.A.A.S., Minnesota Med. Assn., Am. Soc. Cancer Research, Soc. Exptl. Biology and Medicine, American Assn. Pathologists and Bacteriologists (exec. council 1959—), Am. Soc. Cell Biology, Harvey Society (N.Y.), Alpha Omega Alpha, Sigma Xi. Presbyn. Clubs: Campus (U. Minn.); Harvard (Minn.); Lafayette. Author: scientific articles in field of infectious disease for profl. jours. Mem. editorial bd. Bacteriological Reviews, Cancer Research, Proceedings of Soc. for Exptl. Biology and Medicine. Home: Woodbridge Rd., Route 1, Box 18, Wayzata, Minn. Office: 1060 Mayo Meml. Bldg., U. of Minn., Mpls. 14. Died Jan. 28, 1961.

SYVERTSEN (von Wedel Jarlsberg), Rolf Christian, medical dean; b. Taunton, Mass., Mar. 22, 1896; s. Ole Christian and Ellen Gertrude (Badger) Syvertsen von Wedel-Jarlsberg; B.S., Dartmouth, 1921; student Dartmouth Med. Sch., 1920-23, Mary Hitchcock Meml. Hosp., 1935-36; M.D., Rush Med. Coll., 1936; m. Margaret Huntly Gordon, Mar. 10, 1935; children—Rosalind Gordon, Margaret Gordon, Caroline Gordon, Astrid Gordon. Asst. in biology Dartmouth, 1919-21, instr., 1921-22, instr. in evolution, 1922-23; instr. in anatomy Dartmouth Med. Sch., 1923-32, asst. prof., 1923-38, prof. since 1938, asst. dean, 1942-45, dean since 1945, sec., 1923-42; research work Mary Hitchcock Meml. Hosp., 1935-36, mem. bd. trustees since 1945. Mem. health com. New Hampshire Citizens Council. Served with U.S. Army, 1917-19. Mem. A.A.A.S.; Dartmouth Scientific Assn., Grafton Co. Med. Soc., N.H. Med. Soc., N.H. Hist. Soc., Soc. for Advancement of Scandinavian Studies, Norwegian-Am. Hist. Assn., Alpha Tau Omega, Alpha Kappa Kappa, Alpha Omega Alpha. Republican. Episcopalian. Clubs: Dartmouth Outing (dir. Winter Carnival 1925-26; trustee since 1947), The Graduate, Appalachian Mountain. Home: Great Hollow Farm, Hanover, N.H. Died Jan. 29, 1960.

SZILARD, Leo (zē-lärd), physicist; b. Budapest, **Feb. 11, 1898;** s. Louis and Thekla (Vidor) S.; student engring., Budapest Inst. of Tech.; Dr. Phil., U. of Berlin, 1922; m. Gertrud Weiss, 1951. Came to U.S., 1937, naturalized, 1943. Mem. teaching staff, U. of Berlin, 1925-32; research work in nuclear physics, St. Bartholomew's Hosp., London and Clarendon Lab., Oxford, Eng., 1934-38; worked on atomic energy, Columbia, 1939-42; chief Physicist, Metall. Lab., U. of Chgo., 1942-46, prof. U. Chgo.; resident fellow Salk Inst. Biol. studies, La Jolla, California, 1964—. Recipient Atoms for Peace award, 1960. Fellow Am. Phys. Soc. With Enrico Fermi, devised chain reaction system composed of uranium and graphite, used in setting up chain reaction, U. of Chicago, 1942, also used at Hanford in mfr. of plutonium. Mem. staff Enrico Fermi Inst. Office: Salk Inst. Biol. Studies, La Jolla, Cal. Died May 30, 1964.

SZLUPAS, John, physician; b. Lithuania, Russia, Mar. 8, 1861; s. Rochus and Anna (Vaitkus) S.; grad. Gymnasium, Courland, 1880; studied law, Moscow U., 1880-82, natural sciences and mathematics, U. of St. Petersburg; M.D., U. of Md., 1891; m. Louisa Malinovski, Sept. 30, 1885. Came to America, 1884. Ex-supreme med. examiner, Lithuanian Alliance of America. Founder 1st Lithuanian Ch. in N.Y. City, 1885; introduced edml. meetings among Lithuanians. Emissary of Lithuanians in America to Lithuanian war refugees in Russia, 1917; chmn. 2d All-Lithuanian Conf., Stockholm, 1918; founder Swedish-Lithuanian Com., Stockholm, 1918; represented Lithuanians at Washington, 1918-19, London, Paris, Riga, 1919. Republican. Free-thinker. Author: Handbook of Lithuanian Literature, 1889; History of Lithuania (3 vols.); History of Latvia; Lithuania in Retrospect and Prospect, 1915; Essay on Lithuania, 1918; Federation of Northwest Peoples, 1918. Home: 1419 N. Main Av., Scranton, Pa.†

T

TABELL, Edmund Weber, financial analyst; b. Bklyn., Jan. 28, 1904; s. Albert and Sophia (Weber) T.; ed. high sch., Bklyn.; m. Margaret Suydam, June 15, 1929; 1 son, Anthony Weber. Market analyst F. I. Dupont & Co., 1939-44; mgr. stock dept. Shields and Company, 1944-48; vice president of Walston & Co., Inc., 1948—, now sr. v.p. Clubs: Innis Arden Golf (Riverside, Conn.); Broad Street (N.Y.C.). Author articles. Home: Cherry Tree Lane, Riverside, Conn. Office: 74 Wall St., N.Y.C. 10005. Died Sept. 11, 1965.

TABER, Harry Persons, author; b. E. Aurora, N.Y., Dec. 25, 1865; s. William King and Mary (Prentice) T.; ed. in Buffalo schs. and pvtly.; m. Anna M. Craft, of Batavia, N.Y., September 12, 1900. Established Creede (Colo.) Chronicle, 1891; staff Denver Republican, 1892-94; founded the Philistine and the Roycroft Shop, E. Aurora, N.Y., 1895; editor Buffalo Times, 1896, foreign corr., 1897; editor Buffalo Courier, 1898, Springfield, (Mass.) Union, 1901-03. Contbr. to newspapers, mags., etc. Republican. Clubs: St. Botolph, Papyrus (Boston). Author: (with Miss Wells) The Gordon Elopement, 1904; (with Miss Wells) The Matrimonial Bureau, 1905; The Rubaiyat of the Commuter, 1905. Address: Ossining, N.Y.†

TABER, John, congressman; b. Auburn, N.Y., May 5, 1880; s. Franklin P. and Mary (Parker) T.; A.B., Yale, 1902; student N.Y. Law Sch. 1 yr.; m. Gertrude J. Beard, Apr. 13, 1929. Began practice at Auburn, 1904; dir. Auburn Trust Co. Mem. Republican County Com. many yrs., chmn. 1920-24; spl. county judge, Cayuga County, 1911-19; del. Rep. Nat. Conv., 1920, 24, 36; mem. 68th to 87th Congresses, 36th and 38th N.Y. Dists.; mem. Com. on Appropriations (chmn. 1947-48, 1953-54), spl. com. on govt. reorgn. Mem. N.Y. State and Cayuga County bar assns. Episcopalian. Mason, Elk. Clubs: Owasco Country; Yale, Republican (N.Y.). Home: 156 South St. Office: 123 Genesee St., Auburn, N.Y. Died Nov. 22, 1965.

TABER, Louis John, past master Nat. Grange; b. Mt. Pleasant, O., Sept. 19, 1878; s. Joseph John and Mary (Pickett) T.; ed. pub. schs., Olney Coll.; m. Edna Bailey, Oct. 27, 1909; children—Joseph Paul, Francis Bailey. Dairy farmer; pres. Eastern Ohio Pub. Co.; an organizer, pres. Farmers and Traders Life Ins. Co., Syracuse, N.Y.; chmn. bd. Farmers and Traders Life Ins. Co.; dir. Nat. Grange Fire Ins. Co., Nat. Grange Mut. Liability Co., Lamson Corp. Del.; dir. Nat. Livestock Marketing Assn. Mem. Hoover Wheat Price Com., 1917, Ohio Council Def., 1917-18. Rep. elector Ohio at large, 1920; dir. agr. State of Ohio, 1921-22; trustee Ohio Agrl. Expt. Sta., 1921-22; mem. Bd. Vocational Edn., 1921-22; mem. Ohio State Library Bd., 1923-24; mem. President's Agrl. Conf., 1924-25; v.p. N.Y. Joint Stock Land Bank, Rochester, and Union Joint Stock Land Bank, Detroit; mem. nat. com. rural areas Boy Scouts Am., awarded Silver Buffalo; nat. com. 4-H Clubs, Crusade for Freedom survey com.; State of Ohio Gov.'s award, 1957. Mem. Am. Acad. Polit. Sci., Am. Inst. Agr., Ohio Dairyman's Assn., Farm Bur. Fedn., Jersey Cattle Club, Home Protection League, Am. Country Life Assn. (v.p.). Am. rep. Internat. Inst. Agr., Rome, Italy, 1926. Lectr., Ohio State Grange, 1907-14, master, 1914-21; master Nat. Grange, 1923-41; v.p. Nat. Farm Chemurgic Council, Columbus, O.; sec. Nat. Highway Users Conf., Washington. Mem. Sec. Wickard's Conf. to Protect Interests of Agr. and Consumer during War Emergency. Trustee Nat. Tax Found. Pres., Ohio Council Chs., 1942-47. Quaker. Hon. recognition for eminent services, U. of Wis., 1929. Home: 753 James St. Office: 960 James St., Syracuse, N.Y. Died Oct. 16, 1960; buried Barnesville, O.

TABER, Mary Jane Howland, author; b. Aurora, N.Y., Aug. 1, 1834; d. Augustus and Phebe Jane Howland; ed. Friends' Boarding Sch., Providence, R.I., 1849-50, Margaret Robinson's Sch., Phila., 1852-53; m. at Aurora, N.Y., Abraham Taber, May 25, 1854. Mem. Soc. of Friends. Author: German-English Primer; The Cathedrals of England, 1904; Just a Few Friends, 1907. Translator: The Chancellor's Secret (from German). Address: New Bedford, Massachusetts.†

TABER, Ralph Graham, traveler, author; b. Red Wing, Minn., May 2, 1866; s. David Madison and Sarah (Field) T.; ed. pub. and parochial schs.; studied law in offices of Hon. Frank M. Wilson, Red Wing, Minn., Feb. 8, 1888. Telegrapher and train dispatcher, Mexico and Central America, 1879-85; practiced law in Grand Forks, N.D., 1888-89; mem. Alonzo M. Murphy & Co., pvt. bankers, Spokane, Wash., 1889-92, also atty. for Citizens Nat. Bank; in charge of expdn. to Hudson Straits to procure exhibit for Columbian Expn., Chicago, 1892; mining nr. Cape Cudliegh, Labrador, 1893-95; asso. editor and art mgr. of Truth, N.Y. City, 1895-98; in charge of expdn. to procure exhibit for Paris Expn., 1899; traveled in Africa, 1900; in charge of exhibit at Buffalo Expn., 1901; mgr. Municipal Auditorium, Red Wing, Minn., 1904-09; mining in Rocky Mountains, 1910-13; with legal dept. G.N. Ry. Co., St. Paul, since 1913; pres. Green Mountain Copper Co. Progressive. Episcopalian. Elk, Club: Commercial (Red Wing). Author: Northern Lights and Shadows, 1900; Chained Lightning—an Adventurous Travelogue of Mexico, 1915; Stray Gold, 1 Wing, Minn. Address: Legal Dep St. Paul, Minn.†

TABOR, Edward A., clergym Valley, Miss., July 28, 1857 schools there, and had partial bilt Univ., studied law; began 22, practiced 1 yr. Water Valley, Fort Smith, Ark.; entered mini South, 1887; 5 yrs. in regula sec. Y.M.C.A. of Ark. and Tex., working 3 yrs. in financial in Coll., Conway, Ark.; now State Saloon League. Author: Danger Little Rock, Ark.†

TABORS, Robert Gustav, mfg Oct. 16, 1914; s. August P. a Taborsky; B.S., Case Inst. Tech., m. Esther J. Fitzgerald, June 7, ard. Sales engr. Baldwin Southwa mgr. hydraulic presses Baldwin 1948-51; gen. mgr. aircraft turb Lima-Hamilton Corp., Eddystone, mgr. machinery and foundry pro gen. mgr. Hamilton (O.) div., 19 57, v.p., gen. mgr. Electronics a div., Waltham, Mass., 1957-60; e tal Electrolog Corp., until 1960; Inc., 1960-61, v.p. operations, Textron Electronics, Inc., 1961— Ballymore Co., West Chester, Golf. Office: Textron Inc., 10 D dence 3. Died May 22, 1962.

TACKETT, John Robert, physi Holmes Co., Miss., Dec. 18, 1 and Elizabeth Anne Tackett; ed public schools, Univ. of Miss., junior yr.); grad. Tulane Univ., post-graduate studies New Yo Columbus, Miss., Oct. 16, 1902, Sec. Miss. State Med. Assn., mem Miss. Valley Med. Assn.; Law Assn.; asst. supt. East Miss. Ins 97; commr. to Havana, Cuba, low fever for the State bd. acting asst. surgeon U.S.A., 1 yellow fever hosp. across Santia ago de Cuba; served in Cuba during Spanish Am. war; co. h derdale Co.; Democrat. Elected Bd. Health, Apr., 1903. Address

TAEUSCH, Carl Frederick (to Wapakoneta, O., Jan. 20, 1899; s. Carolyn (Wintzer) T.; Coll. of Litt.B., Princeton U., 1914; Ph.D., m. Mary Estelle Haman, June 23 Frederick Leonard, Mary Carolyn Vi Huddleson, Jr.), Barbara Jean (M Teacher pub. sch., Yampa, Colo., high sch., Hollywood, Calif., 1914- osophy, U. of Chicago, 1920-21; ophy, Tulane U., 1921-23, State U asso. prof. business ethics, Harva merly actg. editor Internat. Jour. editor Harvard Business Review, 1935-45; head Div. of Program cussion and Director, Latin-Ameri gram B.A.E. U.S. Army in Euro philosophy div. Biarritz American and with Econ. Div., OMGUS, 1945-46; prof. pub. adminstrn.; S 1946. Fulbright Lecturer in Pub. Ankara, Turkey, 1952-53. Fellow Am. Philos. Assn., Assn. of Pub. can Economic Association, Delta Te Kappa, Delta Sigma Rho. Author Business Ethics, 1926; Policy and 1931. Contbr. to philos., legal Home: 2450 Warring St., Berke Sept. 20, 1962; buried Greenlawn koneta, O.

TAFFINDER, Sherwoode Ayerst, Council Bluffs, Ia., Mar. 18, Geoffrey and Mina (Ayerst) T.; Acad., 1906; m. Margaret Knowlt 28, 1915; children—Sherwoode Brownell, Constance De Wolf. Con Navy and advanced through grad 1940; served on Asiatic Station, 1909-13; Atlantic, 1913-21; Pacif Naval Mission to Peru, S.A., 1924 30; War Coll., 1932-35; Navy Dep staff U.S. Fleet, 1940-41; comdr Pacific Fleet, 1941; comdt. Puget Bremerton, Wash., 1942-43; ap comdr. Service Force Atlantic Fle 14th Naval Dist., also Hawaiian S ret. vice adm., 1947. Decorated Mexican Campaign medals; Def. Se Clasp; Legion of Merit with 2 sta del Peru, Grande Official Peru. Ep New York Yacht; Army and Navy (dress: 20 Sea View Av., Newport, Jan. 25, 1965; buried Naval Acad.

GP

GALLEY PROOF

WHO WAS WHO IN AMERICA

VOLUME IV—1961-1968

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Marquis Publications Building
Chicago, Illinois 60611

DEADLINE FOR RETURN: ONE WEEK AFTER RECEIPT

SZILARD, Leo (zē-lärd), physicist; b. Budapest, Feb. 11, 1898; s. Louis and Thekla (Vidor) S.; student engring., Budapest Inst. of Tech.; Dr. Phil., U. of Berlin, 1922; m. Gertrud Weiss. Came to U.S., 1937, naturalized, 1943. Mem. teaching staff, U. of Berlin, 1925-32; research work in nuclear physics, St. Bartholomew's Hosp., London and Clarendon Lab., Oxford, Eng., ~~1933~~ 38; worked on atomic energy, Columbia, 1939-42; ~~also~~ Metall. Lab., U. of Chicago, 1942-46, prof. U. Chgo.; resident fellow Salk Inst. Biol. studies, La Jolla, California, 1964—. Recipient Atoms for Peace award, ~~1959~~. Fellow Am. Phys. Soc. With Enrico Fermi, devised chain reaction system composed of uranium and graphite, used in setting up chain reaction, U. of Chicago, 1942, also used at Hanford in mfr. of plutonium. Mem. staff Enrico Fermi Inst. Office: Salk Inst. Biol. Studies, La Jolla, Cal. Died May 30, 1964.

1951
1934-38
Chief Physicist, Metall. Lab.
1960

Member:
Advisory Committee on Nuclear Research, President's Committee on Uranium '40.
Uranium Section of National Defense Research Committee 1941-42.
Fellow, Amer. Academy of Arts & Sciences, 1954.
Member, National Academy of Sciences, U.S.A., 1961. Sigma Xi, 1952.
Honorary Doctor of Humane Letters, Brandeis U., 1961.
Einstein Gold Medal, Lewis & Rosa Strauss Memorial Fund, 1960
Led successful drive for civilian control of atomic energy (McMahon ~~Bill~~ Act)'46
Participant Pugwash Internat'l Conferences on Science & World Affairs 1957-63
Founder, Council for a Livable World, Washington, D.C. 1962 - .

Author, political satire, The Voice of the Dolphins and other Stories, Simon & Schuster, 1961.
1929 Paper "On the Decrease of Entropy in a Thermodynamic System by the Intervention of Intelligent Beings" contains ideas basic to present information theory.
Initiated Albert Einstein's letter to President Roosevelt, dated Aug. 2, 1939 and based on work of Fermi and Szilard, leading to U.S. atom bomb project.

Gertrud Weiss Szilard, M.D. (Mrs. Leo Szilard)

AN AUTHORIZED SIGNATURE so that the Editors may be assured biographical data have been checked.

YOUR NAME AND ADDRESS Mrs. Leo Szilard
2380 Torrey Pines Road, La Jolla, California 92037

February 2, 1968

Please write very plainly—preferably printing out or having typewritten.

WWW/GP

Additions to Galley Proof. Who Was Who in America Vol. IV, 1961-1968

Biographee: SZILARD, LEO

Section on Education.

Honorary Doctor of Humane Letters, Brandeis Univ., 1961

Section on Professional Life.

"...research work in nuclear physics (Szilard-Chalmers reaction, photodisintegration of beryllium), St. Bartholomew's Hosp., ..."

"...worked on atomic energy (discovery with Walter Zinn of neutron emission in uranium fission), Columbia, ..."
member, Advisory Committee on Nuclear Research to President's Committee on Uranium 1940
member, Uranium Section of National Defense Research Committee, 1941-42;

"prof. U. Chgo (invention and use of chemostat to study bacterial growth);"

Section on Activities

persuaded Albert Einstein to write letter to President Roosevelt, based on work of Szilard and Fermi, Aug.2, 1939, initiating Manhattan Project;

led successful drive for civilian control of atomic energy (McMahon Act), 1946;

participant, Pugwash International Conferences on Science and World Affairs, 1957-1963;

Founder, Council for a Livable World, Washington D.C. 1962

Section on Honors

Einstein Gold Medal, Lewis & Rosa Strauss Memorial Fund, 1960;

Living History Award, Research Institute of America, 1960;

Memberships

National Academy of Sciences

Sigma Xi

Fellow, American Academy of Arts and Sciences

Author

On the Decrease of Entropy in a Thermodynamic System by the Intervention of Intelligent Beings, 1929 (forerunner of information theory);

The Voice of the Dolphins and Other Stories, 1961 (political satire);

also contributions to physics, biology and public affairs journals.

Kathleen Winsor
February 2, 1968

S-35

Pen files

March 10, 1964

Mrs. Noreen Mann
5646 Maryland Avenue
Chicago 37, Ill.

Dear Mrs. Mann:

I intend to withdraw from active service with The University of Chicago on April 1st. My new permanent address will be:

c/o The Salk Institute
Post Office Box 9499
San Diego, California 92109.

I think that there would be little point in bothering you with looking after my mail in Chicago. Rather, I propose to file with the Chicago post office a forwarding order, both for mail which I receive at the University of Chicago, and for mail which I receive at the Quadrangle Club.

In addition, to be on the safe side, I should appreciate if you were to ask both the University and the Quadrangle Club to forward to my San Diego address any mail that leaks through to them. I intend to resign from the Quadrangle Club in the next few days.

I should be very grateful for your checking for a little while with the Institute and the Quadrangle Club to see whether any mail is leaking through to them and whether they forward to me such mail as does leak through to them.

With kind regards.

Sincerely,

Leo Szilard

LS:jm

(V-33)

THE UNIVERSITY OF CHICAGO
CHICAGO 37 · ILLINOIS
THE DIVISION OF THE PHYSICAL SCIENCES
Office of the Dean

May 29, 1963

Professor Leo Szilard
Hotel Dupont Plaza
Dupont Circle and
New Hampshire Avenue, N.W.
Washington 6, D.C.

Dear Professor Szilard:

Feb 11, 1963
65

We have finally cleared up the matter of your post-retirement status. You will retire as scheduled on September 30, 1963 and be given the title of Professor Emeritus. This will be the status of Professors Wentzel and Mulliken. Since they will be here and teaching they will remain on the academic budget and you will not. You are expected to continue on full salary as Principal Investigator on your NIH Grant on a year to year basis depending on the condition of your health. In all such cases fringe benefit contributions by the University cease and this will be true in all of the cases in the Division mentioned. Indeed, there is a statement on page 66 of the Statutes (April 1963) to the effect that in no event shall the University continue its contribution (to your retirement plan) beyond the end of your appointive year. It is my understanding that Social Security payments will be continued.

I trust that this will clear up any confusion in your status.

Cordially yours,

Adrian Albert

A. A. Albert, Dean

CC: H. L. Anderson
M. G. Inghram
E. H. Levi

May 17, 1927 – ~~March 34~~ Nov 33 1933, Privatdozent für Physik, Friedrich Wilhelm Universität, Berlin

1928-1932 Consulting Physicist, AEG Berlin

1931
Dec.25-May 4, 1932
First visit to the U.S. on immigration visa

March 31, 1933
Left Berlin for Vienna

April-July, 1933. 20, April left Vienna for London
In England, active in laying the groundwork for the Academic Assistance Council, to place refugee scholars.

Spring, 1934.
British patent application, "Nuclear chain reaction in which more than one neutron is emitted per neutron absorbed." Patent was assigned to the British Admiralty for purposes of secrecy, March 25, 1936.

August 1934 - Jan.1935
Research in nuclear physics, St. Bartholomews Hospital, London.
Szilard-Chalmers reaction developed here; work on photodisintegration of beryllium.

Feb.21-May 23, 1935
Second visit to the U.S.

June 1, 1935-Dec.31, 1937.
Fellowship as research physicist at Clarendon Laboratory, Oxford, from Imperial Chemical Industries. Worked in nuclear physics under F.A. Lindemann.

April 5-May 12, 1937
Third visit to the U.S.

Jan.2, 1938
Enters the U.S. permanently

March 1 - June 1, 1939
Guest of the Physics Dept., Columbia University.
Discovery with Walter Zinn of neutron emission in uranium fission.

June - July, 1939
Meetings with Einstein, leading to his August 2nd letter to President Roosevelt; this culminated in the Manhattan Project.

Oct. 21, 1939
First meeting of the Presidents's "Uranium Committee," of which Szilard was a member, at the National Bureau of Standards, Washington, D.C.

April 27, 1940
Attends second meeting of the Uranium Committee.

June 7, 1940
Appointed a member of the Advisory Committee on Nuclear Research of the President's Committee on Uranium.

Nov. 1, 1940 - Feb. 1, 1942
Member of staff, Columbia University, National Defense Research Division, under a grant to Columbia from the U.S. government.

Aug. 19, 1941
Appointed a member of two subsections of the "Uranium Section" (called S-1) of the National Defense Research Committee: Consultants on Power Production, and Consultants on Theoretical Aspects.

Nov. 24, 1941
Elected a Fellow of the American Physical Society.

Feb.1, 1942
The Columbia group was transferred to the University of Chicago, where it formed the nucleus of the uranium project, code-named Metallurgical Laboratory.

Feb. 1 - June 1, 1946
Chief Physicist, Metallurgical Laboratory, Chicago.

March 29, 1943
Naturalized a U.S. citizen

July 17, 1945
Date of petition to the President, drafted by Szilard and signed by 70 scientists; it urged the President, on moral grounds, not to drop the bomb on Japan.

Dec.1945-June, 1946
On leave of absence without salary from the Metallurgical Laboratory.

December 8 and 11, 1945
Testified at the Senate Special Committee on Atomic Energy, McMahon, Chairman. Urged civilian control of atomic energy.

~~Oct.1~~, 1946 - ~~Sept.30, 1963~~ 1964 University of Chicago.

Oct.1, 1946-Sept.30, 1950 (concurrent positions)
Professor of Biophysics, Institute of Radiobiology and Biophysics (half-time).
Adviser, Office of Inquiry into the Social Aspects of Atomic Energy, in the Division of Social Sciences (half time).

Oct.1, 1950 - June 30, 1954
Professor of Biophysics, Institute of Radiobiology and Biophysics (full time)
(Institute abolished June 30, 1954)

July 1, 1954 - June 30, 1956
Professor of Social Sciences, Div. of Social Sciences.

July 1, 1956 - Sept.30, 1963
Professor of Biophysics, Institute for Nuclear Studies.

Sept.30, 1963 -
Becomes Professor Emeritus. (on active service) (Resig. effective Apr. 1, 1964)

April 1, 1964
Withdraws from active service with the University of Chicago.

Sept.1, 1953 - Aug.31, 1954
At Brandeis University (on leave from the University of Chicago).
Visiting Professor of Physics (half time).

Oct.13, 1951
Marriage to Gertrud Weiss.

May 12, 1954
Elected a Fellow of the American Academy of Arts and Sciences.

May 17, 1955
Jointly with Enrico Fermi granted the first patent on "Neutronic Reactor."

1957 - 1963
U.S. participant in the Pugwash International Conferences on Science and World Affairs.

May 18, 1960
Received Atoms for Peace Award.

April 25, 1961
Elected to membership, National Academy of Sciences.

1961
Publication of The Voice of the Dolphins, New York, Simon & Schuster.
Science fiction and political satire.

1962
Founded the Council for a Livable World, Washington, D.C. (1962-63 called Council for Abolishing War), to "lobby for peace."

July 1, 1963
Appointed Non-resident Fellow, Salk Institute for Biological Studies, La Jolla, Ca.

April 1, 1964
Appointed Resident Fellow of the Salk Institute.

May 30, 1964
Dies of a heart attack in La Jolla.

First Meeting of Uranium Committee appointed by Roosevelt - Briggs of Natl. Bur. Standards.

Oct 21 1939.

Szilard → Wigner 10/17/39
Bk f. 5 (2)

June 7, 1940
Member, Advisory Committee on Nuclear Research, (Advisory committee to President's Committee on Uranium)

Nov 1, 1940
Member of staff, National Defense Research Division, Columbia U.
Nov 1 1940 to Feb. 1942
Under U.S. grant to Columbia of $40,000

Aug 19, 1941
Appointed member of subsections:
Consultants on Power Production
Consultants on Theoretical Aspects
of Uranium Section (Briggs, chairman) S-1
of Natl. Defense Research Committee
(Conant, Chairman)

Feb. 1942
Moved from Columbia to Chicago
Chief Physicist, Met Lab
U. of Chicago

July 11, 1942
Sections S-1 and its sub-sections 2 and 4 dissolved. Therefore appointment as consultant to these sub-sections terminated.

Feb. 1 1942
Chief Physicist, Metallurgical Laboratory, Univ. of Chicago
Feb. 1 1942 to April 1946
June 1

March 29, 1943
Date of U.S. Naturalization.

F-20

June 1, 1946

U. of Chicago
Termination d.t.: Chief Physicist,
Metallurgical Lab.
(Check-out form in F-22)

Winter quarter, 1951-52
Part time in Dept. of Biophysics,
Dept. of Medicine,
Univ. of Colo.
Title: Visiting Professor of Biophysics

Oct. 1946
Professor of Biophysics
Institute of Radiobiology and Biophysics
University of Chicago

U. of Chicago 1952
Prof. of Biophysics, Inst. of Radiobiol & Biophysics
June 12
(Applic. for Research Grant, N.I.H. in C-1)
also in A-3 p1011

Oct 1, 1949
U. of Chicago
Half-time: Prof. of Biophysics, Institute of Radiobiology & Biophysics (indefinite tenure)
Half-time: Div. of Social Sciences, Adviser, Office of Inquiry into the Social Aspects of Atomic Energy (one year)
E-28a

Sept 1, 1953
Appointed Visiting Professor of Physics, Brandeis Univ. Waltham, Mass., for term of 1 year. Sept 1, 1953 - Aug 31, 1954
(2 days/wk)

Dec 9, 1950
Univ of Colorado. Appointed Visiting Prof. of Biophysics in School of Medicine Half-time
Steams → L.S.
E-28a

U. of Chicago Oct 1, 1953
Leave without salary, as Prof. of Biophysics in Institute of Radiobiology & Biophysics
Oct 1, 1953 - June 30, 1954

June 30, 1954
Institute of Radiobiology and Biophysics, U. of Chicago, to be abolished as of 6/30/54
Work to be absorbed by Division of Biological Sciences.

June 1962
Founded Council for a Livable World. Washington, D.C.
(Original title: Council for Abolishing War)

July 1, 1954
Appointed Professor of Social Sciences on indefinite tenure in Div. of the Social Sciences, full time.

May 1963
Appointed Non-Resident Fellow Salk Institute for Biological Studies, La Jolla.
To start July 1, 1963
Option to become Resident Fellow

May 29, 1956
U. of Chicago
Transferred from Division of Social Sciences to Physical Sciences Division.

G-2

Sept 30, 1963
Retires from U. of Chicago with title: Professor Emeritus.
Continues as Principal Investigator on N.I.H. grant.

July 1, 1956
U. of Chicago
Transferred from Institute of Radiobiology & Biophysics to Enrico Fermi Institute for Nuclear Studies. Prof of Biophysics

D-17
also F21

Feb 20, 1964
Leaves Washington for La Jolla

LEO SZILARD

Honors

Aug. 14, 1922	Ph.D. cum laude, University of Berlin
Nov. 24, 1941	Fellow, American Physical Society
Aug. 6, 1945	Certificate of Appreciation, U.S. War Department, Manhattan District. Signed by Secretary Stimson.
Jan. 2, 1952	Popular Mechanics' Half Century Hall of Fame (50 Americans, 1901-1951)
May 2, 1952	Member, Society of the Sigma Xi
May 12, 1954	Fellow, American Academy of Arts and Sciences
Feb. 27, 1960	Humanist of the Year, American Humanist Association
March 1960	Einstein Gold Medal of the Lewis & Rosa Strauss Memorial Fund
Apr. 27, 1960	Living History Award, Research Institute of America (Quarter century 1935-1960)
May 18, 1960	Atoms for Peace Award
Apr.25, 1961	Elected to membership, National Academy of Sciences
Oct. 8, 1961	Honorary Doctor of Humane Letters, Brandeis University
1957 to 1963	American delegate to the Pugwash meetings

April 1, 1964 — Resident Fellow, Salk Institute

July 1, 1963 — Appointed Non-Res. Fellow, Salk Institute

Sept 1, 1963 — Retires from Univ. Chicago, Prof. Emeritus, on active Service

July 1, 1956 — Prof. Biophysics, Enr. Fermi Inst. Nucl. Studies

Appl. June 25, 1959 for Year 1960. RG-6876-C2
Renewed:

Renewal submitted Sept 1962
" " Sept 1963 (04)
05

60 (01)
61 (02)
62 (03)
63 (04)
64 (05)

s655

February 27, 1945

CORRECTION

Please note that my letter addressed to W. A. Akers dated February 27, 1945 should correctly read in the first paragraph January 1939 instead of January 1938.

Leo Szilard

RESTRICTED

6651

May 28, 1945

To: L. Szilard

From: J. C. Stearns

I am extending to you an invitation to remain with the Metallurgical Laboratory of the University of Chicago at your present salary for the year beginning July 1, 1945.

I am keenly aware of how essential it is to have the services of scientists of imagination and ingenuity connected with this Laboratory. Your counsel and recommendations have been and will continue to be an inspiration to me and to many others at this Laboratory.

In a few days you will receive a supplement to your contract from the Director of Personnel. I should be glad to talk further with you regarding any questions you have regarding conditions of employment at a time which is convenient to you.

J. C. Stearns
Laboratory Director

cc: Wayne Johnson

ccc

RESTRICTED

Metallurgical Laboratory
P.O. BOX 5207
CHICAGO 80, ILLINOIS

May 11, 1945

BUTTERFIELD 4300

TO: Mr. J. C. Stearns

FROM: Mr. L. Szilard

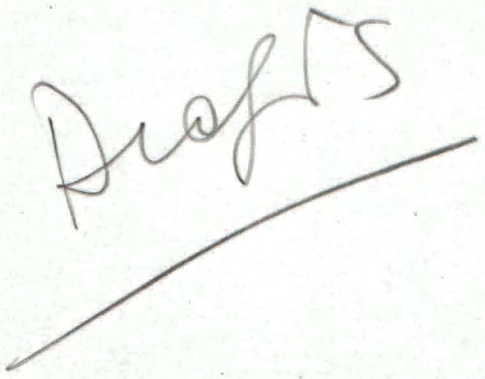
As you know, my present contract with the Metallurgical Laboratory ends on June 30th of this year. It is beginning to get rather late for me to make plans if I am to leave the Metallurgical Laboratory on that date. Conversely, if I were supposed to continue here it would be urgent to decide whether a satisfactory arrangement can be found and whether the manpower problem involved can be solved on the basis of the men who are becoming available through the present reorganization or otherwise.

In view of this I have talked to Dr. Compton this morning and suggested that we try to arrive at a conclusion as soon as convenient.

Leo Szilard

cc: Zinn
Daniels
Franck
Bartky
Hilberry
Compton

The preceding pages were written by Szilard as part of an "Application for a Research Grant" which he filed with the General Medical Sciences Division of the National Institutes of Health - RG 6876 in June 1959. The title of the project was "Quantitative Studies of General Biological Phenomena." Because the proposed Research Plan is unusual indeed, parts of it are excerpted here: } italics



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du italics

The Research/Grant ~~First~~ became effective on January 1, 1960 and continued through March 31, 1964. During this time the following papers were published (we continue the numbering system used by Szilard in the foregoing pages): } italics

(26) Leo Szilard - THE CONTROL OF THE FORMATION OF SPECIFIC PROTEINS IN BACTERIA AND IN ANIMAL CELLS. Proceedings of the National Academy of Sciences, 46:277-292 (March) 1960. Communicated January 19, 1960.

(27) Leo Szilard - THE MOLECULAR BASIS OF ANTIBODY FORMATION. Prodeedings of the National Academy of Sciences, 46: 293-302 (March) 1960. Communicated January 19, 1960.

(28) Leo Szilard - DEPENDENCE OF THE SEX RATIO AT BIRTH ON THE AGE OF THE FATHER. Nature, 186: 649-650 (May 21) 1960. Letter to the Editor.

(29) Leo Szilard - ON MEMORY AND RECALL. Proceedings of the National Academy of Sciences, 51: 1092-1099 (June) 1964. Communicated April 27, 1964.

In his progress reports to NIH Szilard described the first three papers as follows: } italics

"A model for the control of the rate of production of repressible enzymes has been developed and this model is described in detail in paper#26. This model assumes that in bacteria the repressor controls the rate of formation of the enzyme by the enzyme forming site, rather than the rate of formation of the enzyme site itself. Experiments which are at present being conducted in a number of different laboratories, with which the author maintains contact, might elucidate, within a year, whether this "premise" is correct.

The above-quoted paper also assumes that the repressor can attach itself to the enzyme and it is shown that accordingly the cell might have two stable states, a state in which the enzyme level is high and a state in which the enzyme level is low. The validity of this assumption does not depend on the above-mentioned "premise" and the assumption might provide the key to the understanding of a certain type of differentiation, discussed in the paper.

A second paper#27 discusses the possibility that antibody formation--in the primary response--is based on this type of differentiation, triggered by the injection of an antigen into the rabbit. This theory can account for a number of phenomena listed in the paper, including the phenomenon of immune tolerance of the new-born rabbit. The explanation of immune tolerance is, however, again based on the "premise" that the repressor controls the rate at which the protein--in this case the antibody--is formed by the specific protein forming site. If future experiments should show that this "premise" is wrong, then the theory of immune tolerance would have to be modified and it is not as yet clear whether a satisfactory modification of the theory would be possible, in that contingency.

A theory for the dependence of the sex ratio at birth on the age of the father has been presented in paper#28 which is based on a theory of ageing previously presented by the author in paper#25. The theory accounts for the decrease in the ratio of boys to girls, with increasing age of the father, on the ground that a spermatogonium in which the X-chromosome suffers an "ageing hit" may not continue

The Research/~~First~~ Grant became effective on January 1, 1960 and continued through March 31, 1964. During this time the following papers were published (we continue the numbering system used by Szilard in the ~~foregoing~~ preceding pages):

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(28) ~~Leo Szilard -~~ DEPENDENCE OF THE SEX RATIO AT BIRTH ON THE AGE OF THE FATHER. Nature, 186: 649-650 (May 21) 1960. Letter to the Editor.

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to give rise to sperm, whereas a spermatogonium in which the Y-chromosome suffers an "ageing hit" may continue to give rise to the sperm."

Paper #29, Szilard's last effort, was published posthumously. He had prepared a much longer manuscript and sent preprints of the shortened version to his friends accompanied by this memorandum which is reproduced in full:

in italics

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— condivise i premi

MEMORANDUM

From: Leo Szilard — May 5, 1964

To: Whom it may concern

Enclosed is a preprint of a paper which will appear in the June issue of the Proceedings of the National Academy of Sciences. Because authors are limited to eight pages in any one issue of the Proceedings, this preprint is but the first of three instalments.

Had I merely postulated — as others seem to have done — that if two neurons fire simultaneoulsy, thereafter the synapse bridging these two neurons has a higher efficacy, then I would not be able to account even for Pavlov's experiments on the conditioned salivary reflex of the dog. As it is, it seems conceivable that the two fundamental postulates of my model might be able to account not only for the peculiarities of all of Pavlov's basic experiments but -- in conjunction with neuron-networks, as yet to be invented -- also for the higher mental functions. This could be true even if the details of the biochemical underpinnings of these two postulates should turn out to be incorrect.

Leo Szilard

(12)

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(5 pp.) Leo Szilard

In addition to the four published papers Szilard during this period outlined several theories in the following reports:

"Induction of Mutations in Mammals by Ionizing Radiation" (1961)
"The Sex Chromatin in Mammalian Cells" (1962)
"Dosage Compensation in the Fruitfly" (1962)
"Enzyme Repression in Bacteria" (1962)
"On the Occasional Dominance of the 'Perceptible Phenotype' in Man" (1963)
"On the Inheritance of Longevity" (1963)

Some of these are summarized in his progress reports:

"(1) An experimental method has been devised and a theory of the experiment developed which should make it possible to determine the dose of radiation which would raise the mutation rate to twice the value of the spontaneous mutation rate. The method consists in exposing a population of mice to ionizing radiation and subsequently determining, among the first generation off-spring, the proportion of females whose off-spring shows an abnormal sex ratio. The method is described in a paper dated March 10, 1961 :Induction of Mutations in Mammals by Ionizing Radiation" which is being privately circulated to those interested in this type of problem.

(2) In mammals and also in the fruit fly the somatic cells of the female contain two X chromosomes while the somatic cells of the male contain only one. Accordingly, the cells of the female carry two homologous copies of each sex linked gene, whereas the cells of the male carry only one copy of each. This difference in "dosage" does not usually manifest itself in a phenotypic difference between the male and the female. Recent observations indicate that in the case of mammals at some point of the embryonal development of the female, one of the two X chromosomes ceases to be functional in the somatic cells. This, on the face of it, could account for the fact that the double dosage of the sex linked genes in the female, as compared to the single dosage of the same genes in the male, does not lead to a difference in the phenotype. However, no such difference in phenotype exists in the fruit fly either, and yet I find that the phenomenon of "dosage compensation", which has been studied in the fruit fly by H.J. Muller cannot be explained on the assumption that only one of the two X chromosomes is functional in the somatic cells of the female. In those circumstances it is necessary to look for another explanation for "dosage compensation" in the fruit fly. I propose to explain this phenomenon in the fruit fly by assuming that the relevant gene products in the fruit fly are under the control of repressors, in much the same way in which many enzymes are under the control of repressors in bacteria, and by further assuming that in the fruit fly the genes corresponding to the repressors (of those gene products which show "dosage compensation") are located on the X chromosome. These considerations are described in a paper, "The sex chromatin in mammalian cells, 'dosage compensation' in the fruit fly and enzyme repression in bacteria," which is being circulated in preprint among those interested in this kind of problem.

(3) It has been shown that the observed frequent occurrence of a striking resemblence between a child and one of its parents might be explained in one of two ways:

a)

b)

(14)

a) → The perceptible phenotype might be determined by a number of different genetic loci, all of which are located on one pair of homologous autosomes. Such an autosome might possess a certain "strength" and a "strong" autosome might supress the homologous autosome if it is substantially less "strong." (For details see the enclosed paper "On the occasional dominance of the 'perceptible phenotype' in Man," dated July 12, 1963.) Revised version stated May 18, 1964.

b) → The genes which determine the perceptible phenotype might all be located within the same operon and different operons might be more strongly or less strongly repressed. This could then account for the observed resemblances, if one assumes that the perceptible phenotype is determined by the ratio of the quantities of the products of these genes in the diploid cell.

(4) An experimental method has been devised for determining whether the competition which exists between spermatozoa for fertilising an ovum might serve the purpose of protecting the ova against being fertilised by a spermatozoon which might contain genetic material that has deteriorated as a result of the aging process. The method devised consists in inseminating females with a mixture of spermatozoa, derived from two donors, and in determining how the fraction of the offspring which is derived from the older donor, decreases with increasing age differences of the two donors. (For details see the enclosed paper "The aging process and the 'competitive strength' of spermatozoa," dated July 25, 1963.) Arrangements for carrying out experiments of this type are at present under discussion. ||

(in italics)

After the Institute of Radiobiology and Biophysics at the University of Chicago was disolved in 1954 Szilard found himself without a laboratory. "I would rather have roots than wings," he said at that time, "but if I cannot have roots I shall use wings." During the ~~next~~ last ten years of his life Szilard became a roving sponsor of the newly emerging science of molecular biology, ~~stimulating the formation of institutes, university departments and other enterprises.~~ He was Visiting Professor at the newly created Department of Biophysics at the University of Colorado Medical Center, Visiting Professor ~~of Physics~~ at Brandeis University and ~~also~~ served as consultant to the Basic Research Program of the National Institute of Mental Health in Washington.

In 1963,

After reaching the age of 65 ~~in 1963~~ Szilard became Professor Emeritus at the University of Chicago but remained in active service until ~~April 1~~ March 31, 1964

On several visits to Europe between 1957 and 1963 Szilard was consulted by the German Government on the organization of postwar scientific research in West Germany; served as advisor to the research program of the World Health Organization and rounded up the European biologists to explore the possibility of creating a European Laboratory for Molecular Biology. These efforts led to the establishment of EMBO, the European Molecular Biology Organization.*

*References:

J.C. Kendrew, "EMBO and the Idea of a European Laboratory," Nature, 218:840-842, (June 1)1968.

Marie Luise Zarnitz, "Molekulare und physikalische Biologie," Bericht zur Situation eines interdisziplinaren Forchungsgebietes in der Bundesrepublik Deutschland, Erstattet im Auftrag der Stiftung Volkswagenwerk, (Vandenhoeck & Ruprecht in Gottingen, 1968.)

end of page

copy

In 1957, while working on problems of population control, he drafted with his friend Professor William Doering "A proposal to create two interdependent research institutes operating in the general area of public health, designated as: Research Institute for Fundamental Biology and Public Health and Institute for Problem Studies." This proposal contains many far reaching thoughts and is therefore partially reproduced as an Appendix to this section.

After the Institute of Radiobiology and Biophysics at the University of Chicago was disolved in 1954 Szilard found himself without a laboratory. "I would rather have roots than wings," he said at that time, "but if I cannot have roots I shall use wings." During the next ten years of his life Szilard became a roving sponsor of the newly emerging science of molecular biology, stimulating the formation of institutes, university departments and other enterprises. He was Visiting Professor at the newly created Department of Biophysics at the University of Colorado Medical Center, Visiting Professor of Physics at Brandeis University and also served as consultant to the Basic Research Program of the National Institute of Mental Health in Washington.

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At that time Szilard contacted among others Jonas Salk to explore whether he might wish to join as an affiliate member of such an Institute. Finding that Salk had been thinking of perhaps setting up a somewhat similar research institute, close co-operation ensued developing the recruitment of members and choice of location.

At that time Szilard contacted a number of scientists to explore whether they might be interested in joining the kind of institute he and Doering had visualized. He was fortunate in finding a sympathetic response among scientists with similar inclinations and worked closely with them in creating a research center at which he hoped to realise his dreams.

He joined the ~~newly established Salk~~ Institute as non-Resident Fellow in July 1963, and became a Resident Fellow on April 1, 1964. After a few short, but ~~happy~~ happy and productive months in La Jolla, he died there suddenly on May 30, 1964.

"was one of the moving spirits who helped to conceive the idea of the Salk Institute and to bring it into being" *

* From: Topics in the Biology of Aging, A Symposium . . . . ed. Peter L. Krohn, ~~ed.~~ Interscience Publishers 1966

After reaching the age of 65 in 1963 Szilard became Professor Emeritus at the University of Chicago but remained in active service until April 1, 1964 when he became a Resident Fellow of the newly created Salk Institute, which he had joined as non-Resident fellow in July 1963. After a few short, but happy and productive months in La Jolla, he died there suddenly on May 30, 1964.

Harold

LEO SZILARD

Honors

1941	Fellow, American Physical Society
1952	Member, Society of the Sigma Xi
1954	Fellow, American Academy of Arts and Sciences
1960	Humanist of the Year, American Humanist Association
1960	Einstein Gold Medal of the Lewis & Rosa Strauss Memorial Fund
1960	Atoms for Peace Award
1961	Elected Membership, National Academy of Sciences
1961	Honorary Doctor of Humane Letters, Brandeis University
1970	Crater on far side of the moon named "Szilard" by International Astronomical Union