January 7, 1956

Mr. C. Lalor Burdick
The Lalor Foundation
4400 Lancaster Pike
Wilmington 5, Delaware

Dear Mr. Burdick:

I wrote you yesterday very briefly in support of Dr. Aaron Novick's application for a Lalor Foundation Faculty Summer Research Award. It occurred to me that I should perhaps add some information about the kind of work Dr. Novick has been doing during the last few years and indicate the nature of some of his major contributions.

Dr. Novick was instrumental in the development of the Chemostat. This apparatus permits studying bacterial populations under controlled physical and chemical conditions, and its use led Dr. Novick to the discovery of a number of hitherto unsuspected phenomena.

Much of Dr. Novick's published work with the Chemostat relates to the study of mutations in bacteria growing in the Chemostat but presently he is engaged in an extraordinarily interesting study of adaptive enzyme formation which seems to reveal new phenomena of considerable importance. He uses the Chemostat in this study also.

Dr. Novick's work demonstrates the benefit that microbiology can derive from applying comparatively simple chemical and physical principles in order to obtain conditions in which otherwise hidden phenomena can be readily detected.

Sincerely yours,

Leo Szilard

m

THE NATIONAL FOUNDATION FOR INFANTILE PARALYSIS
FRANKLIN D. ROOSEVELT, FOUNDER
120 BROADWAY
NEW YORK 5, N.Y.

BASIL O'CONNOR
PRESIDENT

BEEKMAN 3-0500

March 7, 1956

Mr. Leo Szilard
1155 East 57th Street
Chicago 37, Illinois

Dear Mr. Szilard:

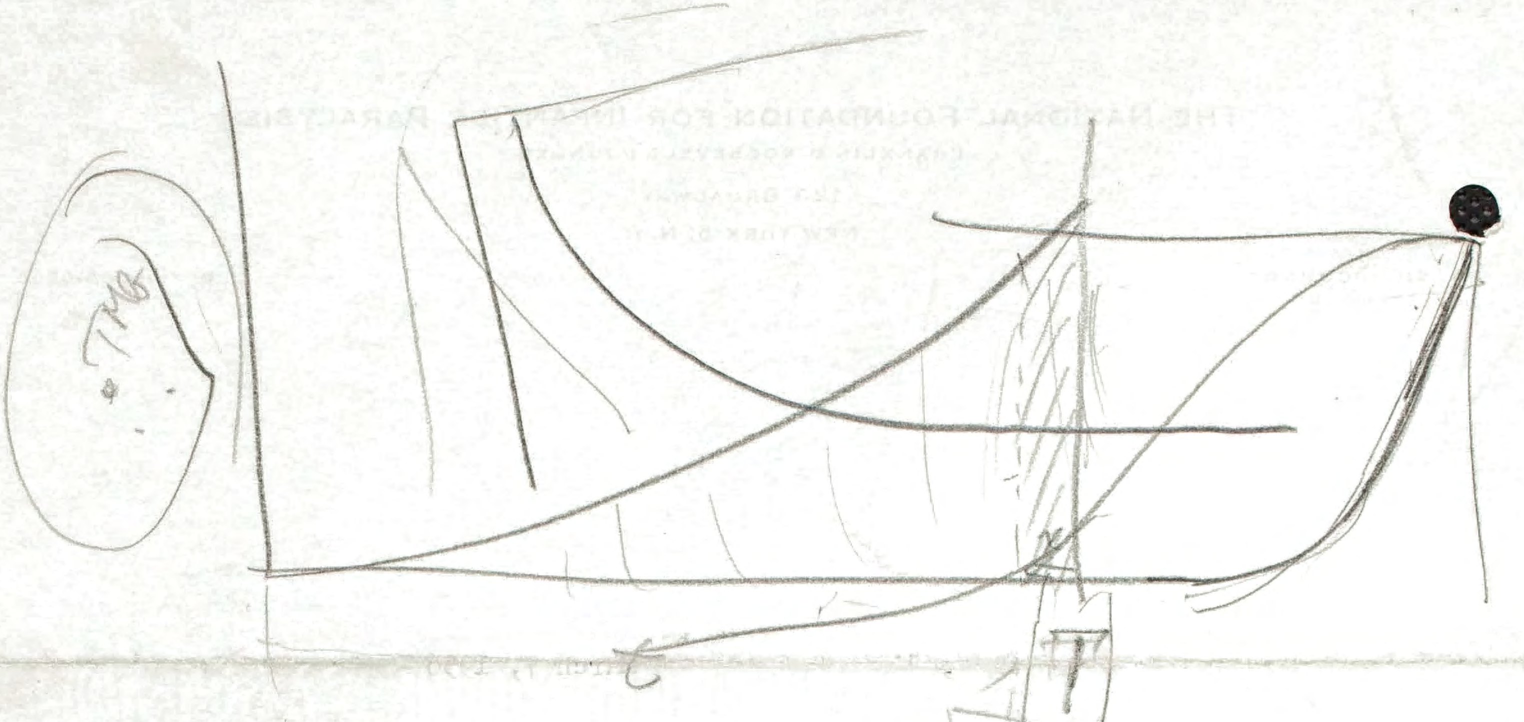
Your name has been given to us as a reference by Miss Nina Byers, who is applying to the National Foundation for a research fellowship.

We should appreciate receiving your opinion of any special qualifications of the candidate to undertake a career in research or teaching. Any information as to her personality and character which you are willing to make available to our Committee on Fellowships will also be helpful. Your reply will be treated confidentially by the staff and members of the Committee.

Sincerely yours,

Marion C. Morris

Marion C. Morris, Ph.D.
Assistant Director of Professional Education



$$N_0\int_0^{\pi} e^{\frac{t}{\tau}}\, dt = 1$$

$$t + x = \pi$$
$$t = \pi - x$$

$$\tau e^{t/\tau}\Big|_0^{\pi} = \tau e^{\frac{\pi}{\tau}} - 1 = \frac{1}{N_0}$$

$$\int_0^x e^{\frac{\pi - x}{\tau}}\, dx = e^{\frac{\pi}{\tau}} \int_0^x e^{-\frac{x}{\tau}}\, dx$$

$$= -\tau e^{\frac{\pi}{\tau}} e^{-\frac{x}{\tau}}\Big|_0^x = \tau e^{\frac{\pi}{\tau}}\left(1 - e^{-x}\right)$$

Number dead after x

Number alive $= \tau e^{\frac{\pi}{\tau}} - \tau e^{\frac{\pi}{\tau}}\left(1 - e^{-x}\right)$

$$= \tau e^{\frac{\pi}{\tau}}\left[e^{-x}\right]$$

From L. b. s

Work Copy

MEMORANDUM

TO: Marshall MacDuffie

FROM: Leo Szilard

DATE: June 13, 1956

1.

After the chain reaction was demonstrated on December 2nd, 1942 and it became evident that the U. S. Government wanted to take out patents on the uranium graphite system, I wrote down what I believed to be my contribution to the invention of this system.

These contributions were made prior to November 1940. The purpose of writing down my inventions relating to this system was to enable the representatives of the Government to evaluate my contribution and to make me an offer in case they wished to acquire a patent covering the system. I was given to understand that this was in fact the case.

Since our work was highly secret, it would have been inadmisable for me to do this writing down job after office hours at home. It seemed more advisable to do the work during office hours on the premises of the guarded project. I therefore asked Dr. A. H. Compton, the director of the project at the University of Chicago, not to put me on the payroll as long as I would take sometime off during office hours to write down my inventions. It so happened that our employment contracts ran out at the end of 1942 and everybody had to be put on the payroll de novo.

2.

Captain Robert C. Lavender who handled patent matters for the O S R D, discussed with me my inventions. At some point of this discussion he told me that he would recommend that the Government pay me $25,000.00 for all of my inventions made prior to November 1940, and that, if I did not want to accept this offer, he would recommend that I be removed from the project.

When asked for the reason for this unusual proposal he told me that if I had a claim against the Government, I would be in a better position to pursue this claim if I had access to information within the project than otherwise.

4.

When I completed the writing down of my inventions and again devoted my full time to the work on the project, I asked Dr. Compton to put me back on the payroll. Dr. Compton told me that he had orders from General Groves not to put me back on the payroll until such time as General Groves directed him to do so.

5.

Dr. Compton told me a short while thereafter that he had orders from General Groves to cut me off from all secret information - which at that time was essentially all information - and inasmuch as there was no way in which he could do this short of keeping me out of the laboratory, he was forced to ask me not to come to the laboratory until such time as I assigned my inventions to the Government. I told Dr. Compton at once that I was forced to choose between dropping the work in which I was engaged and losing the rights to my inventions. I would choose the latter. Dr. Compton thereupon told me that I might continue my work on the project, and I would not be cut off from secret information. I also told Dr. Compton that I would write to Dr. Vannevar Bush, head of the O. S. R. D., protesting against being forced to choose between two such alternatives.

I wrote Dr. Bush such a letter. In this letter I stated that I would be willing to enter into an undertaking whereby the Government could use all of my inventions free of charge so that I would have no claim against the Government but otherwise might retain the rights to my inventions. I showed this letter to Dr. Compton before sending it off.

6.

Dr. Bush in his reply did not respond to my offer and did not say that I could remain at work if I did not sell my inventions to the Government at the Government's price, and evaded the issue which I had raised.

7.

My offer stated in the letter to Dr. Bush (whereby I would abandon any claim against the Government but otherwise retain all rights to my inventions) was regarded by Capt. Lavender as unsatisfactory on the grounds that it did not permit the Government to take out the patents that would have protected the Government against possible claims by other inventors, and this is the reason, I understand, why my offer was not accepted.

All through the year 1943 while I continued working on the project, I received no salary. An amount equal to my salary for 1943 was paid to me in 1944 after I assigned my inventions to the Government under circumstances which are stated further below.

8.

Towards the end of 1943 Captain Lavender informed me that General Groves would come to Chicago and wanted to reach a final decision concerning the Government purchase of my inventions. My attorney was out of town at that time, and I so advised Dr. Compton, asking that the conference be postponed until my attorney returned. Dr. Compton took up the matter with Col. Metcalf (who worked with Captain Lavender in this matter) and, I believe, also with Captain Lavender himself. Subsequently Dr. Compton informed me that he was not able to persuade them to change the date in order to permit my attorney to be present at the final conference.

9.

In the absence of my attorney I met Col. Metcalf, Captain Lavender and General Groves. In this conference I asked General

Groves whether he would be willing to say that I could remain at work on the project whether or not I accepted Captain Lavender's offer of $25,000.00 for my inventions. General Groves declined to say that I could remain on the project. I then asked General whether he would be willing to say that I could not remain on the project if I rejected Captain Lavender's offer of $25,000.00. General Groves said that he was unwilling to say that, because if he said so, that would be duress.

Since I understood from Dr. A. H. Compton that I could not remain on the project unless I accepted the Government offer, I told General Groves the following:

I believe as do a number of my colleagues, on the project, that the Germans might be ahead of us in the development of the bomb, and that therefore I can not leave my post. I also told him, however, that I am not going to accept Captain Lavender's offer of $25,000.00 but instead will accept my expenses for which I presented an itemized list.

These expenses included living expenses of $333.33 per month in New York while I worked at Columbia University without a salary from March 1939 till November 1940.

I therefore signed a contract assigning all of my inventions to the Government for $15,417.60 which represented the sum of the itemized expenses.

There was a rubber stamp on the last page of the contract which expressed that I signed the contract of my own free will and not because I was forced to do so. I have never before or since seen a stamp of this sort on any contract I have signed.

10.

Within 24 hours after the conversation with General Groves I wrote a Memorandum describing the conversation that led to my signing the contract.

11.

In addition to the expenses received I was subsequently paid a sum equal to the back salary which I would have received for my work during the year 1943 and had I not been kept off the payroll throughout the year.

* * * * *

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

---

(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 isoantibodies 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 desoxyribonucleic 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.

THE UNIVERSITY OF CHICAGO
CHICAGO 37 · ILLINOIS
THE ENRICO FERMI INSTITUTE
FOR NUCLEAR STUDIES

June 25, 1957

Dr. Aaron Novick
Biological Laboratory
Cold Spring Harbor
New York

Dear Novick,

I am sending you under separate cover Stent's manuscript. My own manuscript which I had prepared for publication I decided not to publish. It turns out that the basic idea (that trinucleotides carrying one amino acid are the intermediates in protein synthesis), was put forward by Crick in the discussion at a meeting which took place in February, 1956, and was recently published in the Biochemical Society Symposium, No. 14, Cambridge University Press. Reference to this idea is also contained in Crick's paper in the May issue of the Proceedings of the National Academy (U.S.A.), which reached me just in the nick of time.

The second half of my manuscript, which relates to the rate of protein synthesis, I shall probably incorporate in the next manuscript, which is in preparation. My additional idea that trinucleotides of the ribose variety carry each a sequence of three amino acids in the form of acid anhydrides on a phosphate which hangs on the (2) carbon of the ribose, I am temporarily abandoning for the following reason:

The past week which I spent in Denver I got hold of a manuscript of Brenner's, in which were collected the known amino acid sequences. According to my postulate, there ought to have been ten sequences of three amino acids -- in this sample -- occurring twice. This is not in fact the case, and therefore the facts do not bear out my postulate. It was a nice try anyway.

I hope it is not too warm and humid in Cold Spring Harbor. With kind regards to Jane and you,

Yours,

Leo Szilard

m

June 24, 1957

Memorandum by Leo Szilard re manuscript dated June 7, 1957

I have in the meantime looked at the known amino acid sequences found in insulin A, insulin B, oxytocin, vasopressin, corticotrophin, glucagon, melanophore stimulating hormone, hypertensin, cytochrome, trypsinogen, and ribonuclease. On the assumption that trinucleotides carrying three amino acids each and tetranucleotides carrying four amino acids each are the "intermediates" in protein synthesis, we should expect to find about ten times in the above mentioned sample that a sequence of three amino acids occurs twice. In fact, we find only two "repeats" which are as follows:

A sequence of four amino acids occurs both in oxytocin and vasopressin, and a sequence of seven amino acids occurs both in corticotropin and the melanophore stimulating hormone.

As one may thus see, the known sequences of amino acids in polypeptides (all of them excretory products of mammalian tissues) do not support the assumptions made in the manuscript of June 7, 1957.

Lh.

January 28, 1959

Professor Leo Szilard
Quadrangle Club
1155 East 57th Street
Chicago 37, Illinois

Dear Szilard:

I am coming east to the Biophysics Meetings in Pittsburgh, February 25 through 27 and to Washington for a NSF Study Section on March 2 and 3. I also plan to stop in Chicago and New York. It would be very good to see you if this can be arranged. Could you let me know where to find you?

We like it here very much.

Best regards,

Aaron Novick

AN:tdm

February 6, 1959.

Mr. Lucien R. Le Lievre
Marc Wood International, Inc.
30 Rockefeller Plaza
New York, N: Y:

Dear Mr. Le Lievre:

I am in complete agreement with the proposed joint venture between Drs .Monod, Novick, Szilard, myself, C.N.R.S., and the Pasteur Institute. The proposed option to the American Sterilizer Company seems more than fair. I have, however, one very minor objection at this particular moment to the contract.

The important point in this contract is that the process patent be developed. American Sterilizer is under no obligation to develop this. They could just as easily shelve it since the amount of money they are paying per month is less than nominal. On the other hand, it is clear that if we, Monod, Novick, Szilard and myself, were to consult for them that this process patent could be developed but it would require a rather output of research money on their part. Of course, there is no guarantee in this contract that they do this, nor that they encourage other firms to do it. I am not posing this as an obstacle to the signing of this contract, but merely to point out its weakness.

I would like to clarify one or two comments made by American Sterilizer in the minutes of December 8, simply to keep the record straight and to be certain that American Sterilizer is being honest. It is incorrect to state that the agreement between American Sterilizer and Rinderer was made at my insistence. This agreement was made essentially without my being informed of the exact details. American Sterilizer had built the first instrument and was anxious to go into production since there was a large number of orders at the time. I remained completely aloof from this arrangement, and Rinderer and American Sterilizer came to agreement with me not being any part of it.

The second point I would like to make about the minutes illustrates, unfortunately, American Sterilizer's real lack of understanding of this process. It is incorrect to say that Anheuser-Busch has done work on contin uous fermentation since the late 1940's. This is the one firm with whose work I am rather familiar, since I was in constant contact with their research department at a time when I tried to interest them in the

development of a continuous culture system and the building of a machine. The confusion lies in the detailed principle of continuous culture with a limiting nutrient. What Anheuser-Busch has done, and I consulted with them on this problem, is to continuously feed new medium into a tank and remove culture without any knowledge of the limiting factors. This is not a continuous culture as described in the process patent, but a way of emptying and filling a vat of culture, which is a distinctly different problem and of no particular interest.

I would appreciate being informed as soon as possible as to the status of these arrangements, since I have been invited to visit the American Sterilizer plant at Erie, at the end of February, where I will probably do some consultant work on the patent. If the agreements are not advancing and are not sufficiently settled, I would rather not indulge in this activity at present.

Sincerely yours,

MC/McK

Melvin Cohn, Ph.D.

THE UNIVERSITY OF CHICAGO
CHICAGO 37 · ILLINOIS
THE ENRICO FERMI INSTITUTE
FOR NUCLEAR STUDIES

Denver, Colorado
February 19, 1959

Dr. Aaron Novick
Institute of Molecular Biology
University of Oregon
Eugene, Oregon

Dear Novick:

Many thanks for your letter. I do not know what my schedule will be. I doubt that I will go to the Pittsburgh (Biophysical Society) meeting and I might hang on mostly West in the next few months, with the exception of one trip East, at an as yet undetermined date.

Concerning the draft agreement (chemostat/Bactogen otat rights) which you sent me, I should say this: I have no intention to consult with anybody else in this field. It seems to me that the arrangement proposed by Monod is a very generous one. My only hesitation is that under as yet unforeseeable circumstances I might be embarrassed by an obligation of not to consult in a given field. For this reason I would prefer to sign the agreement as it stands, with the proviso that I shall be free to withdraw from it, and that if I do, I forfeit all income from the agreement. My share could then be divided up among those who will remain a party to the agreement. If this proviso were acceptable, I should then be glad to sign the agreement as it is. If this proviso is unacceptable, I would have to think more about the unexpected contingencies that might arise and in which the agreement might become embarrassing to me, unless I can withdraw from it. Among these is, above all, the possibility that I might join the National Institutes of Health.

Kind regards,
How is the family?

Sincerely yours,

Leo

Leo Szilard

February 20, 1959

Mr. Lucien R. Le Lievre
Marc Wood International, Inc.
30 Rockefeller Plaza
New York, New York

Dear Mr. Le Lievre:

I am writing to endorse the proposed option which you sent to me. The only fault I find is that already pointed out by Melvin Cohn in his letter of February 6 to you. That is, there isn't sufficient assurance that American Sterilizer will pursue the development diligently.

I enclose a copy of a letter I received from Professor Leo Szilard, as well as my reply to him.

Sincerely,

Aaron Novick

AN:tdm

Enclosures

February 20, 1959

Dr. Leo Szilard
Enrico Fermi Institute
University of Chicago
Chicago 37, Illinois

Dear Szilard:

It was certainly good to hear from you, and I am indeed very sorry not to be able to see you on this trip east. I have been invited to participate in U. N. Week at the University of Colorado in April. I plan to accept and hope that I shall be able to see you at that time.

I see no conflict between the Monod proposal and your employment by the NIH. The Monod proposal, as I understand it, does not oblige you to consult for anyone. It only denies you the right to consult in these matters with any other company but a licensee.

Sincerely,

Aaron Novick

AN:tdm

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

PUBLIC HEALTH SERVICE . BETHESDA 14, MD.

NATIONAL INSTITUTES OF HEALTH

c/o Robert B. Livingston, M.D.
Clinical Center, Rm. 3N-242

May 22, 1959

Professor Aaron Novick
Institute of Molecular Biology
University of Oregon
Eugene, Oregon

Dear Aaron:

I wonder whether you could semd me a copy of your mailing list for reprints. I want to compile a mailing list of my own and having yours would help me a lot toward this end.

I am leaving around the 20th of June for Europe, where there is another Pugwash Conference to be held, this time near Vienna. It is supposed to be a meeting devoted to thinking and, if we are lucky, it will be a good meeting.

With kind regards.

Sincerely,

Leo Szilard

May 29, 1959

Dr. Leo Szilard
Enrico Fermi Institute
University of Chicago
Chicago 37, Illinois

Dear Leo:

Unfortunately, a stupid secretary in Chicago managed to throw out my reprint list. I will make up another one and send you it. Best of luck for the conference this summer. I hope you can come by and visit us when you return.

Sincerely,

Aaron Novick

AN:tdm

THE UNIVERSITY OF CHICAGO
CHICAGO 37 • ILLINOIS
THE ENRICO FERMI INSTITUTE
FOR NUCLEAR STUDIES

SZILARD

June 23, 1959

Dr. Aaron Novick
Institute of Molecular Biology
The University of Oregon
Eugene, Oregon

Dear Dr. Novick:

This letter is, as you will see, something of a circular. The University of Chicago has applied for a U. S. Public Health Service grant for my work which would cover my salary, travel expenses, and secretarial services. This grant would leave me free to pursue in the next ten years my research interests wherever they might take me. It is anticipated that much of the work in which I shall be interested may have to be pursude in collaboration with some laboratory away from Chicago. To the Research Plan submitted with the grant application there is appended a list of persons and laboratories who might take an interest in one or another of the research projects that I may pursue. As you may see from the enclosed list, I have taken the liberty to include your name. This list is supposed to serve as an indication of the kind of persons in general who might take an interest in my work, but not to indicate an obligation on the part of anyone in particular actually to take an interest in it.

A somewhat similar list of names might be appended to an

overlapping application for a research grant which The University of Chicago may file with the N.S.F.

With best wishes.

Sincerely yours,

Leo Szilard

Enclosure

This letter was dictated by Dr. Szilard before he left for Europe, and he had no chance to read the letter.

Marie Davies

In order to indicate what kind of persons I would expect to take an interest in some of the problems which I would wish to pursue, I am presenting below a list of names. To the names of those with whom I had some communication on the subject named I have affixed a star.

Re: The problem of aging.

H. J. MULLER* - University of Indiana

JOSHUA LEDERBERG* - Stanford University

GEORGE BEADLE - California Institute of Technology

KIM ATWOOD* - University of Chicago

Re: Induced enzyme formation in micro-organisms.

AARON NOVICK* - Institute of Molecular Biology, The University of Oregon

BORIS MAGASANIK* - Cambridge, Mass.

WERNES MAAS* - Department of Microbiology, New York University Medical School

MELVIN COHN* - Stanford University

SIDNEY BRENNER - MRC Unit for Molecular Biology, Cavendish Laboratory, Cambridge, England

BRUCE AMES* - NIH, Bethesda, Maryland

JACQUES MONOD* - Pasteur Institute, Paris

ARTHUR PARDEE* - The Virus Institute, University of California, Berkeley

FRANCOIS JACOB* - Pasteur Institute, Paris

Re: Antibody formation.

ED LENNOX* - Department of Microbiology, New York University Medical School

MELVIN COHN - Stanford University

HOWARD GREEN* - Department of Pathology, New York University Medical School

Colin MacLeod
~~COLLIN McLEOD~~ - University of Philadelphia, Philadelphia

Re: Inherent stability of competent genes.

MAT MESELSON* - California Institute of Technology

Re: Delayed hypersensitivity, tissue compatibility, and the tumor problem.

HILARY KOPROVSKI* - The Wistar Institute, Philadelphia

GEORGE KLEIN* - Laboratory for Tumor Biology, Karolinska Institute, Stockholm

Re: Delayed hypersensitivity, tissue compatibility, and the tumor problem (continued)

JIM WATSON - Harvard, Cambridge, Mass.

Re: Higher functions of the brain and the problem of sleep.

ROBERT B. LIVINGSTON* - The National Institutes of Health.

Re: Killing and mutagenic effect of ionizing radiation on mammalian cells.

MORTIMER ELKIND* - NIH, Bethesda, Maryland

KIM ATWOOD - The University of Chicago

RENATO DULBECCO - California Institute of Technology

Re: The gene-protein problem.

MAUREY FOX* - The Rockefeller Institute, New York

F. H. C. CRICK* - MRC Unit for Molecular Biology, Cavendish Laboratory, Cambridge, England.

ALEXANDER RICH* - MIT, Cambridge, Mass.

In the following I list a number of institutions where conditions might be favorable for the experimental pursuit of some of the problems in which I am interested:

The Institute of Molecular Biology, The University of Oregon, Eugene, Ore. (Director - Aaron Novick)

The National Institute of Mental Health, Bethesda, Md. (Scientific Director - Robert B. Livingston)

The Department of Microbiology, New York University Medical School, New York City (Head of Department - Bernard Horecker)

The Wistar Institute, Philadelphia (Director - Hilary Koprovski)

The California Institute of Technology, Pasadena, Calif. (Heads of Divisions - George Beadle and Linus Pauling)

The Laboratory for Tumor Biology, Karolinska Institute, Stockholm (Director - George Klein)

MRC UNIT for Molecular Biology, Cavendish Laboratory, Cambridge, England (Director - N. F. Mott)

The Pasteur Institute, Paris (Heads of Divisions - Jacques Monod and Andree Lwoff)

The Department of Pathology, New York University Medical School, New York City (Head of Department - Stetson)

Stanford University (Departments of Joshue Lederberg and Arthur Kornberg)

The Oak Ridge National Laboratory, Knoxville, Tenn. (Director - Alvin Weinberg)

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF BIOLOGY
CAMBRIDGE 39, MASSACHUSETTS

July 7, 1959

Professor Leo Szilard
Department of Biophysics
University of Chicago
Chicago 37, Illinois

Dear Leo:

It seems like a long time since we met in Boulder and we have wondered on several occasions what you have been up to. We would very much enjoy having you stop in again at M. I. T. some time when you are in the East. We certainly enjoyed the two weeks you spent with us as Arthur D. Little Lecturer.

Specifically, I am writing to inquire as to whether or not you might have any writing plans for the near future. I am now one of the editorial consultants for Rinehart and have been asked by them to let you know of their interest in your writing a book for their studies series. These are to be relatively short reviews of not more than 150 pages and are intended to bring up to date the advanced undergraduate or the beginning graduate student. They will be paper-back volumes which will be published quickly and with a minimum expense. In particular, I would like to inquire as to whether you have thought of writing up the work which has been done with the chemostat. This would make a very interesting little study indeed. Another possibility would be to write up your notions concerning the mechanisms involved in the formation of adaptive enzymes.

I shall look forward to hearing any ideas you have in mind concerning your writing plans for the future.

Cordially yours,

Irwin

Irwin W. Sizer
Head, Department of Biology

IWS:JR

cc: W. H. Y. Hackett

Copy for Novick
for his information.
LZ.

Professor Irwin W. Sizer,

Department of Biology,
Massachusetts Institute of Technology,
CAMBRIDGE 39, Massachusetts.

Vienna, 24th July, 1959.

Dear Professor Sizer,

Many thanks for your very kind letter of July 7th. I have very pleasant memories of the two weeks that I spent as Arthur D. Little Lecturer at M.I.T.

Concerning your specific inquiry, I regret to say that I am disinclined to write any books on any specific subject in biology or in physics at the present time. If you are interested in a small book on the chemostat, perhaps you would want to ask Professor Aaron Novick, Institute for Molecular Biology, The University of Oregon, Eugene, Oregon, with whom I have collaborated over a long period of years.

I do appreciate your having thought of me in connection with this matter.

With best wishes,

very sincerely yours,

LZ.

(LEO SZILARD)

July 15, 1959

Dr. Leo Szilard
Enrico Fermi Institute
University of Chicago
Chicago 37, Illinois

Dear Szilard:

I am writing to acknowledge your letter of June 23 in which you inform me that you have included me on a list of persons interested in your work. I have wanted to tell you how delighted I am that you included my name. It is indeed an honor to be on this list.

I hope it is not long before we see you in Eugene.

Best wishes,

Aaron Novick

AN:ret

THE UNIVERSITY OF CHICAGO
CHICAGO 37 • ILLINOIS
THE ENRICO FERMI INSTITUTE
FOR NUCLEAR STUDIES

June 22, 1959

Dr. Aaron Novick
Institute of Molecular Biology
The University of Oregon
Eugene, Oregon

Dear Novick:

Don't bother please about the reprint mailing list which you have lost. However, if in time you manage to assemble one again, keep a copy for me. You may send it to me later on when I ask for it again.

I am leaving for Europe tomorrow to attend the Fourth Pugwash Meeting in Baden near Vienna.

From copies of letters sent to me by Mel Cohn and Monod, I see they are having some trouble in arriving at an agreement. I am writing to authorize you to accept, in my absence, any modification of the agreement which is limited to a change in the financial terms but does not impose any additional personal obligations on me. Please feel free to put my signature under any such agreement if my signature should be required. This will avoid unnecessary delay if you have trouble reaching me.

With kindest regards.

Sincerely,

Leo Szilard

October 2, 1959

Dr. Leo Szilard
Enrico Fermi Institute
5640 Ellis Avenue
Chicago 37, Illinois

Dear Leo:

I have continued to maintain an active interest in the space biology program. At present there seems to be some conflict of interest between the people who want to go to the moon, the people who want to go to the planets, and the Russians who seem to want to go everywhere.

It is well known that the Russians have superior booster rockets. Their recent moon shot establishes that they are also far ahead with their guidance systems; however, even they admit that our telemetry and electronic miniaturization is far better than theirs. Some of us wonder if it might not be possible for us to design the experimental package and for the Russians to deliver it. I discussed this and learned that one of the Russians at Kitzbuehl (Topchive's secretary) had in fact suggested this idea in a conversation with Harrison Brown.

It is obvious that there is an opportunity for a very fruitful collaboration in space exploration. Such collaboration has already been suggested by the top political leaders. Khrushchev suggested collaboration repeatedly while here.

In the discussions of our Westex group, it was realized that such collaboration might require an enormous amount of negotiation. It was feared that there were few Americans with sufficient brains to carry out such negotiations. We all wondered whether you would be interested in pursuing such a project either actively or by advice.

Is there any chance of your coming out to visit us? Please remember that you have a standing invitation and that we are even prepared to pay your expenses.

Best regards,

Aaron Novick

AN:ret

THE UNIVERSITY OF CHICAGO
CHICAGO 37 · ILLINOIS

THE ENRICO FERMI INSTITUTE
FOR NUCLEAR STUDIES

October 20, 1959.

Professor Aaron Novick
Institute for Molecular Biology
The University of Oregon
Eugene, Oreg.

Dear Novick:

Enclosed I am sending you two copies of the agreement which has been signed by everybody. Would you be kind enough to forward it to where it belongs?

I believe I have at last a convincing model for antibody formation which has some rather exciting implications. I am in the process of writing the paper and I should have "pre-prints" available within two weeks. At that time I shall send you a copy.

I shall have to undergo in the near future some surgery which might be just a minor operation but it might also turn out to be a major one. In the latter case I may conceivably be out of circulation for several months and so I am now clearing the docket. With luck I should be through with this job within a week.

With kindest regards,

Sincerely,

Leo Szilard

THE UNIVERSITY OF CHICAGO
CHICAGO 37 · ILLINOIS

THE ENRICO FERMI INSTITUTE
FOR NUCLEAR STUDIES

November 21, 1959.

Professor Aaron Novick
Institute for Molecular Biology
The University of Oregon
Eugene, Oreg.

Dear Novick:

This is just to let you know that I have received word, so far inofficial and therefore confidential, that the N.I.H. is going to approve the research grant which I requested through the University of Chicago for a period of ten years. I thought that you might want to hear this "good news".

It was kind of you to invite Trude and me to visit you in Oregon in December. I am scheduled to undergo surgery at the New York Hospital for this coming Monday Nov. 23 and plan, depending on the outcome, to recuperate in Denver. Mail will be forwarded to me from Chicago but I do not expect to get around to answering any letters until after January 1.

With kindest regards,

Sincerely,

Leo Szilard

January 7, 1960

Dr. Leo Szilard
St. Moritz Hotel
New York, New York

Dear Szilard:

I enclose the copies of the Group's Agreement for signature as well as a stamped envelope so that you can send it on to Melvin Cohn. I understand that you received a copy of Yates' letter to me of January 5 in which he replies to my letter of December 14 regarding the disposition of a member's monetary benefits in the event of his death. My lawyer friends here agree with Yates but I will get this spelled out more clearly, if you wish.

I am interested to see your antibody paper especially before I come East. I expect to be in New York the last week in February and look forward to seeing you.

Best regards.

Sincerely,

Aaron Novick

Encl.

January 14, 1960

Warren Johnson, Dean
Physical Sciences Division
University of Chicago
Chicago 37, Illinois

Dear Dr. Johnson:

Edward Teller was here to give a lecture the other evening and we discussed how sad we were about Leo Szilard's illness. Edward said that he believed that Leo is the outstanding candidate for the Enrico Fermi Award for 1960, and I am writing to you in support of this idea.

His contributions to the initiation of the atomic energy program are well-known as are his many inventions used in the field of atomic energy, such as, for example, the electromagnetic pump (with Einstein), the Szilard-Chalmers process, and the graphite pile (with Fermi). Then there are the countless suggestions and ideas that he supplied at critical moments when he was associated with the program.

Somehow his important role in the development of atomic energy legislation and related problems should be recognized. How this should be done, I do not know, but certainly we all owe him a great debt.

My association with him has been in biology, where he has continued to have the same originality and enthusiasm. As you might guess, so often great discoveries were made in many laboratories shortly after a visit by Leo.

I think it is a tragic shame that he has not received the recognition he so much deserves. This is probably a wide-spread opinion and scientists everywhere would be very pleased should Szilard be recognized by such a major honor as the Fermi prize.

If there is anything I can do to help in this, please let me know.

Sincerely,

Aaron Novick

January 14, 1960

Dr. Cyril Smith
Institute of Metals
University of Chicago
Chicago 37, Illinois

Dear Cyril:

Edward Teller came to Eugene to give a lecture and we discussed Leo Szilard. He said that he was trying to do something about getting the Fermi prize for Leo. I think this is a great idea and I am writing to enlist your aid, if you agree. Edward thinks it would help if you were to recommend this to Warren Johnson.

We are very happy in Eugene except that we miss our old friends. Please do come visit us if you are anywhere nearby.

Best regards.

Sincerely,

Aaron Novick

January 15, 1960

Dr. Leo Szilard
St. Moritz Hotel
New York, New York

Dear Leo:

I have just received from Howard Green your two manuscripts. I have read the first and am about to start the second. I found the first extremely interesting, especially since it crystallizes much of my own vague speculation. I have two remarks which I want to make right away. More comments will follow later.

The first has to do with when regulation occurs. We have done the following experiment: bacteria in a test tube are permitted to become starved for phosphate. Under these conditions they began to make large quantities of phosphotase, the RNA falls, and the DNA rises. We added TMG during this period of phorphorus starvation and observed an immediate production of β-galactosidase at a rate at least equal to that of a control of excess phosphate. This was done with ML3 (a permeaseless strain) and at a TMG concentration which gives 10% of the maximum rate. We would like to conclude that, if the templates contain phosphorus, they are already present before inducer is added.

Another point is some evidence which may contradict some of your ideas. This is an observation at the Institut Pasteur reported by Jacob, Schaeffer, and Wollman in a paper entitled "Episomic Elements in Bacteria" to be given at the Tenth Symposium of the Society for General Microbiology in London, April, 1960. I quote the pertinent paragraph from pages 34-35 of their ms:

"One may also wonder whether the regulation of the heterocatalytic functions of the galactose determinants is disturbed when these determinants are incorporated into a phage genome. Preliminary experiments suggest that this might be the case (G. Buttin, unpublished). In wild E.coli K12, the synthesis of galactokinase occurs only in the presence of an external inducer which is likely to release a specific repression as in the case of β-galactosidase. When non-lysogenic gal^- mutants are infected with λ-gal^+ phages. it is observed that, after a short lag, the infected cells are able to manufacture the enzyme constitutively,

that is in the absence of any external inducer. Such a constitutive synthesis occurs even in conditions of single infection, in which the defective λ-gal appears (of Arber, 1958) not to multiply vegetatively. If, however, lysogenic gal$^-$ mutants, carrying a prophage λ, are infected with λ-gal$^+$ phage, no constitutive synthesis of enzyme is observed, unless the cells are exposed to a dose of U.V. light which releases immunity and initiates phage development. In the same way, in heterogenotes carrying a λ-gal prophage, which synthesize galactokinase only in the presence of inducer during growth, U.V. irradiation initiates a constitutive synthesis during the latent period. These results suggest that, when incorporated into a phage genome, the hetero-catalytic functions of the gal determinants may escape the normal system of bacterial regulation and perhaps become submitted in some way to the phage system of repression which determines immunity. If confirmed by further experiments, this would support the hypothesis that repression systems operate by regulating the expression of groups of determinants which are structurally associated in the genetic material."

I am eager to discuss these matters with you and hope to be in New York soon.

Best regards,

Aaron Novick

GENERAL ADVISORY COMMITTEE
TO THE
U. S. ATOMIC ENERGY COMMISSION
WASHINGTON 25, D. C.

January 18, 1960

Dr. Aaron Novick
Institute of Molecular Biology
University of Oregon
Eugene, Oregon

Dear Aaron:

I want to thank you for your gracious as well as timely letter pertaining to Leo Szilard's achievements and contributions. The seriousness of Leo's illness first came to my attention on December 2 in Washington, on the occasion of the Fermi Award to Glen Seaborg. Eugene Wigner was there and he apprised me of the situation. I had previously, in late September, received a letter from Leo written in Stockholm stating that he was returning to New York for a medical examination at Presbyterian Hospital.

Your letter has been forwarded to Mr. A. A. Tomei of the office of the General Advisory Committee in Washington. Several other letters have already been received.

Best regards,

Sincerely,

Warren

Warren C. Johnson

cc Mr. A. A. Tomei

THE UNIVERSITY OF CHICAGO
CHICAGO 37 · ILLINOIS

THE ENRICO FERMI INSTITUTE
FOR NUCLEAR STUDIES

May 28th. 1960.

Professor Aaron Novick,
Institute of Molecular Biology,
University of Oregon,
Eugene, Oregon.

Dear Aaron,

Enclosed is a memorandum which I have also sent to Pardee and Jacob. I did not get around to discussing these things with Jacob because I had only a few hours with him. If you see Pardee ask him what he thinks and arrange with him that someone shall do the Phage experiment if it appears reasonable to both of you.

Sincerely,

Leo Szilard.

Enclosure:

Memorandum Concerning the Stent, McFarlaine, Pardee Experiment. May 28th. 1960

I postulate that most of the bacteria, which die through radio-active Phosphorus suicide, die because, as the result of damage to a gene, the R Moiety of a repressor is not made and accordingly the corresponding enzyme is produced in great abundance. If the enzyme happens to be one which creates a metabolic imbalance the bacterium dies. Moreover, in case of such an imbalance the synthesis of proteins might be interfered with. It is conceivable that a single damage prevents the synthesis not only of one R Moiety, but a large number of R Moities, which are genetically closely linked.

There are two experiments which may put to a test the above formulated postulate.

1.) We choose an F minus strain which is constitutive for an enzyme but is not competent to produce the enzyme. Such a bacterium we allow to commit suicide (through the decay of radio-active Phosphorus which is incorporated in its chromosome), we incubate it, after its suicide, for a reasonable period of time and then introduce into it, from an Hfr strain, a gene which is capable of making the enzyme.

If our postulate is correct we should expect that the damage suffered by the F minus bacterium is ~~dominant~~ recessive and that the enzyme will not be produced in substantial quantity.

2.) Another relevant experiment is as follows: We permit a bacterium to commit suicide (through the decay of radio-active Phosphorus incorporated in its chromosome) and subsequently we incubate the bacterium for a reasonable period of time. After this we infect the bacterium with a virulent mutant of a temperate phage and perform a single burst experiment.

If our postulate, formulated above, is correct we should expect that a certain fraction of the bacteria gives a high yield of phage and another fraction gives a low yield of phage. Further, we should expect that if we increase the time

allowed for the decay of the Phosphorus, the fraction of the bacteria which gave a low yield will increase parallel to the fraction of the bacteria which are killed.

SZILARD

To Novick
for information
LK.

August 31, 1960.

Professor E. Novitski,
Department of Biology,
University of Oregon,
Eugene, Oregon.

Dear Professor Novitski,

I am writing to thank you for your kind letter of June 29. If you should be in New York, I would like to discuss some of the questions you raised in your letter. You can reach me in New York over the telephone at extension 133, TRafalgar 9-3000 at Memorial Hospital.

I was very glad to have your reprint from the Annals of Human Genetics, 1956, which I did not previously see and, particularly, the plot in figure 1 on page 124 of the paper. Unfortunately, the sample size is still too small to tell from it how the sex ratio falls with the age of the father. If one draws a vertical interval around each point, representing the statistical error, one can draw either a straight line through the points or else a line with a steadily and very markedly decreasing slope. (My note to 'Nature' could account for either of these two alternatives, but I personally prefer the second alternative.) This is a somewhat primitive way of looking at the results but I am uncertain whether by using more sophisticated methods, one can really get much further.

I regret that I am not able to give any "mechanism" for the "ageing hits" which are postulated in my paper on ageing. There is no reason to believe that it has anything to do with radiation hits which cause mutational damage.

That the deviation of the sex ratio with the increasing age of the father does not start from a 50/50 base does not bother me because I believe that the base merely reflects the fact that the probability that the X chromosome fails to get included into the sperm is smaller than the probability that the Y chromosome fails to get included into the sperm.

Concerning the question that you raised on the third page of your letter, I am inclined to think that a number of individuals afflicted with Turner's syndrome is far smaller than would correspond ~~with~~ to the number of nullo X nullo Y sperm; such sperm - for reasons unknown - might generally lose out in the competition with other sperm or the probability that an XO embryo comes to term is perhaps very small. If my memory is correct, in individuals afflicted with Turner's syndrome, where this could be examined, the X chromosome did not come from the mother but from the father.

If you could show conclusively that it is not the father's age but rather the birth order which affects the sex ratio at birth, then my note to 'Nature' would indeed be in serious trouble. This is a point which I would like to discuss with you when an opportunity arises.

With best wishes,

Sincerely yours,

Leo Szilard

UNIVERSITY OF OREGON
EUGENE, OREGON

INSTITUTE OF MOLECULAR BIOLOGY

September 8, 1960

John S. Yates
Vice President
Marc Wood International Inc.
30 Rockefeller Plaza

Dear Mr. Yates:

I wish to acknowledge your letter of August 12 and state that I approve in principle of Mr. Rinderer's proposal. To my best knowledge Professor Szilard would also approve. Regarding the specific problem of any share we have in royalties from American Sterilizer we both would like to do as have the CNRS, the Pasteur Institute, and Dr. Monod and contribute our shares toward setting up the laboratory.

Your suggestion that the group hold a plenary meeting is a wise one. I do not think it will be convenient for Dr. Szilard to attend, and I wonder if the meeting could be held here on the west coast since Monod, Cohn, and myself will be here.

Sincerely,

Aaron Novick
Director

cc: Professor Leo Szilard

lru

COPY

THE UNIVERSITY OF CHICAGO
CHICAGO 37 · ILLINOIS

THE ENRICO FERMI INSTITUTE
FOR NUCLEAR STUDIES

September 13, 1960.

Professor Aaron Novick,
Institute of Molecular Biology,
University of Oregon,
Eugene, Oregon.

Dear Novick,

I have a copy of your letter addressed to Mr. Yates dated September 8, 1960. Please note that I and Trude, to whom I have assigned my income from this arrangement, accede to the arrangement proposed by Mr. Rinderer, provided that it does not involve any refunding of royalties already received by us.

Yours,

Leo Szilard

March 17, 1961

MEMO TO L. SZILARD

This is a recapitulation of the description I gave you last week in Washington of the results that Horiuchi and I have obtained with the temperature sensitive mutant, strain E103.

This strain exhibits the novel feature of being "inducible" at low temperatures and "constitutive" at higher temperatures. Expressed in units based on a fully induced cell having an enzymatic level of two, we find that in the absence of inducer this strain has an activity of 0.01 at 14^{o}, of 0.15 at 37^{o}, and of 0.9 at 43.8^{o}. We believe that the enzyme present is uniformly distributed in the population since very low concentrations of inducer (10^{-6}M IPTG) maintain this strain where much higher concentrations are needed with the wild type strain. In the presence of inducer about the same level is observed at all three temperatures.

This constitutive character probably results from a mutation at the i locus since it is recessive to i^{+} in appropriate F lac diploids. This was shown by deriving an F^{-} strain from E103, which like E103 is constitutive at higher temperatures. Upon contact with an F^{+} strain carrying F lac ($Fi^{+}o^{+}z^{+}y^{+}$), a "diploid" is formed which is inducible at all temperatures. Need Flac/+ at 42° X

Two kinds of temperature transfer experiments have been performed. In the first type illustrated in Figure 1, bacteria growing at one temperature are suddenly switched to another. Here bacteria growing at 14^{o} are transferred to 45^{o} or 37^{o}. Note that after a slight delay, the rate of enzyme synthesis rises quickly.

At the point indicated by the red arrow the bacteria were returned to 14°. After return to 14°, the bacteria continued to make enzyme for some time before the rate falls to the low level, normally observed at 14°. The 37° sample returns sooner to the normal 14° value.

A second type of temperature transfer experiment is illustrated in Figure 2. Here an aliquot of bacteria growing at 14° was washed and placed in phosphate buffer where it could not grow. These bacteria were heated at 45° for forty minutes and then returned to the normal growth medium where they were grown again at 14°. It can be seen that enzyme is made at a high rate for almost one doubling, after which the rate falls toward the low value normally observed at 14°.

We also have made some measurements of the time required to heat the bacteria at 45° to destroy the heat-labile substance. We found that heating for times longer than fifteen minutes give no further effect. Moreover, six minutes of heating was sufficient to give what appears to be about half destruction.

To test whether the presumed substance being destroyed by heating is a protein, bacteria grown at 14° were transferred to buffer (with 5-methyl tryptophan) and heated as in Figure 2 for thirty minutes at 45°. These bacteria were then incubated at 14° in medium containing 5-methyl tryptophan to inhibit protein synthesis. After various times the bacteria are transferred to medium without 5-methyl tryptophan and incubated again at 14°. If the 5-methyl tryptophan treatment results in no enzyme production after removal of the inhibiter, then it would be concluded that

the heat labile substance is not a protein. When the experiment was performed, it was found that during the first thirty hours (which would correspond to about one generation in normal medium) the optical density almost doubles; and such thirty hour treated bacteria do form some enzyme. When the 5-methyl tryptophan treatment is extended to seventy-two hours, there is not much further increase in turbidity; but this length of treatment does prevent subsequent enzyme production. Thus, we are inclined to conclude that the heat labile agent is not a protein.

Unfortunately, it has been impossible to perform the experiment you suggested. i.e. To see whether the strain has difficulty growing on galactose or related sugars at 44° for stupid reasons. We will try soon. Incidently, I may have mentioned that this strain grows extremely slowly at temperatures above 44°. When attempts are made to grow it at 44.5°. Selection of a mutant strain able to grow much more rapidly at 44.5° occurs. Curiously, these strains no longer exhibit the relationship between temperature and enzyme level shown by the parent strain. They are inducible at all temperatures.

Aaron Novick

Growth on galactose at 42-43°
E102 growth rate at 47.5°

the heat labile substance is not a protein. When the experiment was performed, it was found that during the first thirty hours (which would correspond to about one generation in normal medium) the optical density almost doubles; and such thirty hour incubated bacteria do form some enzyme. When the 5-methyl tryptophan treatment is extended to seventy-two hours, there is not much further increase in turbidity; but this length of treatment does prevent subsequent enzyme production. Thus, we are inclined to conclude that the heat labile agent is not a protein.

Unfortunately, it has been impossible to perform the experiment you suggested. i.e. To see whether the strain has difficulty growing on galactose or related sugars at 44° for stupid reasons. We will try soon. Incidently, I may have mentioned that this strain grows extremely slowly at temperatures above 44°. When attempts are made to grow it at 44.5°. Selection of a mutant strain able to grow much more rapidly at 44.5° occurs. Curiously, these strains no longer exhibit the relationship between temperature and enzyme level shown by the parent strain. They are inducible at all temperatures.

Love, Dave

HOTEL
DUPONT
PLAZA
DUPONT CIRCLE AND NEW HAMPSHIRE AVENUE N. W., WASHINGTON 6, D.C.

$C^+ C^{*-}$
$C^- C^+$

Br 22/23 April

2

HUdson 3-6000

March 24, 1961

Aaron Novick
c/o Gerard
11 Harvard Place
Ann Arbor, Michigan

Dear Aaron:

If I understand your note from the 17th correctly, you will arrive late on March 29th and leave some time in the evening of the next day, March 30th. I have reserved a room for you for late arrival on March 29th.

Since I do not know what you had planned to discuss, I do not know how worth while it will be for you to visit Washington for such a short period of time. I have no difficulty keeping Thursday free, say, from 10:00 a.m. until 7:00 p.m., but Thursday being the middle of the week, I don't know that I can keep my mind as free and receptive for "science" as might be desirable.

It would certainly be nice to see you again, but ~~since~~ Washington is hardly on the shortest routes from Ann Arbor to Portland, and perhaps you might want to reconsider whether you should make such a detour. If you feel like it, call me collect from Ann Arbor and we can discuss this point over the telephone.

With kindest regards,

Sincerely,

Leo Szilard

P. S. Please convey my best wishes to the Gerards, whom I last saw in Moscow.

Leo Szilard
Hotel Dupont Plaza
Washington 6, D. C.

February 28, 1962

THE NEXT STEP

There seems to be a consensus among those with whom I have discussed the matter on the East Coast that the time has come for us to take the next step and to identify those who would form the Council.

The Council would, in close consultation with its Panel of Political Advisers, determine from time to time the political objectives which it regards as attainable and which it proposes to advocate.

At the outset the Council would try to identify, say, 25,000 people who would want to be members of the Movement and would want to spend 2 per cent of their income on campaign contributions. If the Council succeeds in finding a sufficiently large number of such potential members of the Movement it would proceed to set up the "Lobby," which would give guidance and advice to the members of the Movement as to how to put their campaign contributions to good use.

The Board of Directors of the Council would have five to seven members who would be elected by the Fellows. The Fellows would also choose the Panel of Political Advisers. Later on, the Fellows would elect the Board of Directors of the Lobby -- even though the Lobby may be a separate corporate entity.

The relationship between the Fellows and the Board of Directors would be similar to the relationship of the shareholders of a corporation and the board of directors of the corporation. The shareholders elect the directors of the corporation, but they are not otherwise responsible for the operations of the corporation and the officers of the corporation are appointed by the Board. Nevertheless, one may say in our case that the moral responsibility lies ultimately with the Fellows and that they assume the responsibility to see to it that what needs to get done gets done.

I propose that the Fellows be drawn from a larger group of distinguished scientisis to whom I shall refer as the Associates. The Associates would all be members of the overall committee to which I shall refer as the Committee for a Livable World. The Committee, as such, would have no jurisdiction over anything in particular, but it would meet once a year to talk things over and the Council would draw on its members for help in performing the tasks with which the Council and the Lobby may be faced.

At a later stage, after the Lobby is established, the Associates could fulfill an important function in their home communities, by helping to find good men who may be persuaded to seek the nomination and to stand for election -- with the backing of the Lobby.

* * *

During the past four months I had conversations with a number of colleagues concerning the speech, "Are We On The Road To War?" which I presented at various colleges and universities. The attached list contains the names of those who gave me reason to believe that they may be in sympathy with what I am trying to do, and I assume that they would want to lend their support to the Council. Their names are marked with a star. The attached list contains also the names of other colleagues with whom I had no personal contact lately, but to whom I have recently sent a copy of my speech and from whom I expect to have a response in the course of the next two weeks.

I propose that those whose names are contained in the attached list form the initial set of "Associates."

* * *

All Associates would be part of a panel of "Visiting Scholars and Scientists" who on occasional visits to Washington would be at the disposal of the Council and may discuss with members of the Administration, and certain key members of Congress, the political issues which are of concern to the Council. This need not involve any "extra" trips to Washington.

An Associate might serve as Fellow of the Council and might then have to attend perhaps three meetings in Washington each year.

An Associate might serve on the Board of Directors of the Council and may then have to meet with the Panel of Political Advisers in Washington, D. C., for several days -- six to ten times a year. Presumably the meetings of the Fellows would always be scheduled to coincide with the meetings of the Board of Directors, for the convenience of those Fellows who serve on the Board of Directors.

An Associate might serve on the Panel of Political Advisers and may then have to meet with the Board of Directors in Washington, D. C., for several days, six to ten times a year.

* * *

I propose to try to fix, by correspondence, the identity of the Associates and also the identity of the Fellows. It should be possible to do this because the by-laws may provide that the initial set of Associates and the initial set of Fellows be designated by the three "incorporators" of the Council.

The incorporators would name as Associates all those whose names are listed in the attachment, provided that their acceptance is received before the relevant document is executed by the incorporators. After that date the election of Associates will rest with the Fellows.

I am mindful of the need to keep the burden carried by scientists who are active in their own field of specialization at a minimum, by keeping the number of Fellows low and by having the Associates take turns in serving as Fellows, so that no one need to carry the burden of serving as Fellow for very long. However, to my mind, it is indispensable that scientists who are at the peak of their activity in their own field of specialization, do serve as Fellows.

I have somewhat arbitrarily drafted the list of Fellows which is enclosed in the hope that most of those listed would be both able and willing to serve as Fellows at the outset and to continue to serve in that capacity for a least one year. Upon receiving the responses of those listed, I would try to cut down the final list even further, if that seems advisable, to what would appear to be the practically indispensable minimum. The names of those whose response is not received by the time the relevant document is executed by the incorporators, must, of course, be deleted from the list. After that date, the election of Fellows will rest with the Fellows. I very much hope, however, that all responses will be in within two weeks.

In contrast to the Associates and Fellows, the identity of the Board of Directors and of the members of the Panel of Political Advisers cannot be settled by correspondence, because they have to be elected by the Fellows and it is preferable that the Fellows should meet for this purpose rather than be polled by mail.

* * *

As far as the Board of Directors and the Panel of Political Advisers are concerned, all I can do for the moment is to prepare the ground for the Fellows and to try to find out who would seem to be desirable as well as available.

It would seem advisable to have some non-scientists on the Board of Directors, but we should preferably choose from among those who have for a

number of years worked closely with scientists and who may be regarded both as safe and likely to be productive. My own preferences would be:

Mrs. Ruth Adams, Associate Editor of the Bulletin of the Atomic Scientists, who attended most of the Pugwash meetings, and

Professor Morton Grodzins, Chairman of the Political Science Department of the University of Chicago, who also attended many of the Pugwash meetings.

I am reasonably certain that both could be persuaded to serve.

The remaining three to five members of the Board of Directors probably ought to be drawn from among the Associates (the Fellows are, of course, all Associates and eligible to serve on the Board of Directors). In order to facilitate matters I am asking all those who may serve as Associates to write me if, because of their preoccupation with other matters or for any other reason, they would rather not serve on the Board of Directors in 1962-63, and I shall transmit the names of those who disqualify themselves in this fashion to the Fellows prior to the election of the Board of Directors.

From the point of view of economizing with the time of the scientists involved, an argument could be made in favor of drawing those members of the Board who are Associates from among the Fellows. This would cut down on the total number of extra trips to Washington that the Associates would have to make. One might, however, argue that from the point of view of spreading the responsibility among the Associates it would be better to adopt just the opposite principle. I presume the Fellows would like to be guided on this point by the views held in general by the Associates, and views communicated to me, prior to the election of the Board of Directors, would be transmitted to the Fellows.

* * *

The Panel of Political Advisers ought to consist mostly of people who are staying in Washington at present or who have earlier spent some time in Washington during the Kennedy Administration.

Gilbert Harrison, publisher of the New Republic, is a keen observer of what is going on at present and would be in a position to give good advice. I am inclined to think that he could be persuaded to serve as a member of the Panel of Advisors.

Lester Van Atta, Director of Research of Hughes Aircraft, Malibu, California, has spent about a year in the Department of Defense as an adviser

to York on disarmament, and I propose to find out whether he would be willing to be on the Panel of Advisers.

I had hoped that the two highly regarded legislative aides and administrative aides, respectively, on the Senate side, who are very much interested in what I am trying to do, would be free to serve on the Panel of Advisers, but it turns out that they would not be free to do so.

Either Roger Fisher or David Cavers, or both, of the Harvard Law School, would be valuable on the Panel of Advisers, and judging from their present interest in what I am trying to do I would assume that they would be willing to serve.

We ought to have two or three further names available in readiness by the time the Board is incorporated, and I shall try to do my best to find them.

* * *

I have tried to draft a political platform for the Council, in order to characterize its initial direction. It goes under the heading "The Premises," and you will find it attached.

The End.

February 28, 1962

List of Potential "Associates"

STANFORD UNIVERSITY

*Schiff, Leonard I.	Department of Physics
*Hogness, David S.	Department of Biochemistry
*Kaiser, A. Dale	Department of Biochemistry
*Berg, Paul	Department of Biochemistry
*Kretchmer, Norman	Professor of Pediatrics
*Holman, Halsted R.	Professor of Medicine
*Kornberg, Arthur	Department of Biochemistry
*Finn, Robert	Department of Mathematics
*Fairbank, Wm. Martin	Department of Physics
*Lederberg, Joshua	Professor of Genetics and Biology

PRINCETON UNIVERSITY

*Goldberger, M. L.	Department of Physics

HARVARD UNIVERSITY

*Meselson, Matthew	Department of Biology
Watson, James	Department of Biology
Edsall, John	Department of Biology
*Shurcliff, Wm. A.	Harvard Electron Accelerator

UNIVERSITY OF ROCHESTER

Marshak, Robert	Department of Physics

UNIVERSITY OF CHICAGO	
*Gomer, Robert	Institute of Metals
*Szilard, Leo	Institute for Nuclear Studies
YALE UNIVERSITY	
Doering, William	Department of Chemistry
UNIVERSITY OF INDIANA	
Muller, H. J.	Department of Zoology
CORNELL UNIVERSITY	
Salpeter, Edward	Department of Physics
UNIVERSITY OF CALIFORNIA - Berkeley	
*Chamberlain, O. N.	Department of Physics
*Chew, Jeffrey	Department of Physics
*Rosenfeld, Arthur	Department of Physics
*Glaser, Donald	Department of Physics
MASSACHUSETTS INSTITUTE OF TECHNOLOGY	
*Feld, Bernard	Department of Physics
THE WORCESTER FOUNDATION	
*Hoagland, Hudson	President of the American Academy of Arts and Sciences

THE ROCKEFELLER INSTITUTE

*Fox, Maurice	Associate Member

THE UNIVERSITY OF OREGON

*Novick, Aaron	Institute for Molecular Biology
*Streisinger, George	Institute for Molecular Biology
*Stahl, Frank	Institute for Molecular Biology

NATIONAL INSTITUTES OF HEALTH

*Livingston, Robert B.	Department of Neurobiology

February 28, 1962

Proposed List of Fellows

Hogness, David S.

Fairbank, Wm. Martin

Meselson, Matthew

Doering, William

Chamberlain, O. N.

Chew, Jeffrey

Glaser, Donald

Feld, Bernard

Fox, Maurice

Stahl, Frank

Livingston, Robert B.

February 22, 1962

THE PREMISES

By Leo Szilard

The following is a very rough draft of the premises on which the Council may be expected to base the statement of its general objectives, which it may issue from time to time for the guidance of the members of the Movement.

The Council would state from time to time also what it regards to be the attainable immediate objectives. No amount of political pressure brought to bear on the Administration can force the Administration to do something that no one inside the Administration wants done. It follows that for an immediate objective to be attainable it is necessary that it have some support inside the Administration. In selecting the immediate objectives it may advocate, the Council would first ascertain how much support for these objectives could be generated inside of the Administration.

* * *

The problem which the bomb poses to the world cannot be solved except by abolishing war, and the overall objective is to have an enduring peace in a livable world. This might be attainable within the next 25 years, whereas a just peace may not be an attainable objective in the predictable future and if we stubbornly persist in asking for peace with justice we may not attain either peace or justice.

It is necessary to abolish war in order to have a livable world, but it is not sufficient. In order to have a livable world we must not only have peace but also a certain minimum standard of stable and effective government, economic prosperity and individual freedom in the less developed regions of the world. The problems which this involves would of necessity come within the scope of the concern of the Council.

* * *

Conceivably, war could be abolished within the predictable future within the framework of a general political settlement through general disarmament. General disarmament does not, however, automatically rule out the possibility of war. In a generally disarmed world, with inspection going full blast, armies equipped with machine guns could spring up, so to speak, overnight.

The question of just how secure America and other nations would be in such a disarmed world would depend on the means that would be adopted in order to secure the peace. Few Americans in responsible positions have a clear notion at present of how the peace may be secured in a disarmed world, and therefore most of them remain uncertain of whether or not they would really want to have general disarmament.

The Russians are strongly motivated toward general disarmament by the economic savings which would result from it and it stands to reason that this should be so. A much larger fraction of industrial production is absorbed by arms in Russia than in America, and the needs of the consumers are satisfied to a much higher degree in America than in Russia. In the circumstances, Russia might be willing to go a long way towards reaching the kind of political settlement which is a prerequisite for disarmament, in return for obtaining general disarmament. But until such time as Americans in responsible positions become clear in their own mind that they really want disarmament they are not in a position successfully to negotiate with Russia an acceptable political settlement because they are not in a position to offer Russia the disarmament that she would want to obtain in return.

In any negotiations centering on the issue of disarmament the problem of inspection is likely to loom large. No major progress is likely to be made on this, or any other, issue involved until Americans in responsible positions are sure in their mind that they would want general disarmament under conditions which Russia could be reasonably expected to accept.

If America and Russia were able to reach a meeting of the minds on the issue of how peace may be secured in a disarmed world, such a meeting of minds could open the door to serious negotiations of the other issues involved in disarmament. This is a point which the Council may have to devote its attention.

* * *

Until such time as the peace of the world may be secured through a disarmament agreement providing for adequate inspection and means which will be adequate for securing the peace in a disarmed world, we cannot rule out the possibility that a war may break out which neither America nor Russia wants.

Reducing the probability that such a war may break out must be one of the <u>immediate objectives</u> of the Council.

1.) A war that neither America nor Russia wanted may break out as a result of an all-out atomic arms race, and avoidance of such an arms race must be regarded as an immediate political objective.

We would be provoking an all-out atomic arms race if America were to maintain the threat that in case of war with Russia she would attempt to shift the power balance in her own favor by mounting an attack against the rocket bases and the strategic air bases of Russia. There is an increasingly influential school of thought within the Administration which advocates that America should use the threat of a "first strike against bases" in case of war as an instrument of her foreign policy -- in order to deter Russia from obstructing objectives of our foreign policy. The Council must oppose this school of thought.

2.) A war that neither Russia nor America wants may break out if either America or the Soviet Union resorts to force in order to extend her sphere of influence. If America had openly intervened in the attempted invasion of Cuba by Cuban exiles and had sent in the Marines, she could have conquered Cuba but the Russians might have responded by occupying West Berlin and there is no way of telling whether or not a Russian response of this kind would have resulted in war. If a war is to be avoided that neither Russia nor America wants, both countries must refrain from resorting to force, in attempting to reach their foreign policy objectives.

3.) Quemoy and Matsu represent one of the danger spots where a war might break out, and these islands ought to be evacuated without further delay before they may come under attack.

4.) The danger of a resort to force could be reduced if America and Russia stopped fighting meaningless battles in the Cold War. In this regard America could and should take the initiative, and the Council may have to devote considerable attention to it.

* * *

If a war were to break out it could quickly escalate into an all-out war in the absence of any clear policy of how to keep the war limited until such time as it becomes possible to arrange for a cessation of hostilities. The adoption of policies aimed at preventing the escalation of a war must also be among the immediate objectives pursued by the Council.

5.) The danger that a war might escalate could be reduced if America and Russia adopted the policy of refraining from using atomic bombs in case of war unless atomic bombs were used against her. As far as manpower and economic resources are concerned, Europe is not inferior to Russia, and within three to five years Europe could build up conventional forces to a level where the West might resolve to forego the use of atomic bombs in case of war. It is rather doubtful, however, whether the outlawing of atomic bombs would be an <u>immediately attainable</u> objective, at the present time.

Moreover, the outlawing of atomic bombs in itself would not prevent an escalation of the war, for if there were a resort to force, even if at first only conventional weapons were used, subsequently the side which is about to lose the war would presumably find it impossible to abide by its pledge and would resort to the use of atomic bombs.

If there is a resort to force, the means which are employed are, of course, important, and the refraining from using atomic bombs could be a very important factor in preventing escalation. But even more important than the means employed would be the purposes for which force is employed. If force is used for the purpose of changing the power balance and thereby to attain certain foreign policy objectives, then escalation of the war may be inevitable no matter what the means that may be initially employed.

An example for this is what happened in Korea. When North Korean troops moved into South Korea, America intervened and pushed the North Koreans back to the 38th parallel. If America had been satisfied with the use of force for the purpose of making the conquest difficult and with luck to prevent it, the war would have ended at this point. But when American troops crossed the 38th parallel in order to unify Korea under free elections, the People's Republic of China intervened.

If, in case of war, escalation is to be avoided, both the American Government and the Government of the Soviet Union must clearly understand that, today, if force is used and is resisted with force, the use of force must only have the aim of preventing an easy conquest and extracting a price -- if necessary, a rather high price. The aim must not be victory or anything approaching victory; it must not be a change in the power balance that would enable either America or the Soviet Union to bring about a settlement in its own favor.

Within this frame of reference the Council would have to consider the possibility that the Administration might be willing to adopt two closely interrelated policies which might be phrased as follows:

6.) America's Atomic Strategic Striking Forces shall be maintained only for the purpose of protecting America and her allies by being able to retaliate in case either America or her allies were attacked by bombs.

7.) In case of war, if America found herself forced to use atomic bombs against troops in combat, she would do so only on her own side of the pre-war boundary as long as the Soviet Union imposed the same restraint on her use of the bomb.

* * *

THE UNIVERSITY OF CHICAGO
CHICAGO 37 • ILLINOIS

THE ENRICO FERMI INSTITUTE
FOR NUCLEAR STUDIES

Washington, D. C.
March 3, 1962

Professor Aaron Novick
Institute for Molecular Biology
The University of Oregon
Eugene, Oregon

Dear Novick:

The attached letter is meant for you and those others whose names are listed in the memo, "The Next Step". I should be very grateful to you for reading the attached letter and the enclosures, and for advising me as soon as possible whether you are willing to serve as an Associate.

I hope very much that you are not going to disqualify yourself from serving on the Board of Directors of the Council.

Sincerely,

Leo Szilard

Hotel Dupont Plaza
Washington 6, D. C.
Telephone: HUdson 3-6000

Enclosures

P.S. I am enclosing the revised and final version of my speech, which will be printed in the April issue of the Bulletin of the Atomic Scientists.

LS

Leo Szilard
Hotel Dupont Plaza
Washington 6, D. C.
Telephone: HUdson 3-6000

February 28, 1962

Dear Colleague:

Enclosed you will find a memo on the "Responses To Date."

If we just sit back at this point we will probably gradually accumulate 2 percent pledges of between 1,000 and 2,000. The question is, could we at this point go further and identify perhaps 25,000 virtual members of the Movement, pledging 2 percent of their incomes for campaign contributions. If that is done, we would be in business and we would then have to set up the Lobby to give guidance and counsel to the members of the Movement.

How do we bridge the gap between 1,000 and 25,000 pledges?

In order to do this we must be in a position to disclose the identity of the Council and its Political Advisors, and we must have some "seed money" to get started. My own guess is that we might have to spend $2.00 per pledge, which means we ought to have at the outset about $50,000 "seed money" and preferably more.

We could presumably raise this amount by going back to those whose pledges we have and ask them to give us this year perhaps 1 percent of their income to get the Council started. We could also try to raise the "seed money" through small dinners, at $300 a plate, in New York and perhaps also in Beverly Hills.

In either case it would be necessary to disclose the identity of the Council and its Political Advisors. The Council need not go into operation, however, until we have actually collected an adequate amount of "seed money."

With the above aim in view I am now grappling with the problem of guessing who the Council and its Political Advisors might be. The problem is somewhat similar to the problem of "the hen or the egg," because I cannot ask anybody to serve without telling them who the others may be who have agreed to serve. Also, both the Board of Directors of the Council and the Panel of Advisors of the Council would have to be formally elected by the Fellows of the Council, and while I may make suggestions to the Fellows I can neither make the decision for them nor predict with assurance what their decision would be.

The attached memorandum entitled "The Next Step" is an attempt to solve this insoluble problem, and my request to you is that you read it and return it to me with your comment. I particularly need to have your comment as far as

it relates to your own role. I need to know whether you would be willing to be part of this operation, and want to play the role which I tentatively have assigned to you in the attached "Next Step" or some other role, and if so, which one.

If you are willing to be part of this operation, will you please send me a very short statement about yourself to be included in a "Who's Who" to be improvised and to be used in raising the "seed money" either from those who pledged 2 percent of their income, or from those who may attend $300-a-plate dinners.

It is important that the operation of the Council be successful from the outset and we would need an Executive Officer to take over from me very soon, probably even before the Council is incorporated. Until such time as the Council assumes responsibility, such a man could operate in my name, but it is important that there should be no discontinuity and that he be able to carry on at least for a few months, on a temporary basis, after the Council takes over. I am looking around for someone who could fill this job.

Sincerely,

Leo Szilard

Enclosures:
"The Next Step"
"Responses To Date"

Leo Szilard
Dupont Plaza Hotel
Washington 6, D. C.

February 24, 1962

RESPONSES TO DATE

Between November 17 of last year and February 12 of this year, the speech "Are We On The Road To War?" was delivered at the following universities or colleges: Harvard, Western Reserve, Swarthmore College, The University of Chicago, The University of California in Berkeley, Stanford, Reed College, The University of Oregon in Eugene, and Sarah Lawrence College.

In most cases I stayed over another day to be available to interested students for further discussion. The audience turnout and response were very good with the possible exception of Western Reserve. I spoke there before a mixed audience of students and adults of about 1,800, and the student response was rather mediocre.

I expected a good response at Reed College but not at the University of Oregon; yet 1,200 people turned out there to hear the talk at 3 o'clock in the afternoon, and 200 students returned the next day to continue the discussion.

The speech was first given under the auspices of the Harvard Law School Forum. After the lecture, a copy of the speech was sent to those who asked for it and gave their name and address. We ran out of copies, and a graduate student, Mr. Michael Brower (at 3 Dana Street, Cambridge 38, Mass.) volunteered that he would mimeograph additional copies and mail them out on request (at 15¢ to 25¢ each, depending on size of order).

By January 1 he had distributed 2,300 copies, by January 15 another 3,500, by February 1 another 2,000, and by February 15 another 3,500.

Each campus mimeographed its own copies of the speech for distribution. Chicago distributed 2,500 copies to date.

The press comments were uniformly favorable. A set of press clippings is available in the office of Professor Bernard Feld in the Physics Department at the Massachusetts Institute of Technology, in the office of Professor David Hogness in the Department of Biochemistry at Stanford University, and at the office of Professor Owen Chamberlain in the Physics Department at the University of California in Berkeley. It can be also obtained from me.

A few days after I delivered the speech in Chicago, ABC's 6 o'clock Television News -- a coast-to-coast broadcast originating from New York -- devoted a few minutes to describe what I am trying to do, and ended up by saying, "We wish him good luck."

I am overwhelmed by the mail that pours in. Mrs. Ruth Adams, who recently looked through my accumulated mail, estimates that we have about 400 hard-and-fast pledges of 2 percent so far, and indications of many more.

A sample of the more interesting letters is available at the offices of Feld, Hogness and Owen Chamberlain. It can also be obtained from me.

The present disorderly procedures might yield us 1,000 or perhaps 2,000 pledges, and the interest manifested so far is sufficient to set up the Council. I presume, however, that the Council would want to identify perhaps 25,000 people by name who would pledge 2 percent of their income, before setting up the political organization that would give advice and guidance to those who pledge 2 percent of their income. For this purpose the Council might need $25,000 to $50,000 "seed money."

Groups have sprung up spontaneously in support of the "Movement" around the Austen-Riggs Center in Stockbridge, Mass., as well as around the University of Connecticut at Storrs, Conn., and I have met with some members of these groups in New York at the apartment of Arthur Penn, a Broadway director. We discussed the possibility of obtaining "seed money" for the Council by holding in New York and perhaps in Hollywood $300-a-plate dinners for 12 to 15 guests each. Mr. Arthur Penn, who would be in charge of this operation in New York, has the names of 8 persons who have volunteered to act as hosts for one dinner each.

I am being approached by representatives of the Methodist Church and the Society of Friends, and I shall discuss with them how to reach those of their members who are interested and who might want to pledge 2 percent of their income.

* * *

10 April 1962

FROM: Leo Szilard

TO: Paul Berg
Geoffrey F. Chew
Charles Coryell
William Doering
John T. Edsall
William M. Fairbank
Bernard T. Feld
Robert Finn
Maurice Fox
M.G.F. Fuortas
Donald Glaser
Marvin L. Goldberger
Robert Gomer
Hudson Hoagland
David S. Hogness
Halstead R. Holman
Dale Kaiser
Arthur Kornberg
Norman Kretchmer
Robert B. Livingston
Matthew Meselson
H.J. Muller
Aaron Novick
Arthur H. Rosenfeld
Leonard I. Schiff
William Shurcliff
Franklin W. Stahl
George Streisinger

Since I wrote to you on 28 February those listed on the attached sheet have agreed to serve as Associates of the Committee for a Liveable World. In order to take the next step we must now freeze this list and additional Associates would have to be elected by the Fellows of the Committee.

The names of those listed were all contained in my communication of 28 February with the exception of Charles Coryell and M.G.F. Fuortas. Of those who were asked to serve as Fellows all have accepted except Donald Glaser, who will serve as an Associate but not as a Fellow, and Owen Chamberlain, who will not serve in any capacity. I would propose that they be repalced by John Edsall and myself. Professor Edsall has advised me that he would be willing to serve as a Fellow.

Accordingly, the Fellows of the Committee would be those whose names are marked by an asterisk on the attached list.

For the immediate future I would propose that those Fellows who reside in Boston and Washington function as the Executive Committee. For the time being, Meselson and I would function as secretaries of the Executive Committee and clear questions of policy over the telephone with the other Fellows who reside outside of the Boston and Washington areas.

The Committee for a Liveable World is not an operating body and it will not need to handle any funds. It is the responsibility of the Fellows to set up the operating organizations that are needed, such as the Council for Abolishing War. They will elect a Board of Directors for each such organization, and the Board of Directors will appoint the officers responsible for the operation of the organization.

By now I have received the names of 1,700 persons, or couples, who have indicated strong support for the proposal contained in my speech, "Are We On The Road To War?", (of which the final version is enclosed) or have specifically pledged 2% of their income for campaign contributions. Enclosed you will find a draft of a letter which I plan to send out over my own signature, to these 1,700 persons, or couples.

If you have any comment to the above, please let me have them Air Mail, Special Delivery.

****

10 April 1962

LIST OF ASSOCIATES OF COMMITTEE for a LIVEABLE WORLD

STANFORD UNIVERSITY

Leonard I. Schiff
Professor of Physics

Dale Kaiser
Associate Professor of Biochemistry

Halstead R. Holman
Professor of Medicine

* David S. Hogness
Associate Professor of Biochemistry

Robert Finn
Professor of Mathematics

Paul Berg
Professor of Biochemistry

Arthur Kornberg
Professor of Biochemistry

* William M. Fairbank
Professor of Physics

Norman Kretchmer
Professor of Pediatrics

PRINCETON UNIVERSITY

Marvin L. Goldberger
Eugene Higgins Professor of
Theoretical Physics

HARVARD UNIVERSITY

* John T. Edsall
Professor of Biological Chemistry

* Matthew Meselson
Associate Professor of Molecular Biology

William Shurcliff
Research Fellow, Physics

UNIVERSITY OF CHICAGO

Robert Gomer
Professor of Chemistry

* Leo Szilard
Professor of Biophysics

YALE UNIVERSITY

* William Doering
Professor of Chemistry

UNIVERSITY OF INDIANA

H. J. Muller
Professor of Genetics

UNIVERSITY OF CALIFORNIA - Berkeley

Arthur H. Rosenfeld
Associate Professor of Physics

* Geoffrey F. Chew
Professor of Physics

Donald Glaser
Professor of Physics

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

* Bernard T. Feld
Professor of Physics

Charles Coryell
Professor of Chemistry

THE WORCESTER FOUNDATION

Hudson Hoagland
Executive Director

THE ROCKEFELLER INSTITUTE

* Maurice Fox
Associate Professor of Biology

THE UNIVERSITY OF OREGON

Aaron Novick
Professor of Biology

George Streisinger
Associate Professor of Biology

* Franklin W. Stahl
Associate Professor of Biology

NATIONAL INSTITUTES OF HEALTH

* Robert B. Livingston
Chief, Laboratory of Neurobiology
National Institute for Mental Health

M.G.F. Fuortas
Chief, Neurophysiology-Opthalmology Section
National Institute for Neurological Diseases
and Blindness

10 April 1962

John Smith
Department of Biochemistry
University of Nowhere
Tucson, Arizona

Dear Mr. Smith:

I am writing to you to report that about 1,700 persons, or couples, have expressed serious interest in the proposal made in my speech, "Are We On The Road To War?", (see the enclosed, final, version) and that I have now formed a committee of scientists who will assume the responsibility for setting up the organizations that will be needed. The Associates and Fellows of the Committee for a Liveable World are identified on the attached sheet.

As the Movement unfolds its members would be expected to make annually campaign contributions in the amount of 2% of their income, or 3% of their income after taxes. Supporters of the Movement would be expected to contribute either 1% of their income or $100. Students are not expected to make financial contributions.

I would be my suggestion that you expend one-half of the total contribution you may wish to make in 1962 -- depending on your preference -- either to help finance a joint Russian-American staff study on disarmament that would be conducted under the auspices of the American Academy of Arts and Sciences, Boston (see enclosed Memo, "Joint Russian-American Staff Study") or to help to win one of the more important contests for the Senate (see the enclosed Memo, "Campaign Contributions for 1962"). If you elect to make a campaign contribution our Committee will make a specific recommendation to you which would be guided by the preferences you and others may express in the questionnaire which is enclosed.

The enclosed Memo, "The Council and The Lobby", should give you most of the information you would want to have at this point. One of the first tasks of the Council will be to identify 25,000 persons, or couples, who would be willing to spend a reasonable fraction of their income on campaign contributions, in support of the general aims of the Movement. As soon as this is done our Committee would set up a political organization to advise members of the Movement on how they could be most effective.

The Council may have to spend $50,000 to identify this number of persons, or couples, and I wish to ask you whether you would be willing to help to set up the Council by giving it one-half of the sum which you are prepared to expend in the current calendar year in support of the Movement.

If you are willing to do this, perhaps you would be good enough to make out a check to the Trustees for Council for Abolishing War and to mail it to me at the Hotel Dupont Plaza, Washington 6, D.C. I have no way of handling checks made out to me personally.

Sincerely,

Leo Szilard

Reprinted from the
April 1962 BULLETIN OF THE ATOMIC SCIENTISTS

Are We on the Road to War?

LEO SZILARD

"Are We on the Road to War?" is the text of a speech which Leo Szilard has recently given at nine American colleges and universities in order to invite students to participate in an experiment. The response could show whether a political movement of the kind described in the speech would take off the ground provided it were started on a sufficiently large scale. When the BULLETIN *asked Dr. Szilard for permission to reprint the text of the speech, he agreed on condition that he may extend the experiment to the readers of the* BULLETIN. *Accordingly, those readers who believe that they would be willing to spend two per cent of their income for campaign contributions—provided that the political objectives formulated meet with their approval—are invited to participate in the experiment by writing Dr. Szilard before May 31, 1962, at the Dupont Plaza Hotel, Washington 6, D.C., giving their name and address and briefly indicating the degree of their interest. Reprints may be secured from the* BULLETIN OF THE ATOMIC SCIENTISTS, *935 E. 60th Street, Chicago 37, Illinois. Single copies, 10 cents; 25 or more, seven cents each.*

For a number of years now, you have had an opportunity to observe how we, as a nation, respond to the actions of the Russians, and how the Russians respond to our responses. Those of you who have watched closely the course of events in the past six months, may have been let to conclude that we are headed for an all-out war. I myself believe that we are, and that our chances of getting through the next ten years without war are slim.

I personally find myself in rebellion against the fate that history seems to have in store for us, and I suspect that some of you may be equally rebellious. The question is, what can you do?

War seems indeed to be inevitable, unless it is possible somehow to alter the pattern of behavior which America and Russia are exhibiting at present. You, as Americans, are not in a position to influence the Russian government; it follows that you would have to bring about a change in the attitude of the American government which, in turn, may bring about a similar change in the attitude of the Russian government.

It is conceivable that if a dedicated minority were to take effective political action, they could bring about the change in attitude that is needed. But such a minority can take effective action only if it is possible to formulate a set of political objectives on which it may unite.

Ever since the end of the war, the policies of the great powers have consistently followed the line of least resistance, and this line leads to an unlimited arms race. I do not believe that America can be made secure by keeping ahead in such an arms race.

There have been repeated attempts to stop the arms race by negotiating an agreement that would provide for some form of arms control. So far, all such attempts have failed, and each time they were followed by the continuation of the arms race, with renewed vigor.

Toward the end of the Eisenhower administration, it was generally expected that the next administration would adopt a new approach to this problem and that a fresh attempt would be made to bring the arms race under control.

When Khrushchev was in New York a year ago last October, I tried to see him, in the hope of finding out how responsive he might be to such a new approach. I was told that they had scheduled fifteen minutes for me but, as it turned out, the conversation went on for two hours. At that time, it was not known whether Kennedy or Nixon would get elected, and I started off the conversation by saying that no matter who is elected, the government would try to reach an understanding with Russia on the issue of stopping the arms race. Khrushchev answered—and he spoke in all seriousness—that he believed this also.

A year ago last November, I checked out of the hospital in New York, where I had been confined for over a year, took a taxi to the airport, and flew to Moscow to attend the sixth Pugwash Conference on Science and World Affairs. I was accompanied by my wife, who is also my doctor, and I stayed on in Moscow for about a month beyond the end of the conference. I stayed on in Moscow in order to engage in private conversations with our Russian colleagues, because I knew from experience that only in private conversations is it possible to get anything across to them or to discover what they really believe to be true.

None of our Russian colleagues brought up the issue of bomb tests in any of these conversations in Moscow, even though two years earlier some of them had been passionately interested in this issue. I found, however, an undiminished interest in far-reaching disarmament which would result in substantial savings. On one occasion, I had tea with Fedorov, the General

Secretary of the Soviet Academy of Sciences, with no one present except my interpreter. I had met Fedorov before and I always got along well with him. On this particular occasion, he spoke to me as follows:

> You must really believe me when I tell you that we want general disarmament. You have seen all this construction work going on in Moscow; it has been going on for many years; still we are not able to catch up with the housing shortage. If we had disarmament, we could not only solve this problem, but many of our other economic problems as well. Also, we could develop other nations on an unprecedented scale. So far, we are building only one hydroelectric dam in Africa—the Aswan Dam in Egypt; if we had disarmament, we could, and we would, build twenty such dams in Africa.

I tried to impress upon our Russian colleagues that the Kennedy administration would make a serious effort to reach an understanding with Russia on the issue of arms control, but that the new administration would need time—six months and more than six months perhaps—to find its bearings on this issue and to get organized to deal with it.

When I returned to this country in February, I decided to stay in Washington for a while.

In Washington, my friends told me that the government was going to make a sincere effort to reach an agreement with Russia on the cessation of bomb tests and that a reasonable proposal would be made to the Russians on this issue. They would have liked to hear from me that Russia would be likely to accept such a proposal, but coming fresh from Moscow, I had serious doubts on this score.

The invasion of Cuba took me by surprise. When I first heard about it, it was not clear, as yet, whether we were going to give air support to the invading Cuban exiles and whether we would, if necessary, send in the Marines also. My immediate reaction was that of alarm, for I believed that if we did any of these things, we would seriously risk war with Russia. I did not think that Russia would try to intervene in the Caribbean area, and I did not think that the Russians would launch long-range rockets aimed at our cities. I thought, however, that Russia might make some military move elsewhere, probably in the Middle East.

In retrospect, it would seem that I was wrong, for Tom Slick of the Slick Oil Company, in San Antonio, Texas recently set forth, apparently on good authority, that, if America had openly intervened in Cuba, at that point, Russia would have moved into West Berlin.

I would not venture to appraise just how close we came to an all-out war on the occasion of the Cuban incident. I am reasonably certain, however, that if our intervention in Cuba had been successful, this would have blocked for many years to come any possibility of reaching an agreement on arms control with Russia. Failure to reach an accommodation on the Berlin issue might, of course, produce the same result.

I would not entirely exclude the possibility of war over Berlin, but to me, it seems more probable that this crisis will be resolved by some uneasy compromise, and that it will not lead to an all-out war. Russia may bring pressure on West Berlin in order to promote any one of a number of her foreign policy objectives, but on the larger issue, the issue of Germany, the true interest of America and Russia is the same. The true interest of both countries is to have Europe politically as stable as possible.

I am convinced that the Berlin issue could be satisfactorily resolved by negotiations, but this conviction is based on the belief that there is something that the Russians want that we should be willing to give them, and that there is something that we want that the Russians should be willing to give us in return.

There are many people who do not share this belief. They hold that the Berlin issue was artificially created by Russia for the purpose of humiliating America, for breaking up NATO, and for converting West Germany into a communist state.

Many people, perhaps the majority, believe that the Russians are very much like the Nazis; that they have concrete plans for bringing about, one way or another, our total defeat in Europe, and also for subjugating the whole world to their rule.

Many people have a black and white picture of the world; they believe that the nations fall into two classes: the peaceloving nations, and those who are not peaceloving. America, France, England, and generally speaking our allies, including Germany and Japan, are peaceloving nations. Russia and China are not peaceloving nations. Twenty years ago, the situation was somewhat different: at that time, Russia was a peaceloving nation, but Germany and Japan were not.

Many people believe that ever since the atomic bomb forced the unconditional surrender of Japan, America has unceasingly tried to rid the world of the bomb, and that Russian intransigence, alone, blocked progress in this direction.

When I listen to people who hold such views, I sometimes have the feeling that I have lived through all this before and, in a sense, I have. I was sixteen years old when the first World War broke out, and I lived at that time in Hungary. From reading the Hungarian newspapers, it would have appeared that whatever Austria and Germany did was right and whatever England, France, Russia, or America did was wrong. A good case could be made out for this general thesis, in almost every single instance. It would have been quite difficult for me to prove, in any single instance, that the newspapers were wrong, but somehow, it seemed to me unlikely that the two nations, located in the center of Europe, should be invariably right, and that all the other nations should be invariably wrong. History, I reasoned, would hardly operate in such a peculiar fashion, and gradually I was led to conclusions which were diametrically opposed to the views held by the majority of my schoolmates.

Many of my schoolmates regarded me as something of an oracle because I was able to cope with the mysteries of lower arithmetic which baffled them and one of them asked me one day quite early in the war who would lose the war. I said that I didn't know who *would* lose the war, but that I thought that I knew who *ought* to lose the war; I thought that Austria and Germany, as well as Russia, ought to lose the war. Since Austria and Germany fought on one side, and Russia on the other side, it was not quite clear how this could happen. The fact is, of course, that it did happen.

I am not telling you this in order to impress you with how bright I am. Nobody at sixty can claim to be as bright as he was at sixteen, even though in most cases it is not the intelligence that deteriorates, but the character. The point I am trying to make is that even in times of war,

you can see current events in their historical perspective, provided that your passion for the truth prevails over your bias in favor of your own nation.

After the first World War, when I lived in Berlin, a distinguished friend of mine, Michael Polanyi, asked me one day what I thought ought to be the rule of human conduct regulating the behavior of an individual in society. "Clearly," he said, "you cannot simply ask a man to be generous to other people, for if the other people are mean to him, and if he follows your rule, he may starve to death." "But," said Polanyi, "perhaps the rule ought to be 'Be one per cent more generous to people than they are to you.'" This should be sufficient, he thought, because if everyone were to follow this rule, the earth would, step by step, turn into a livable place.

I told him that, to my mind, this would not work at all, because if two people behave the same way toward each other, each is bound to think that he is 30 per cent more generous than the other. Clearly, the rule would have to allow for this bias. Perhaps if we were to stipulate as the rule of conduct, "Be 31 per cent more generous to the others than they are to you" such a rule might work.

America and Russia are not following any such rule of conduct. Moreover, their bias greatly exceeds 30 per cent.

Most Americans apply a yardstick to America's actions which is very different from the yardstick which they apply to Russia's actions. Whenever their bias in favor of their own nation gets into conflict with the truth, the odds are that the bias will prevail. As a result of this, they are not capable of seeing current events in their historical perspective. They may well realize that we are in trouble, but they cannot correctly diagnose the cause of the trouble and therefore, they are not in a position to indicate what the right remedy might be.

The people who have sufficient passion for the truth to give the truth a chance to prevail, if it runs counter to their bias, are in a minority. How important is this minority? It is difficult to say at this point, for, at the present time, their influence on governmental decisions is not perceptible.

If you stay in Washington, you may gain some insight into the manner in which governmental decisions come about; you may get a feel of what kind of considerations enter into such decisions, and what kind of pressures are at work.

With President Kennedy, new men moved into the administration. Many of them understand the implications of what is going on and are deeply concerned. But, they are so busy trying to keep the worst things from happening, on a day-to-day basis, that they have no time to develop a consensus on what the right approach would be, from the long-term point of view.

There are also a number of men in Congress, particularly in the Senate, who have insight into what is going on and who are concerned, but mostly they lack the courage of their convictions. They may give a lucid analysis of the trouble in private conversations and then at some point or other, they will say: "Of course, I could not say this in public."

In Washington, wisdom has no chance to prevail at this point.

Last September, *Life* magazine printed an article about me which said that I was in Washington trying to find out if there was a market for wisdom. Thereupon, I received a flood of letters from colleges and universities inviting me to give lectures. Most people get some pleasure out of hearing themselves talk, and so do I; yet I did not see much point in going around the country giving talks, if all I had to say was that there was no market for wisdom. Therefore, I declined all these invitations; that is, I declined them all, until Brandeis University invited me to attend a special convocation and receive an honorary doctor's degree. At that point, my vanity got the better of me, and I accepted. At Brandeis, I spoke at dinner informally to the trustees and fellows of the university, and this was my closest contact with grass roots since I moved to Washington—if, indeed, you may regard the trustees and fellows of Brandeis as grass roots.

I told them at Brandeis that I thought we were in very serious trouble; people asked me what there was that they could do about it, and I had no answer to give.

Is there, indeed, anything that these people—and for that matter I, myself—could do at this point that would make sense?

When I got back to Washington, I started to think about this, and I believe it will be best now if I simply recite to you how my thoughts developed from this point on.

The first thought that came to my mind was that in cooperation with others, I could try to set up an organization in Washington—a sort of lobby, if you will—which would bring to Washington, from time to time, scholars and scientists who see current events in their historical perspective. These men would speak with the sweet voice of reason, and our lobby could see to it that they be heard by people inside the administration, and also by the key people in Congress.

The next thing that occurred to me was that these distinguished scholars and scientists would be heard, but that they might not be listened to, if they were not able to deliver votes.

Would they be listened to if they were able to deliver votes?

The minority for which they speak might represent a few per cent of the votes, and a few per cent of the votes alone would not mean very much. Still, the combination of a few per cent of the votes and the sweet voice of reason might turn out to be an effective combination. And if the minority for which these men speak, were sufficiently dedicated to stand ready not only to deliver votes, but also to make very substantial campaign contributions, then this minority would be in a position to set up the most powerful lobby that ever hit Washington.

The problem which the bomb poses to the world cannot be solved except by abolishing war, and nothing less will do. But first of all, we must back away from the war to which we have come dangerously close.

Could such a dedicated minority agree not only on the long-term political objectives which need to be pursued in order to abolish war, but also on the immediate political objectives, the objectives which must be pursued in the next couple of years, in order to make the present danger of war recede to the point where attention can be focused on the task of abolishing war?

America cannot be made secure by keeping ahead in an atomic arms race and an agreement providing for arms control is a necessary first step toward abolishing war.

An agreement on arms control does not seem to be, however, "around the

corner." It might very well be, therefore, that *in the immediate future* America would have to take certain unilateral steps. Some of the steps would be taken in order to reduce the present danger of war; other steps would be taken so that if a war breaks out, which neither America nor Russia wants, it may be possible to bring hostilities to an end before there is an all-out atomic catastrophe.

Such unilateral steps are not adequate substitutes for negotiated agreements, and they can carry us only part of the way, but still there are some unilateral steps which should be taken at the present time and I propose to discuss at this point what these steps may be.

The issue of bomb tests and the issue of bomb shelters are peripheral issues; they are more the symptoms of the trouble we are in than the cause of the trouble, and I propose to turn now to issues which I believe to be more relevant.

1.) Nothing is gained by America's winning meaningless battles in the cold war, and a change of attitude in this regard is urgently needed. Take the International Atomic Energy Agency in Vienna, for instance. This organization has at present no function whatsoever, and if it is maintained in existence at all, it should be maintained as an exercise in cooperation among nations.

The first director of this agency was an American, and his term expired recently. Since, next to America, the Soviet Union is the most important atomic power, America could have proposed that the next director of the agency be a Russian. Instead, America proposed a Swede, who was not acceptable to the Russians, and since America had the votes she was able to win one more victory in a meaningless battle of the cold war.

All this "victory" accomplished was to reduce the chances of finding some useful function for this agency, because the Russians resent being pushed around in this agency and there is no way for us to force them to play ball.

I believe that it would be important for the government to reach a major policy decision, and for the President to issue an executive order against fighting meaningless battles in the cold war.

We have a cultural exchange program with the Russians but their State Department and our State Department are playing a game of "if you hit our scientists, we shall hit your scientists." Accordingly, our State Department imposes senseless travel restrictions on our Russian colleagues who visit this country. These travel restrictions are not aimed at the safeguarding of any secrets, but are merely a way of hitting back at travel restrictions which the Soviet government occasionally imposes on American scientists who travel about in Russia.

I believe that representations ought to be made, at as high a level of the administration as is necessary, for the Secretary of State to find some other assignment in the State Department for those who have, up till now, handled the East-West Cultural Exchange Program.

2.) I believe that America could and should make unilaterally two crucially important policy decisions and that she should proclaim these decisions.

First of all, America should resolve and proclaim that she would not resort to any strategic bombing of cities or bases of Russia (either by means of atomic bombs or conventional explosives), except if American cities or bases are attacked with bombs, or if there is an unprovoked attack with bombs against one of America's allies.

Further, America should make a second policy decision and should proclaim this decision. In order to understand the meaning and relevance of this second decision, it is necessary to consider the following:

Soon after the war, when Russia did not as yet have any atomic bombs, she proposed that the bomb be outlawed. This could take the form of a unilateral pledge, given by each atomic power, that it would not resort to the use of atomic bombs, either for the purpose of attacking cities or bases, or as a tactical weapon to be used against troops in combat.

Recently, Sulzberger of the *New York Times* discussed with Khrushchev the possibility of such unilateral pledges, renouncing the use of the bomb. Khrushchev said, on this occasion, that if there were a war, even if at first only conventional weapons were used, subsequently the side which is about to lose the war would find it impossible to abide by its pledge and would resort to the use of the bomb.

This brings out what I believe to be the crux of the issue, that today it might still be possible to resist force with force, but the objective of the use of force must no longer be victory. The objective must only be to make a conquest difficult and expensive.

If force is used then an all-out war, which neither side wants, can be avoided only if both sides recognize that the use of force must not be aimed at victory, or anything approaching victory.

Keeping this point of view in mind, *America* could and *should* adopt *the policy that, in case of war, if she were to use atomic bombs against troops in combat, she would do so only on her own side of the prewar boundary.*

In case of war America would then be bound by a pledge to this effect as long as Russia imposed a similar restraint on her conduct of the war.

Manifestly, this type of use of atomic bombs would be a defensive operation and moreover, it would be a very effective defensive operation, either on the part of Russia or on the part of America, as long as the restraints remain in effect on both sides.

Such a pledge would be no less clear than the simple pledge renouncing the use of the bomb, but it would be much easier to keep and therefore it would be a more believable pledge. And if neither side aimed at anything approaching victory, then it would substantially reduce the danger of an all-out war.

When I discussed this issue in Germany three years ago, people there said that if the ground forces of the allies were pushed back to the Rhine, and America used atomic bombs against troops in combat between the Rhine and the Oder-Neisse line, many West German cities might be destroyed by American bombs. I do not know to what extent West German cities could be spared by a judicious tactical use of atomic bombs by American forces, but I do know that if America were to use bombs beyond the prewar boundary, West German cities would be destroyed by Russian bombs.

Recently, the United Nations Assembly vetoed with a more than two-thirds majority, 55 against 20, to outlaw the use of atomic bombs in war. The use of atomic bombs in warfare was declared by the Assembly to be a crime and a violation of the United Nations Charter.

Since the machinery of the United Nations was set up for the purpose of maintaining peace among the smaller nations, assuming the cooperation of the great powers to this end, attempts to regard a two-thirds vote of the Assembly as legally binding must necessarily fail. Still the United States must

not fly in the face of world opinion and simply disregard the vote of the General Assembly, when a two-thirds vote of the Assembly expresses the legitimate concern of the great majority of the nations that the use of atomic bombs in warfare might lead to a world catastrophe. Rather, out of respect for world opinion and in its own interest, the United States ought to go as far toward complying with it, as valid considerations for its own security permit. The restrictions on the use of atomic bombs in case of war which I am advocating, are advocated with this end in view.

Western Europe is not inferior to Russia either in manpower or in resources and it would be possible for Western Europe to build up within five years conventional forces to the point where it could renounce the use of atomic bombs against troops in combat in case of war. But even this would be to no avail unless the nations involved give up any thought of fighting limited wars for "limited objectives" and resort to force only to make a conquest difficult and, with luck, to prevent it.

As long as there is no agreement providing for arms control, and Russia remains in possession of large stockpiles of bombs, America has no choice but to maintain a strategic atomic striking force. However, it should maintain such a force only as protection against America or her allies being attacked with bombs. The number of bombs retained for this purpose need not be very large, and more important than the number of bombs retained is the invulnerability of the bases from which they would be launched. If these bases are invulnerable, so that no single massive attack against them could substantially damage America's ability to retaliate, then America needs to retain only enough bombs to be able to destroy in retaliation a substantial number of Russia's cities, after giving due notice to permit their orderly evacuation.

It must be made clear, however, that if America adopts the policy here advocated, she thereby renounces the threat of strategic bombing as a general *deterrent* because she could then make this threat only in case Russia would drop bombs, and drop them on *our* side of the prewar boundary.

I, personally, do not believe that America would lose much by giving up the threat of strategic bombing, because the deterrent effect of such a threat is negligible unless the threat is believable.

If America were to threaten to drop bombs on a large number of Russian cities in case of war, knowing full well that Russia would retaliate by dropping bombs on a large number of American cities, such a threat would be tantamount to a threat of murder and suicide. The threat of murder and suicide would not be a believable threat, in the context of the so-called Berlin Crisis, nor would it be a believable threat in the context of any other similar conflict in which America's rights and interests may be at stake, but not America's existence as a nation.

Those responsible for the planning of strategy in the Department of Defense would concede this much.

According to persistent press reports there is, however, an increasingly influential school of thought in the Department of Defense which holds that, in case of war with Russia, America may engage in strategic bombing, aimed at the destruction of Russian rocket bases and strategic air bases. America would not bomb any of Russia's cities if she can help it, as long as Russia did not bomb any of America's cities.

This school of thought holds that, at present, Russia does not have many long-range rocket bases and strategic air bases, that the location of many of these bases is known, and that most of them are vulnerable and could be destroyed by attacking them with bombs. By building enough long-range solid-fuel rockets (Minutemen) and submarines capable of launching intermediate range solid-fuel rockets (Polaris) America may be able to keep ahead in this game for the next five years.

Those who advocate such a policy believe that if America should succeed in knocking out, say, 90 per cent of Russia's strategic atomic striking forces, then the Russians would probably speak to us as follows: "We have enough rockets left to destroy a large number of American cities, but we know that if we did this America may retaliate by destroying all of our cities. Therefore, we are going to hold our fire and we propose to negotiate peace. We concede that the power balance has now shifted in America's favor and we are now willing to yield on a number of issues on which we took an inflexible stand prior to the outbreak of hostilities." If this were to happen America would have won a victory even though it may be a victory in a limited sense of the term only.

Naturally if there is a war and America resorts to the bombing of bases in Russia, one could not expect the Russians to sit idly by and watch America picking up step by step one base after another. It follows that America would have to start the strategic bombing of Russian bases with a sudden, massive attack and to try to destroy all vulnerable Russian bases of known location, in the first attack.

There are, of course, people in the Department of Defense who have serious doubts that America would actually carry out such a first strike against bases, in case of war, yet they believe that—at the present juncture—it is a good thing to threaten to bomb Russian bases in case of war because this is a more believable threat than the threat of "murder and suicide."

I do not know just how believable this threat is, but I do know that at best we are purchasing an increased restraint on Russia's part for a year or two, and that we are purchasing it at a very high price. For whether we adopt such a strategy or merely give Russia the impression that we have adopted such a strategy, we are provoking an all-out atomic arms race and may within a very few years reach the point of no return, in this regard.

Therefore, I believe that it is imperative to oppose: (a) the adoption of plans which call for a first strike against Russian rocket and strategic air bases in case of war, and (b) the adoption of the policy of "deterring" Russia, with the threat that America would resort to such a first strike in case of war. I believe that the rejection of both these policies is an attainable political objective because there is considerable doubt within the administration of the wisdom of these policies.

3.) *America could and should resolve that atomic bombs and the means suitable for their delivery, which are supplied by her and which are stationed in Europe, shall remain in the hands of American military units which are under American command, rather than be placed under the control of NATO.* As long as America is committed to defend Western Europe, there is no valid argument for turning over bombs to the control of other Western European nations.

Germany is going to put increasingly strong pressure on the United States government to turn over such equipment to NATO control, and I would be in favor of balancing any such pressure by bringing domestic

political counterpressure to bear on the government.

America should stand firm in opposing the production of atomic and hydrogen bombs by Germany as well as the production of means suitable for their delivery.

It is conceivable, of course, that all attempts to achieve arms control may fail and that in the end it will not be within the power of the United States to prevent Germany from producing its own bombs and rockets. At about the same time the United States may however also free herself from her commitments to defend Germany against external military intervention. But we are not concerned at this point with developments that may conceivably occur in the unpredictable future.

4.) Not every issue can be solved by Congress passing a law, and there are borderline issues where political action alone can bring no solution because the specific knowledge is lacking of how to go about the solution. The issue of general disarmament seems to be such a borderline issue.

I believe that, at the present time, little could be gained by bringing pressure on the administration to enter into formal negotiations with Russia on the issue of general disarmament, because—as they say, "You can lead a horse to the water, but you can't make him drink."

I believe that no substantial progress can be made toward disarmament until Americans and Russians first reach a meeting of the minds on the issue of how the peace may be secured in a disarmed world.

American reluctance to seriously contemplate general disarmament is largely due to uncertainty about this point. If it became clear that a satisfactory solution of this issue is possible, many Americans may come to regard general disarmament as a highly desirable goal.

On the issue of how to secure the peace in a disarmed world, progress could probably be made reasonably fast, through nongovernmental discussions among Americans and Russians. *I believe that such discussions ought to be arranged through private initiative, but with the blessing of the administration.*

The Russians know very well that America is *not* ready seriously to contemplate general disarmament and this, to my mind, explains why, in spite of being strongly motivated for disarmament, the Russian government displays in its negotiations on this issue much the same attitude as does the American government. As far as negotiations on disarmament are concerned, hitherto both governments have been mainly guided by the public relations aspect rather than by the substantive aspect of the issue.

The Soviet Union's attitude might change overnight, however, if it became apparent that America was becoming seriously interested in disarmament.

The Russians are very much aware of the economic benefits they would derive from disarmament, and I believe that the Soviet Union would be willing to pay a commensurate price for obtaining it. It stands to reason that this should be so for the Soviet Union spends on defense an even larger fraction of her industrial output than America does.

America is at present committed to protect certain territories which are located in the geographical proximity of Russia. In the case of general disarmament, America would not be able to live up to any such commitments. Disarmament would therefore be politically acceptable to America only if it is possible for her to liquidate her present commitments—without too much loss of prestige and without seriously endangering the interests of the other nations involved.

Khrushchev seems to be very much aware of this. Therefore, if it came to serious negotiations on the issue of disarmament, and if it became manifestly necessary to reach a political settlement in order to permit America to liquidate her military commitments, then the Soviet Union might go a long way toward seeking an accommodation.

5.) General disarmament may, if we are lucky, eliminate war, but it would not end the rivalry between America and Russia.

It is a foregone conclusion that American efforts toward creating an orderly and livable world will be frustrated in Southeast Asia and Africa because of our failure to devise forms of democracy which would be viable in these regions of the world. The task of devising forms of democracy which would be suitable to the needs of such areas is not a task that the government can handle. Various forms of democracy may have to be devised which are tailor-made to fit the various areas. *A major private group could tackle and ought to tackle this problem.* If it is not solved, more and more underdeveloped nations may become dictatorships; some of them may have a rapid succession of dictator after dictator and, in the end, the people may have to choose between chaos and communism.

It is a foregone conclusion that America's efforts to raise the standard of living of underdeveloped nations may be frustrated in those areas where the birth rate is high, infant mortality is high, and there is little arable land left. Improvement in the standard of living will initially lead to a fall in infant mortality, and if the birth rate remains high, the population will shoot up so rapidly that economic improvements will not be able to catch up.

Our failure to develop biological methods of birth control, suitable for the needs of such areas, is responsible for this state of affairs. The development of such methods is not a task which the government can undertake. The government could not create research institutes which would attract scientists who are ingenious and resourceful enough to come up with an adequate solution. *A major private group could and should tackle this problem.*

If it should turn out that it is possible to formulate a set of political objectives on which reasonable people could generally agree, and if these objectives could count on the all-out support of a sizable and dedicated minority, then I should be impelled to go further, and I would plan to go further along the following lines:

I would ask about fifteen distinguished scientists to serve as fellows of a council which might be called Council for Abolishing War or perhaps Council for a Livable World. The fellows (who are all scientists) would elect the board of directors, but membership on the board would not be restricted to scientists.

This council would, first of all, assemble a panel of political advisors, and then in close consultation with these advisors, it would formulate two sets of objectives. To the first set belong those objectives which cannot be attained at the present time through political action because it would take further inquiry, and perhaps even real research to know, in concrete terms, what needs to be done. To the second set belong those objectives which can be pursued through political action because it is clear what needs to be done.

The fellows of the council would

set up a research organization aimed at the pursuit of the first set of objectives, and they would elect the trustees of that organization. The fellows of the council would also set up a political organization aimed at the pursuit of the second set of objectives, and they would elect the board of directors of that organization. Because one of the major functions of the second organization would be to lobby, we may refer to it for our purposes as the lobby.

The council would hold hearings, perhaps one every four months, and would subsequently proclaim in detail the immediate political objectives it proposes to advocate. It would communicate these objectives, perhaps in the form of a series of pamphlets, to all those who are believed to be seriously interested. Those who regularly receive the communications of the council would be regarded as members of the movement, if they are willing *actively* to support *at least one* of the several specific objectives proclaimed by the council.

It seems to me that there is no need to enlist those who are interested as members of an organization. What one needs to create is not a membership organization, but a movement.

The articulate members of the movement would be expected to discuss the relevant issues with editors of their newspaper and various columnists and other opinion makers in their own community. They would be expected to write to, and in other ways keep in touch with, their congressman and the two senators of their own state.

One of the functions of the lobby would be to help the members of the movement clarify their own minds on the political objectives they wish actively to support.

The members of the movement would be regarded as pledged to vote in the primaries as well as in the elections. As far as federal elections are concerned, they would be pledged to cast their vote, *disregarding domestic issues,* solely on the issue of war and peace.

The members of the movement would be regarded as pledged annually to spend two per cent of their income on campaign contributions. The members would be asked to make out a check payable to the recipient of the campaign contribution but to mail that check to the Washington office of the lobby for transmission. In this manner the lobby would be in a position to keep track of the flow of campaign contributions.

Those in high income brackets may be left free to contribute three per cent after taxes rather than two per cent before taxes.

All members of the movement would be free to wear an emblem that would identify them as members of the movement, if they wish to do so.

Those who can not spend two per cent of their income on campaign contributions may regard themselves as supporters of the movement if they spend either one per cent of their income or $100 per year, according to their preference. Such supporters of the movement may receive the advice and guidance of the lobby on the same terms as the members of the movement.

So that each member of the movement may know where his contribution should go, in order to be most effective in furthering the political objectives which he has chosen to pursue, the lobby would keep in touch with each member. The lobby would keep the members informed about the particular contests for seats in Congress which are of interest to the movement; but it may advise one member to take an interest in one of these contests and another member to take an interest in another of these contests.

For covering the operating expenses of the lobby and the research organi-

zation (which would be maintained independently from and operated parallel to the lobby), one would look to the members of the movement. Each year a certain group of the members would be asked by the lobby to contribute two per cent of their income to it, rather than to spend it for political contributions. One year this group might be composed of those whose names start with the letter "C." Another year it might be composed of those whose names start with the letter "R," etc.

The movement must not wield the power that it may possess crudely. People in Washington want to be convinced, they do not want to be bribed or blackmailed. He who gives consistently financial support to certain key members of Congress, may evoke their lasting friendship and may count on their willingness to listen to him as long as he talks sense. He who talks to members of Congress, but does not talk sense, will not accomplish anything of lasting value, even if he temporarily sweeps some members of Congress off their feet by making huge political contributions to them.

There are many intelligent men in Congress who have insight into what goes on; the movement could help these men to have the courage of their convictions. There are others in Congress who are not capable of such insight; the only thing to do with them is not to return them to Congress, and to replace them with better men. This may make it necessary to persuade better men to run in the primaries and to stand for election. To find such better men must be one of the main tasks of the movement, and the lobby must be prepared to help members of the movement to perform this task.

I did not come here to enlist any of you in such a movement or to launch such a movement. I came here to invite you to participate in an experiment that would show whether such a movement could be successfully launched.

First of all, I ask each of you to look into your own heart and try to discover whether you yourself would want to participate in a political movement of the kind described, provided the objectives—as formulated from time to time—appeal to you and you thought that the movement could be effective.

Those of you who wish to participate in the experiment are asked to show a copy of this speech to people in your home community who might be interested and to determine who of these would be likely to be part of a dedicated minority that would give all-out support to a movement of the kind I have described.

I would appreciate your writing me, as soon as possible, how many people you have talked to and how many of these and who of these (name and address), you think, could be counted upon.

If the result of this experiment indicates that such a movement could get off the ground, provided it were started in the right way and on a sufficiently large scale, then the Council for Abolishing War would be constituted. Presumably the council would attempt to identify 25,000 individuals who would be willing to make campaign contributions in the amount of two per cent of their income. Presumably, if the council is successful in this, the fellows of the council would proceed to establish the lobby.

By the time the movement attains 150,000 members it would presumably represent about $20 million per year in campaign contributions or $80 million over a four year period.

Whether such a movement could grow further and come to represent not only a decisive amount in campaign contributions but also a significant number of votes, would then presumably depend on the future course of world events.

AARON NOVICK
INSTITUTE OF MOLECULAR BIOLOGY
UNIVERSITY OF OREGON
EUGENE, OREGON

MEMORANDUM

From: Leo Szilard

May 5, 1964

To: Warren Weaver
Aaron Novick
Jack Sadler
E.P. Wigner
Edward Teller
George Beadle
H. Stanley Bennett
Michael Fuortes
Leo H. Bartemeier
Cody Webb
D.A. Sholl
Sidney Brenner
H.F.C. Crick

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 simultaneously, 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

Not For Release

Preprint of an article scheduled to appear in
the June issue of the Proceedings of the
National Academy of Sciences

On Memory and Recall* - Part I

by Leo Szilard

The Salk Institute for Biological Studies
La Jolla, California

The subject of this paper is a hypothetical biological process on which the capability of the Central Nervous System to record and to recall a sensory experience might conceivably be based. It may be open to doubt whether one knows enough about the living cell to be able to say anything with reasonable assurance about the molecular processes that the brain employs. Still, with luck, one might perhaps guess correctly the general nature of these processes. To what extent we may have succeeded in doing so, remains to be seen.

The Efficacy of a Synapse Bridging Two Neurons: The neural network models which we shall be using here are based on excitatory neurons, as well as inhibitory neurons of one particular kind, the kind having post-synaptic inhibitory action.

Let us consider an excitatory neuron which contacts through a synapse another neuron. If such an excitatory neuron sends a volley of nerve impulses to this synapse, then a certain quantity of an excitatory "transmitter substance" is released in the vicinity of the pre-synaptic membrane which diffuses across a gap - the synaptic cleft - into the post-synaptic neuron and raises the level of excitation of that neuron by a certain amount. We shall designate this excitatory transmitter substance as "acetylcholine" - in quotes. The "acetylcholine" which diffuses into the post-synaptic neuron is destroyed, in the vicinity of the post-synaptic membrane, by an enzyme which we shall designate as "choline esterase" - in quotes.

The rate at which "acetylcholine" is released in the vicinity of the pre-synaptic membrane is a function of the frequency of the nerve impulses which reach the synapse and we shall designate this rate as the "signal intensity". For the sake

---

*This work was supported by a research grant, administered by the University of Chicago, of the Division of General Medical Sciences of the National Institutes of Health.

of simplicity, we shall assume that the "signal intensity" is for all synapses the same function of the frequency of the nerve impulses which are fed into the synapse.

The rate at which "acetylcholine" is destroyed in the post-synaptic neuron is proportional to the product of the concentration of "acetylcholine" and the concentration of the enzyme "choline esterase" in the vicinity of the post-synaptic membrane. Therefore, if, at a given point in time, nerve impulses of a certain frequency begin to arrive at a synapse, the "acetylcholine" concentration will begin to rise and will asymptotically approach a limit in the vicinity of the post-synaptic membrane, which is proportional to the "signal intensity" and inversely proportional to the concentration of "choline esterase", prevailing in the vicinity of the post-synaptic membrane. The "acetylcholine" concentration which is asymptotically approached at the post-synaptic membrane constitutes the "excitatory input", which is received from the synapse by the post-synaptic neuron. On this basis we may then say that, for any given "signal intensity", the excitatory input received from a given synapse by the post-synaptic neuron is inversely proportional to the "choline esterase" concentration prevailing in the vicinity of the post-synaptic membrane of that synapse.

We assume that the enzyme "choline esterase" is inactivated at the post-synaptic membrane in different synapses at different rates and that this rate of inactivation is determined by the chemical specificities of the two neurons which are bridged by the synapse. We shall assume, for the sake of simplicity, however, that the enzyme "choline esterase" is produced at the same rate in all excitatory neurons.

We designate as the "efficacy" of the synapse the "excitatory input" which a post-synaptic neuron receives from that synapse per unit of "signal intensity". On the basis of the above assumptions we may then say that the efficacy of the synapse is proportional to the rate at which "choline esterase" is inactivated at the post-synaptic membrane which, in turn, is determined by the chemical specificities of the two neurons which are bridged by the synapse.

The Rate of Inactivation of "Choline esterase": We assume that neurons which differ from each other in their response-specificity contain a different set of certain specific proteins in their cell membrane. We shall refer hereafter to these proteins as the "specific membrane proteins".

We postulate that to each "specific membrane protein", there exists a complementary specific membrane protein and that a specific membrane protein molecule can combine with its complementary counterpart, just as an antibody molecule can combine with a molecule of its antigen. Accordingly, two complementary specific membrane proteins may behave as if they were, so to speak, each other's antibodies, as well as each other's antigens.

When an antibody molecule combines with an antigen molecule it undergoes an allosteric transition and an antibody molecule, when it is thus "dimerized", can bind complement. We assume that quite similarly a molecule of a "specific membrane protein", when it combines with its complementary counterpart, undergoes an allosteric transition and, when it is thus "dimerized", it can bind - and not only bind but also inactivate - the enzyme "choline esterase".

The gap (synaptic cleft) between the pre-synaptic membrane and the post-synaptic membrane is estimated to be about 200 Å wide. According to the notions here adopted, there must be, however, a number of places within the active zones of the two synaptic membranes at which this gap is narrowed down, so that the pre-synaptic membrane and the post-synaptic membrane are in physical contact. We assume that at such a point of contact, a molecule of a "specific membrane protein", located in the post-synaptic membrane, can "dimerize" across the synaptic gap, with its complementary counterpart, located in the pre-synaptic membrane. The number of such "dimers", contained within the active zone of the synaptic membranes, would then determine the rate at which the enzyme "choline esterase" is inactivated at the post-synaptic membrane.

Let us now consider two neurons, A and B, which are bridged by a synapse. Neuron A is characterized by a set, (a), of specific membrane proteins, which are present

in its cell membrane and neuron B is characterized by another set, (b). We shall designate as the "overlap number" of these two neurons the number of specific membrane proteins contained within the set (a) which have their complementary counterpart contained within the set (b) [or vice versa].

From this overlap number we may compute the "efficacy" of the synapse which bridges these two neurons. In order to simplify this computation we shall assume that the area of the active zone of the synaptic membrane is the same for all synapses, and also assume, that the concentration of each "specific membrane protein" in the cell membrane is the same for any given neuron. On the basis of these simplifying assumptions, we may then say that the number of "dimers" contained within the active zone of the membrane of a synapse, which bridges neuron A and neuron B, is determined either by the ratio of the "overlap number" to the total number of specific membrane proteins of neuron A, or by the ratio of the "overlap number" to the total number of specific membrane proteins of neuron B - whichever ratio is smaller. We shall designate the smaller one of these two ratios as the "overlap fraction" of the neurons A and B. Accordingly, we may then say that the "efficacy" of a synapse bridging two neurons is proportional to the overlap fraction of the two neurons. This is the first fundamental postulate of our model.

We assume that the same holds true also for the synapses of our inhibitory neurons, except that in this case the "transmitter substance" which diffuses across the synaptic gap into the post-synaptic neuron lowers, rather than raises, the level of excitation of the post-synaptic neuron.

The Transprinting of Neurons: We divide neurons of the Central Nervous System into two broad classes: the "congenitally-determined" neurons and the "memory" neurons. We designate the neurons which attain their full chemical specificity of their cell membrane during the development of the individual (mostly during embryonal life and at the latest during the early post-natal period) as "congenitally-determined" neurons. If all the neurons of the Central Nervouse System were of this sort then

the individual would not be able to learn and his behavior would be wholly governed by the inborn reflexes. According to the notions here adopted, an adult can learn, and recall what he has learned, because his Central Nervous System contains "memory neurons" and each of these can, once in a lifetime, acquire an additional set of specific membrane proteins, through a process which we designate as "transprinting".

We assume that there is a class of "congenitally-determined" neurons which are capable of participating in the transprinting of a memory neuron and that if a "congenitally-determined" neuron of this class fires, then those parts of its cell membrane (covering the boutons of the branch fibres of its axon), which form the active zones of the pre-synaptic membranes become permeable for the specific membrane proteins. Similarly, we assume that when a memory neuron fires, then those parts of the cell membrane, (covering its cell body and its dendrites) which constitute the active zones of the post-synaptic membranes, become permeable for the specific membrane proteins. Accordingly, if a "congenitally-determined" neuron of this class contacts a memory neuron through a synapse and if both neurons fire "simultaneously" so that for a period of time both the pre-synaptic and the post-synaptic membrane is permeable for the specific membrane proteins, then the specific membrane proteins of the pre-synaptic "congenitally-determined" neuron will diffuse through the pre-synaptic and the post-synaptic membrane into the post-synaptic memory neuron. We postulate that if a specific membrane protein penetrates in this fashion into a memory neuron it induces in the memory neuron the complementary specific membrane protein - just as an antigen induces its antibody, if it penetrates into certain lymphatic cells of the rabbit.(1) If several such pre-synaptic neurons fire simultaneously with the memory neuron, then the memory neuron will on such an occasion acquire the sets of specific membrane proteins which are complementary to the sets of all of these pre-synaptic neurons.(2) This is the process of transprinting. Its occurrence as an "all or none" process, constitutes our second fundamental postulate.

(1) H.S. Anker, Nature, 188 938, 1960
Leo Szilard, Proc. Nat. Acad. Sc. March, 1960

We shall refer to memory neurons before they are transprinted, as "transprintable" neurons, and, thereafter, we shall refer to them as "transprinted" neurons. "Transprinted" neurons resemble "congenitally-determined" neurons, in that they may transprint "transprintable" neurons.

If a neuron participates in the transprinting of a "transprintable" neuron then we may expect this neuron and the "transprinted" neuron to have a large overlap fraction and, accordingly, we may expect synapses bridging these two neurons to have a high efficacy.

The Conditioned Response: In order to illustrate how transprinting may take place, we shall use as an example, the classical (Pavlovian) conditioning of the salivary reflex of the dog.(3) We shall indicate on this occasion, however, only rather sketchily what takes place during conditioning.

When "food" is introduced into the mouth of a dog, the dog responds with salivation. This is the inborn, or unconditioned, response. Let us now expose the dog to a compound stimulus which has an auditory, as well as a visual, component and let us - before the compound stimulus is turned off - place "food" into the mouth of the dog. If, after several such "conditioning exposures", the dog is then presented for the first time with the compound stimulus, unreinforced on this occasion by the introduction of "food" into its mouth, the dog may be expected to salivate. This is the conditioned response.

We assume that there is a neuron F in the Central Nervous System, characterized by the set (f), which preferentially responds to the stimulus of "food in the mouth". Moreover, we shall assume, in particular, that the signal to which the neuron F responds is the "onset" of this stimulus.

As shown in Figure 1, the neuron F is connected through a synapse to an Effector neuron, which innervates the salivary gland. This Effector neuron is characterized

---

(2) No neuron may, however, incorporate into its cell membrane the complementary counterpart of a specific membrane protein which its cell membrane already contains.

(3) I.P. Pavlov, Conditioned Reflexes, Oxford University Press, 1927.

by the set $(\bar{f})$, where $(\bar{f})$ denotes a set of specific membrane proteins which is complementary to the set (f). Because the overlap fraction of the neuron A and the Effector neuron is one, the synapses which bridge these two neurons have a high efficacy. Therefore, placing "food" into the dog's mouth may be expected to cause the dog to salivate.

In order to account for the conditioned response, we postulate the existence of a number of groups of transprintable neurons E. Each of these groups may consist of several hundred neurons E, all of which have the following in common. The neuron F contacts through a synapse each of the neurons E and in turn each neuron E contacts, through a synapse, an inter-neuron $\bar{FI}$ [characterized by the set $(f)+(\bar{i})$] which in turn contacts, through a synapse, the Effector neuron.

Until something happens which is "significant" from the point of view of the salivary reflex, all the transprintable neurons E are repressed, because they are inhibited by signals which are continuously being sent out by the inhibitory neurons $\bar{E}^*$ [characterized by the set $(\bar{e})$]. This inhibition is assumed to be strong enough to prevent a transprintable neuron E to fire, even if it should receive a substantial aggregate "excitatory input", because the overlap fraction of the inhibitory neuron $\bar{E}^*$ and of the transprintable neuron E is one. It should be noted, however, that after the neuron E is transprinted and acquires a set of specific membrane proteins which is composed of a large number of such proteins, then its overlap fraction with the inhibitory neuron $\bar{E}^*$ is reduced by a substantial factor and the efficacy of the synapse bridging the two neurons is also reduced by the same factor. Accordingly, such a "transprinted" neuron E may be caused to fire in spite of receiving inhibitory signals from the neuron $\bar{E}^*$.

The transprintable neurons E get de-repressed if the inhibitory neuron $\bar{E}^*$ is inhibited by signals emanating from a neural network designated as the "Derepressor". This will happen if the Derepressor sends out signals which are sufficiently strong to excite the inhibitory inter-neuron E**, which in turn will inhibit the inhibitory

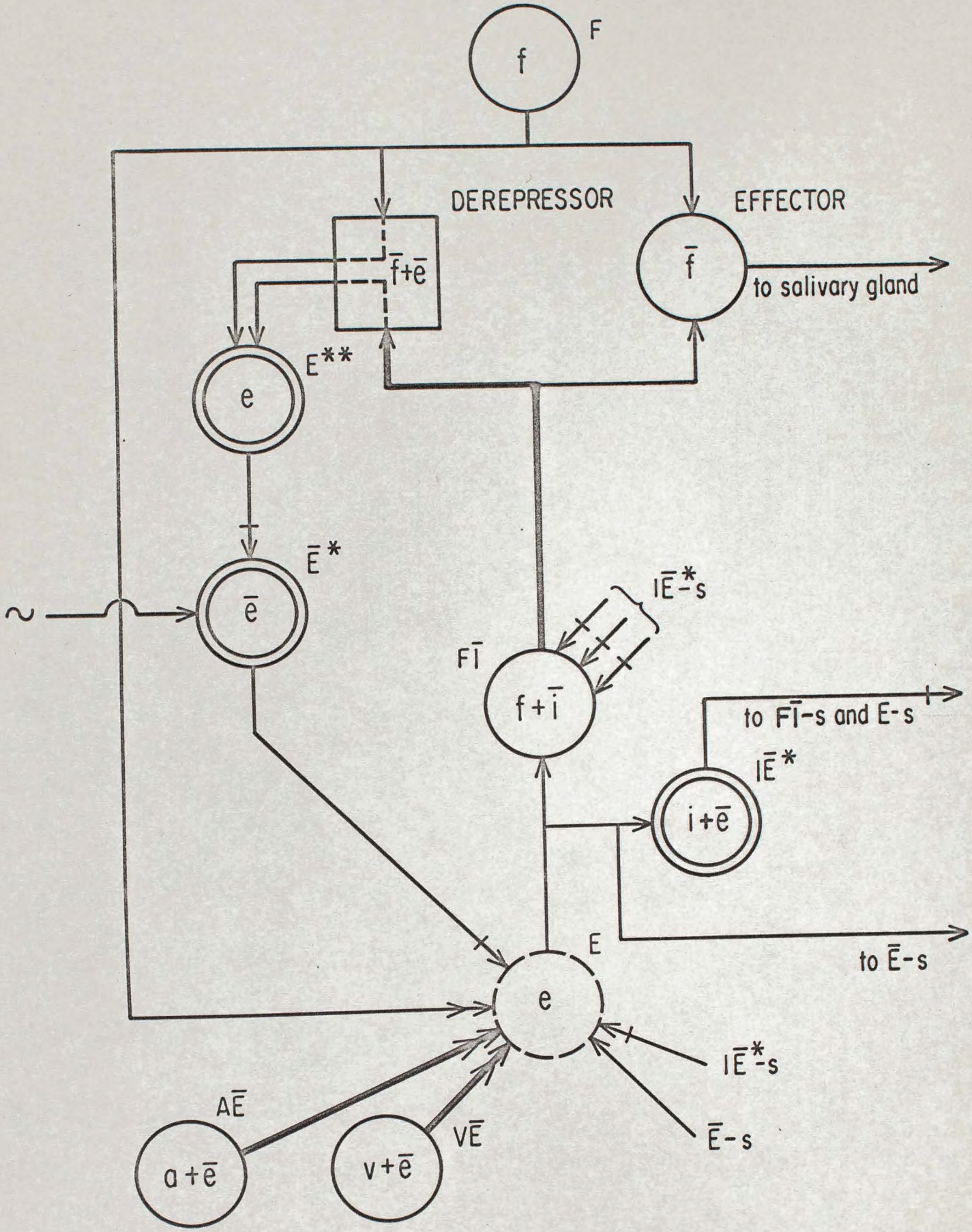


Figure 1: Excitatory neurons are represented by circles and inhibitory neurons are represented by double circles. Excitatory synapses are represented by simple arrows, except if they belong to neurons which are capable of transprinting, in which case they are represented by double arrows. Inhibitory synapses are represented by arrows with a crossbar. The transprintable neuron E is represented by a dotted circle.

neuron $\overline{E}^*$. The Derepressor network may receive an input signal from the neuron F and it may also receive an input signal, via the inter-neuron $\overline{FI}$, from neurons E. These two input signals counteract each other within the Derepressor, however, and they cancel out if the intensity of both input signals is about the same. Accordingly, the Derepressor will send out strong signals only if the intensities of these two input signals differ from each other substantially. In our second paper we shall describe a very simple "neural network" which would function in this fashion.

As will be seen later, the Derepressor network may be expected to send out strong signals if "food" is introduced into the mouth of an inconditioned dog and to send out strong signals also when a dog, whose salivary reflex has been fully conditioned to a certain stimulus, is presented with that stimulus, without having, on this occasion, "food" placed into its mouth. The Derepressor network will not send out signals, however, if the fully conditioned dog is presented with the correct stimulus and "food" is placed into its mouth. Accordingly, no additional neurons E would be transprinted as the result of such "routine exposures".

It is probably generally true that a sensory experience is recorded only if there is "significance" attached to that experience. In our model of the conditioned salivary reflex there is "significance" attached to the stimulus "food in the mouth" for an unconditioned (or not fully conditioned) dog, while for a fully conditioned dog, there is "significance" attached to the conditioned stimulus, but only if that stimulus is not accompanied by the signal "food in the mouth".

We shall try to indicate next in what manner a conditioned salivary response may be established to a compound stimulus which has a visual and an auditory component. To this end we assume that in the Central Nervous System there is a neuron $\overline{AE}$ which responds preferentially to the auditory component of the compound stimulus, and another neuron $\overline{VE}$ which responds preferentially to the visual component. These two neurons are characterized by the sets $(a) \dashv (\overline{e})$ and $(v) \dashv (\overline{e})$ respectively. We assume that the number of different specific membrane proteins contained in the neurons $\overline{AE}$ and $\overline{VE}$, which we designate by $n(\overline{AE})$ and $n(\overline{VE})$, respectively, are large

compared to the number of different specific membrane proteins contained in the transprintable neuron E, which we designate by n(E). Accordingly, we have: $n(\overline{AE}) \geq n(E)$, and $n(\overline{VE}) \geq n(E)$.

We assume that, out of a group of several hundred neurons E, a certain fraction is contacted through a synapse by the neuron $\overline{AE}$, a certain fraction is contacted through a synapse by the neuron $\overline{VE}$ and a certain fraction is contacted by both the neuron $\overline{AE}$, as well as the neuron $\overline{VE}$. Because the neuron $\overline{AE}$, as well as the neuron VE has an appreciable - even though small - overlap fraction with the transprintable neurons E, we may assume that if either of these two neurons fires, or if both of them fire, at a time when the transprintable neurons E are de-repressed, then one or more transprintable neurons E will fire also and will on that occasion be transprinted by the neurons $\overline{AE}$ or $\overline{VE}$ or both. If, at the same time, the neuron F fires also, then these same neurons E will be transprinted also by the neuron F. The firing of neuron F alone would, however, not cause the neuron E to fire, even when the neurons E happen to be de-repressed, because the neurons F and the transprintable neurons E have zero overlap.

If the unconditioned dog is for the first time exposed to the compound stimulus, and at the same time "food" is introduced into its mouth, the Derepressor network will send out a strong signal and one, or several, of the transprintable neurons E will be caused to fire. These neurons E will then be transprinted, on this occasion, with the sets $(\overline{f})$, $(\overline{a})$ and $(\overline{v})$. If this dog is exposed, for the second time, to the compound stimulus and at the same time "food" is introduced into its mouth, then the signal sent out by the Derepressor network will be somewhat weaker than the first time. This is so because the neurons E which have been transprinted, at the time of the first conditioning exposure, and which will be excited at the time of the second exposure, have a large overlap fraction with the inter-neuron $\overline{FI}$ and will, therefore, send a signal to the Derepressor network which counteracts the signal received by this network from the neuron F. As the conditioning process is continued and the dog is repeatedly subjected to such "conditioning exposures", the neurons E which are trans-

printed with the sets $(\bar{f})$, $(\bar{a})$ and $(\bar{v})$ will increase in number. Finally, the Derepressor network will no longer send out a signal when the dog is exposed to the compound stimulus and at the same time "food" is introduced into its mouth. Such a dog is then fully conditioned and continuing the conditioning exposures would not make the conditioning any deeper.

Let us now expose such a fully conditioned dog to the compound stimulus, unreinforced on this occasion by the introduction of "food" into its mouth. The neurons E which have been transprinted during the previous conditioning exposures, with the set $(\bar{f})$, as well as the sets $(\bar{a})$ and $(\bar{v})$ will now be caused to fire. Because of the substantial overlap of the transprinted neurons E, which contain the set $(\bar{f})$, with the inter-neuron $\bar{FI}$, the firing of the neurons E will lead to the firing of the inter-neuron $\bar{FI}$ and this in turn will lead to the firing of the Effector neuron. Accordingly, on the occasion of this unreinforced exposure of the dog to the compound stimulus, the dog will salivate. This is the conditioned response.

Incidentally, on this occasion when the inter-neuron $\bar{FI}$ fires, it will cause the Derepressor network to send out a strong signal because this network does not receive on this occasion a signal from the neuron F. Accordingly, on this occasion, one or more neurons E will get transprinted with the sets $(\bar{a})$, or $(\bar{v})$ or both, but none of them will be transprinted with the set $(\bar{f})$. Therefore, if the dog is repeatedly exposed to the compound stimulus in such a fashion, i.e. without reinforcement, then the number of neurons E which are transprinted with the sets $(\bar{a})$ or $(\bar{v})$ or both, but not with the set $(\bar{f})$, will increase on each such occasion. The overlap fraction of these transprinted neurons E with the inter-neurons $\bar{FI}$ is zero and therefore, the excitation of these transprinted neurons E would not contribute to the excitation of the Effector neuron. Their activation would, however, contribute to the excitation of the inhibitory neurons $\bar{IE}^*$, with which the neurons E have an appreciable overlap. This is the reason why the accumulation of neurons E which are transprinted with $(\bar{a})$ or $(\bar{v})$ or both, but not with $(\bar{f})$, will extinguish

the previously established conditioned response to the compound stimulus.

Note to the First Model:

One more thing needs to be said at this point: It seems to be a fact that if we establish a conditioned salivary response in the dog to a compound stimulus, which has an auditory as well as a visual component, and if we subsequently extinguish the response, say to the visual component, we thereby automatically extinguish the conditioned response to the auditory component also. It can be shown that, in order to account for this fact, we must assume in our model that the Central Nervous System contains, in addition to a number of neurons E which are characterized by the set (e), an about equal number of neurons $\overline{E}$ which are characterized by the complementary set $(\overline{e})$, and that the neurons E, characterized by one of these two sets, must contact through synapses the neurons $\overline{E}$, characterized by the complementary set (and vice versa). Presumably, this would mean that quite generally neurons characterized by complementary sets of specific membrane proteins must be present in about equal numbers in the Central Nervous System of each individual.

The Second Model: We may escape this complication (if a complication it is), by assuming that every specific membrane protein is complementary to itself. According to this second, alternative, model, any set of specific membrane proteins is then identical with the complementary set of specific membrane proteins. Thus we may write (e) in place of $(\overline{e})$ and (f) in place of $(\overline{f})$, etc. Accordingly, in our second model, the overlap number of two sets is then defined as the number of specific membrane proteins which the two sets have in common and when transprinting takes place, the "transprinted" neuron incorporates the sets of specific membrane proteins of the transprinting neurons. Whatever functions neural networks, of the kind represented in Figure 1, would be capable of fulfilling on the basis of our first model, they would fulfill on the basis of our second model also, and the remainder of our discussion will be couched in terms of this second model, rather than the first one.

The Orderliness of the Inborn Code: According to the notions here adopted, we assume that two neurons in the Central Nervous System, which preferentially respond to two different sensory stimuli that "resemble" each other, must have a

large overlap number. We assume that in the code of the "congenitally-determined" neurons there is an orderly transition to smaller and smaller overlap numbers, as we go from one neuron to other neurons which differ from it more and more in their response-specificity. If it were otherwise, our model could not account for the phenomenon of the "generalization of stimuli" in the conditioned salivary reflex of the dog, first described by Pavlov.

Postscript: If our two fundamental postulates are correct, then it ought to be possible to devise a neural network which would fully account for the phenomena exhibited by the conditioned responses of the autonomous nervous system. (The network described by Figure 1 represents a first attempt in this direction). If one wanted to see, however, whether higher mental functions could be explained on the basis of our two fundamental postulates, then one would first have to invent adequate neural networks. Thus, if one wanted to see whether one could explain on this basis the mental functions which man is capable of performing, but the primates are not, one would perhaps have to invent the very same networks which are contained in the brain of man, but not in the brain of the primates. Clearly, this would be no mean task.

The "mental capacity" of suitable neural network models, operating on the basis of our two fundamental postulates, might be very high. For instance, the recording of information such as may be contained in a "simple sentence" would have to tie down only one "transprintable" neuron. Thus, if one were to expose an individual to a simple sentence every four seconds, twenty-four hours a day, and if, on each such occasion, one would tie down one "transprintable" neuron, then one would tie down just about 10^9 neurons, over a period of one hundred years. This is about one tenth of the number of neurons to be contained in the human brain.

THE END

ARE WE ON THE ROAD TO WAR?

Note to the speech of Dr. Leo Szilard

If you have read a copy of this speech--written for a number of university audiences--you may want to participate in the proposed experiment. If you wish to do this, you are asked:

(a) to look into your heart and try to discover whether you, yourself, would want to participate in a political movement of the kind described, provided the objectives--as finally formulated--appealed to you and you thought that the movement could be effective.

(b) to show Dr. Szilard's speech to people who might be interested and to determine who of these would be likely to form part of a dedicated minority that would give strong support to a movement of the kind described by Dr. Szilard.

(c) to write to Dr. Szilard, Hotel Dupont Plaza, Washington 6, D.C. as soon as possible telling him if you will support such a movement yourself, and advising him to how many people you have talked and how many of these and who of these (with names and addresses) you think could be counted upon.

You can get additional copies of this speech from: Michael or Barbara Brower, 3 Dana Street, Cambridge 38, Mass., Telephone Eliot 4-1371, at 25 cents each for 1-10 copies, plus 15 cents each for all additional copies.

About the Author of this Speech

The following note is taken from Dr. Szilard's book, The Voice of the Dolphins. Containing five stories of political and social satire, this book was published in 1961 by Simon and Schuster in paper for $1.

"Dr. Leo Szilard was among the first to conceive of the possibility of an atomic chain reaction and to recognize what it would mean to the world. The first patent issued in America in the field of atomic energy was issued jointly in his name and the name of the late Enrico Fermi. With Professor E.P. Wigner he shared the Atoms for Peace Award for 1959.

"In 1939 Szilard took the initiative in inducing the U.S. Government to assume responsibility for the development of atomic energy. The historic letter which Albert Einstein wrote on August 2, 1939, to President Roosevelt was based on the work of Fermi and Szilard. In 1945 Szilard assumed the leadership of those of his colleagues who were opposed to dropping atomic bombs on the cities of Japan. In 1946 he led the successful fight of his colleagues against the May-Johnson Bill, which would have placed the development of atomic energy in the U.S. in the hands of an agency not under the direct "civilian" control of the President. At present Dr. Szilard is professor of biophysics at the University of Chicago."

Leo Szilard
Hotel Dupont Plaza
Washington 6, D.C.

Berkeley, California
January 9, 1962

"ARE WE ON THE ROAD TO WAR?"

by Leo Szilard

For a number of years now, you have had an opportunity to observe how we, as a nation, respond to the actions of the Russians, and how the Russians respond to our responses. Those of you who have watched closely the course of events, in the past six months, may have been led to conclude that we are headed for an all-out war. I myself believe that we are, and that our chances of getting through the next ten years, without war, are slim.

I, personally, find myself in rebellion against the fate that history seems to have in store for us, and I suspect that some of you may be equally rebellious. The question is, what can you do?

War seems indeed to be inevitable, unless it is possible somehow to alter the pattern of behavior which America and Russia are exhibiting at present. You, as Americans, are not in a position to influence the Russian government; it follows that you would have to bring about a change in the attitude of the American Government which, in turn, may bring about a similar change in the attitude of the Russian Government.

It is conceivable that if a dedicated minority were to take effective political action, they could bring about the change in attitude that is needed. But such a minority can take effective action only if it is possible to formulate a set of political objectives on which it may unite. I shall try to outline to you today such a set of political objectives.

Ever since the end of the war, the policies of the great powers have consistently followed the line of least resistance, and this line leads to an unlimited arms race. I do not believe that America can be made safe by keeping ahead in such an arms race.

There have been repeated attempts to stop the arms race by negotiating an agreement that would provide for some form of arms control. So far, all such attempts have failed, and each time they were followed by the continuation of the arms race, with renewed vigor.

Towards the end of the Eisenhower Administration, it was generally expected that the next administration would adopt a new approach to this problem and that a fresh attempt would be made to bring the arms race under control.

When Khrushchev was in New York a year ago last October, I tried to see him, in the hope of finding out how responsive he might be to such a new approach. I was told that they had scheduled fifteen minutes for me but, as it turned out, the conversation went on for two hours. At that time, it was not known whether Kennedy or Nixon would get elected, and I started off the conversation by saying that no matter who is elected, the Government would try to reach an understanding with Russia on the issue of stopping the arms race. Khrushchev answered--and he spoke in all seriousness--that he believed this also.

A year ago last November, I checked out of the hospital in New York, where I had been confined for over a year, took a taxi to the airport, and flew to Moscow to attend the 6th Pugwash Conference. I was accompanied by my wife, who is also my doctor, and I stayed on in Moscow for about a month beyond the end of the conference. I stayed on in Moscow in order to engage in private conversations with our Russian colleagues, because I knew from experience that only in private conversations is it possible to get anything across to them or to discover what they really believe to be true.

None of our Russian colleagues brought up the issue of bomb tests in any of these conversations in Moscow, even though two years earlier some of them had been passionately interested in this issue. I found, however, an undiminished interest in far-reaching disarmament which would result in substantial savings. On one occasion, I had tea with Fedorov, the General Secretary of the Soviet Academy of Sciences, with no one present except my interpreter. I had met Fedorov before and I always got along well with him. On this particular occasion, he spoke to me as follows:

"You must really believe me when I tell you that we want general disarmament. You have seen all this construction work going on in Moscow; it has been going on for many years; still we are not able to catch up with the housing shortage. If we had disarmament, we could not only solve this problem, but many of our other economic problems as well. Also, we could develop other nations on an unprecedented scale. So far, we are building only one hydro-electric dam in Africa--the Aswan Dam in Egypt; if we had disarmament, we could, and we would, build twenty such dams in Africa."

I tried to impress upon our Russian colleagues that the Kennedy Administration would make a serious effort to reach an understanding with Russia on the issue of arms control, but that the new Administration would need time--six months and more than six months, perhaps--to find its bearings on this issue and to get organized to deal with it.

When I returned to this country in February, I decided to stay in Washington for a while.

In Washington, my friends told me that the Government was going to make a sincere effort to reach an agreement with Russia on the cessation of bomb tests and that a reasonable proposal would be made to the Russians on this issue. They would have liked to hear from me that Russia would be likely to accept such a proposal, but coming fresh from Moscow, I had serious doubts on this score.

The invasion of Cuba took me by surprise. When I first heard about it, it was not clear, as yet, whether we were going to give air support to the invading Cuban exiles and whether we would, if necessary, send in the Marines also. My immediate reaction was that of alarm, for I believed that if we did any of these things, we would seriously risk war with Russia. I did not think that Russia would try to intervene in the Caribbean area, and I did not think that the Russians would launch long-range rockets aimed at our cities. I thought, however, that Russia might make some military move elsewhere, probably in the Middle East.

In retrospect, it would seem that I was wrong, for Tom Slick of San Antonio, Texas recently set forth, apparently on good authority, that, if America

had openly intervened in Cuba, at that point, Russia would have moved into West Berlin.

I would not venture to appraise just how close we came to an all-out war, on the occasion of the Cuban incident. I am reasonably certain, however, that if our intervention in Cuba had been successful, this would have blocked for many years to come any possibility of reaching an agreement on arms control with Russia. Failure to reach an accommodation on the Berlin issue might, of course, produce the same result.

I would not entirely exclude the possibility of war over Berlin, but to me it seems more probable that this crisis will be resolved by some uneasy compromise, and that it will not lead to an all-out war. Russia may bring pressure on West Berlin in order to promote any one of a number of her foreign policy objectives, but, on the larger issue, the issue of Germany, the true interest of America and Russia is the same. The true interest of both countries is to have Europe politically as stable as possible.

I am convinced that the Berlin issue could be satisfactorily resolved by negotiations, but this conviction is based on the belief that there is something that the Russians want that we should be willing to give them, and that there is something that we want that the Russians should be willing to give us in return.

There are many people who do not share this belief. They hold that the Berlin issue was artificially created by Russia for the purpose of humiliating America, for breaking up NATO, and for converting West Germany into a Communist state.

Many people, perhaps the majority, believe that the Russians are very much like the Nazis; that they have concrete plans for bringing about, one way or another, our total defeat in Europe, and also for subjugating the whole world to their rule.

Many people have a black and white picture of the world; they believe that the nations fall into two classes: the peace-loving nations, and those who are not peace-loving. America, France and England, and generally speaking our allies, including Germany and Japan, are peace-loving. Russia and China are not peace-loving nations. Twenty years ago, the situation was somewhat different: at that time, Russia was a peace-loving nation, but Germany and Japan were not.

Many people believe that ever since the atomic bomb forced the unconditional surrender of Japan, America has unceasingly tried to rid the world of the bomb, and that all her efforts were frustrated by Russian intransigence.

When I listen to people who hold such views, I sometimes have the feeling that I have lived through all this before and, in a sense, I have. I was sixteen years old when the first World War broke out, and I lived at that time in Hungary. From reading the Hungarian newspapers, it would have appeared that, whatever Austria and Germany did was right and whatever England, France, Russia, or America did was wrong. A good case could be made out for this general thesis in almost every single instance. It would have been quite difficult for me to prove, in any single instance, that the newspapers were wrong, but somehow, it seemed to me unlikely that the two nations located in the center of Europe should be invariably right, and that all the other nations should be invariably wrong. History, I reasoned, would hardly operate in such a peculiar fashion, and gradually I was led to conclusions which were diametrically opposed to the views held by the majority of my schoolmates.

Many of my schoolmates regarded me as something of an oracle because I was able to cope with the mysteries of lower arithmetic which baffled them, and one of them asked me one day quite early in the war who would lose the war. I said that I didn't know who would lose the war, but that I thought that I knew who ought to lose the war; I thought that Austria and Germany, as well as Russia, ought to lose the war. Since Austria and Germany fought on one side, and Russia on the other, it was not quite clear how this could happen. The fact is, of course, that it did happen.

I am not telling you this in order to impress you with how bright I am. Nobody at sixty can claim to be as bright as he was at sixteen, even though in most cases it is not the intelligence that deteriorates, but the character. The point I am trying to make is that even in times of war, you can see current events in their historical perspective, provided that your passion for the truth prevails over your bias in favor of your own nation.

After the First World War, when I lived in Berlin, a distinguished friend of mine, Michael Polanyi, asked me one day what I thought ought to be the rule of human conduct regulating the behavior of an individual in society. "Clearly," he said, "you cannot simply ask a man to be generous to other people, for if the other people are mean to him, and if he follows your rule, he may starve to death." "But," said Polanyi, "perhaps the rule ought to be 'Be one per cent more generous to people than they are to you.' " This should be sufficient, he thought, because if everyone were to follow this rule, the earth would, step by step, turn into a livable place.

I told him that, to my mind, this would not work at all, because if two people behave the same way toward each other, each is bound to think that he is 30 per cent more generous than the other. Clearly, the rule would have to allow for this bias. Perhaps if we were to stipulate, as the rule of conduct, "Be 31 per cent more generous to the others than they are to you," such a rule might work.

America and Russia are not following any such rule of conduct. Moreover, their bias greatly exceeds 30 per cent. Most Americans apply a yardstick to America's actions which is very different from the yardstick which they apply to Russia's actions. Whenever their bias in favor of their own nation gets into conflict with the truth, the odds are that the bias will prevail. As a result of this, they are not capable of seeing current events in their historical perspective. They may well realize that we are in trouble, but they cannot correctly diagnose the cause of the trouble, and, therefore, they are not in a position to indicate what the right remedy might be.

The people who have sufficient passion for the truth to give the truth a chance to prevail, if it runs counter to their bias, are in a minority. How important is this "minority?" It is difficult to say at this point, for, at the present time, their influence on governmental decisions is not perceptible.

If you stay in Washington, you may gain some insight into the manner in which important governmental decisions come about; you may get a feel of what kind of considerations enter into such decisions, and what kind of pressures are at work.

With President Kennedy, new men moved into the Administration. Many of them understand the implications of what is going on and are deeply concerned. But, they are so busy trying to keep the worst things from happening, on a day-to-day basis, that they have no time to develop a consensus on what the right approach would be, from the long-term point of view.

There are also a number of men in Congress, particularly in the Senate, who have insight into what is going on and who are deeply concerned, but mostly they lack the courage of their convictions. They may give a lucid analysis of the trouble in private conversations and then at some point or other, they will say: "Of course, I could not say this in public."

In Washington, wisdom has no chance to prevail at this point.

Last September, Life Magazine printed an article about me which said that I was in Washington trying to find out if there was a market for wisdom. Thereupon, I received a flood of letters from colleges and universities inviting me to give lectures. Most people get some pleasure out of hearing themselves talk, and so do I, yet I did not see much point in going around the country giving talks, if all I had to say was, that there was no market for wisdom. Therefore, I declined all these invitations; that is, I declined that all, until Brandeis University invited me to attend a Special Convocation and to receive an honorary doctor's degree. At that point, my vanity got the better of me, and I accepted. At Brandeis, I spoke at dinner informally to the Trustees and Fellows of the University, and this was my closest contact with the grass roots since I moved to Washington--if indeed, you may regard the Trustees and Fellows of Brandeis as grass roots.

I told them at Brandeis that I thought we were in very serious trouble; people asked me what there was that they could do about it, and I had no answer to give.

Is there, indeed, anything that these people--or for that matter I, myself, could do at this point that would make sense?

When I got back to Washington, I started to think about this, and I believe it will be best now if I simply recite to you how my thoughts developed from this point on.

The first thought that came to my mind was that--in cooperation with others--I could try to set up an organization in Washington--a sort of Lobby, if you will--which would bring to Washington, from time to time, scholars and scientists who see current events in their historical perspective. These men would speak with the sweet voice of reason, and our lobby could see to it that they would be heard by people inside of the Administration, and also by the key people in Congress.

The next thing that occurred to me was that these distinguished scholars and scientists would be heard, but that they might not be listened to, if they were not able to deliver votes.

Would they be listened to if they were able to deliver votes?

The minority for which they speak may represent just a few per cent of the votes, and a few per cent of the votes alone would not mean very much, just as the sweet voice of reason alone would not mean very much. Still, the combination of a few per cent of the votes and the sweet voice of reason might turn out to be an effective combination. And, if the minority for which these men speak, were sufficiently dedicated to stand ready not only to deliver votes, but also to make very substantial campaign contributions, then this minority would be in a position to set up the most powerful lobby that ever hit Washington.

The problem which the bomb poses to the world cannot be solved except by abolishing war, and nothing less will do. But first of all, we must back away from the war to which we have come dangerously close.

Could such a dedicated minority agree not only on the long-term political objectives which need to be pursued in order to abolish war, but also on the immediate political objectives, the objectives which must be pursued in the next couple of years, in order to make the present danger of war recede to the point where attention can be focused on the task of abolishing war?

America cannot be made secure by keeping ahead in an atomic arms race, and an agreement providing for arms control is a necessary first step towards abolishing war. An agreement on arms control does not seem to be, however, "around the corner." It might very well be, therefore, that in the immediate future America would have to take certain unilateral steps. Some of these steps would be taken in order to reduce the present danger of war; other steps would be taken so that if a war breaks out, which neither American nor Russia wants, it may be possible to bring hostilities to an end before there is an all-out atomic catastrophe.

Such unilateral steps are not adequate substitutes for negotiated agreements, and they can carry us only part of the way, but still there are some unilateral steps which can and should be taken at the present time. I propose to discuss with you at this point what these steps may be:

The issue of bomb tests and the issue of bomb shelters are peripheral issues; they are more the symptoms of the trouble we are in, than the cause of the trouble, and I propose to turn now to issues which I believe to be more important.

1.) Nothing is gained by America's winning meaningless battles in the cold war and a change of attitude in this regard is urgently needed. Take the International Atomic Energy Agency in Vienna, for instance. This organization has at present no function whatsoever, and if it is maintained in existence at all, it should be maintained as an exercise in cooperation among the nations.

The first director of this Agency was an American, and his term expired recently. Since, next to America, the Soviet Union is the most important atomic power, America could have proposed that the next director of the Agency be a Russian. Instead, America proposed a Swede, who was not acceptable to the Russians, and since America had the votes, she was able to win one more victory in a meaningless battle of the cold war.

All this "victory" did was to reduce the chances of finding some useful function for this Agency, because the Russians resent being pushed around in this Agency, and there is no way for us to force them to play ball.

I believe that it would be important for the Government to reach a major policy decision, and for the President to issue an Executive Order against fighting meaningless battles in the cold war.

We have a cultural exchange program with the Russians but their State Department and our State Department are playing a game of "if you hit our scientists, we shall hit your scientists." Accordingly, our State Department imposes senseless travel restrictions on our Russian colleagues who visit this country.

These travel restrictions are not aimed at the safeguarding of any secrets, but are merely one way of hitting back at travel restrictions which the Soviet Government occasionally imposes on American scientists who travel about in Russia.

I believe that representations ought to be made, at as high a level of the Administration as is necessary, for the Secretary of State to find some other assignment in the State Department for those who have, up till now, handled the East-West Cultural Exchange Program.

2.) I believe that America could and should make two crucially important policy decisions and that she should proclaim these decisions.

First of all, America should resolve and proclaim that she would not resort to any strategic bombing of cities or bases of Russia (either by means of atomic bombs or conventional explosives), except if American cities or bases are attacked with bombs, or if there is an unprovoked attack with bombs against one of America's allies.

Further, America should make a second policy decision and should proclaim this decision. In order to understand the meaning and relevance of this second decision, it is necessary to consider the following:

Soon after the war, when Russia did not as yet have any atomic bombs, she proposed that the bomb be outlawed. This could take the form of a unilateral pledge, given by each atomic power, that it would not resort to the use of atomic bombs either for the purpose of attacking cities or bases or as a tactical weapon to be used against troops in combat.

Recently Sulzberger of the New York Times discussed with Khrushchev the possibility of such unilateral pledges renouncing the use of the bomb. Khrushchev said on this occasion that if there were a war, even if at first only conventional weapons were used, subsequently the side which is about to lose the war would find it impossible to abide by its pledge and would resort to the use of the bomb.

This brings out what I believe to be the crux of the issue, that today it might still be possible to resist force with force, but the objective of the use of force must no longer be victory. The objective can only be to make a conquest difficult and unpalatable by making it painful and expensive. If force is used then, an all-out war which neither side wants can be avoided only if both sides recognize that the use of force must not be aimed at victory, or anything approaching victory.

Keeping this point of view in mind, America could and should adopt the policy that if, in case of war, she were to use atomic bombs against troops in combat, she would do so only on our own side of the pre-war boundary.

America would then be bound by a pledge to this effect in case of war, as long as Russia imposes a similar restraint on her conduct of the war.

Manifestly, this type of use of atomic bombs would be a defensive operation and moreover, it would be a very effective defensive operation, either on the part of Russia or on the part of America, as long as the restraints remain in effect on both sides.

Such a pledge would be no less clear than the simple pledge renouncing

the use of the bomb, but it would be much easier to keep and therefore it would be a more believable pledge. And if neither side aims at anything approaching victory, then it would greatly reduce the danger of an all-out war.

When I discussed this issue in Germany three years ago, the people there said that if the ground forces of the allies were pushed back to the Rhine, and America used atomic bombs against troops in combat between the Rhine and the Oder Neisse line, many West German cities might be destroyed by American bombs. I do not know to what extent West German cities could be spared by a judicious tactical use of atomic bombs by American forces, but I do know that if America were to use bombs beyond the pre-war boundary, West German cities would be destroyed by Russian bombs.

Recently , the United Nations Assembly voted with a more than two-thirds majority, 55 against 20, to outlaw the use of atomic bombs in war. The use of atomic bombs in warfare was declared by the Assembly to be a crime and a violation of the United Nations Charter.

Since the machinery of the United Nations was set up for the purpose of maintaining peace among the smaller nations, assuming the cooperation of the great powers to this end, attempts to regard a two-thirds vote of the Assembly as legally binding must necessarily fail. Still, the United States must not fly in the face of world opinion and simply disregard the vote of the General Assembly, when a two-thirds vote of the Assembly expresses the legitimate concern of a great majority of the nations that the use of atomic bombs in warfare might lead to a world catastrophe. Rather, out of respect for world opinion and in its own interest, the United States ought to go as far towards complying with it as valid considerations for its own security permit. The restrictions on the use of atomic bombs in case of war which I am advocating are advocated with this end in view.

Western Europe is not inferior to Russia either in manpower or in resources and it would be possible for Western Europe to build up within five years conventional forces to the point where it could completely renounce the use of atomic bombs against troops in combat in case of war. But even this would be to no avail unless the nations involved give up any thought of fighting limited wars for "limited objectives," and use force only to make a conquest difficult and, with luck, to prevent it.

As long as there is no agreement providing for arms control, and Russia remains in possession of large stockpiles of bombs, America has no choice but to maintain a strategic atomic striking force. However, we should maintain such a force only as protection against America or her allies being attacked with bombs or missiles. The number of bombs retained for this purpose need not be very large, and more important than the number of bombs retained is the invulnerability of the bases from which they would be launched. If these bases are invulnerable, so that no single massive attack against them could substantially damage America's ability to retaliate, then America needs to retain only enough bombs to be able to destroy, in retaliation, a substantial number of Russia's cities, after giving due notice to permit their orderly evacuation.

It must be made clear, however, that if America adopts the policy here advocated, she thereby renounces the threat of strategic bombing as a <u>general deterrent</u> because she could then make this threat only in case Russia would drop atomic bombs, and drop them on <u>our</u> side of the pre-war boundary.

I, personally, do not believe that America would lose much by giving up the threat of strategic bombing because the deterrent effect of such a threat is negligible unless the threat is believable.

If America were to threaten to drop bombs, in case of war, on a large number of Russian cities, knowing full well that Russia would retaliate by dropping bombs on a large number of American cities, such a threat would be tantamount to a threat of Murder and Suicide. The threat of murder and suicide would not be a believable threat, in the context of the so-called Berlin Crisis, nor would it be a believable threat in the context of any other similar conflict in which America's rights and interests may be at stake, but not America's existence as a nation.

Those responsible for the planning of strategy in the Department of Defense would concede this much. According to persistent press reports there is, however, an increasingly influential school of thought in the Department of Defense which holds that in case of war with Russia, America may engage in strategic bombing, aimed at the destruction of Russian rocket bases and strategic air bases. America would not bomb any of Russia's cities if she can help it, as long as Russia did not bomb any of America's cities.

This school of thought holds that, at present, Russia does not have many long-range rocket bases and strategic air bases, that the location of many of these bases is known, and that most of them are vulnerable so that they could be destroyed by attacking them with bombs. By building enough long-range solid-fuel rockets (Minutemen) and submarines capable of launching intermediate-range solid-fuel rockets (Polaris), America may be able to keep ahead in this game for the next five years. By that time Europe should build up conventional forces to the level where it may be possible for the West to forego the use of atomic bombs.

Those who advocate such a policy believe that if America should succeed in knocking out, say, 90% of Russia's strategic atomic striking forces, then the Russians may speak to us as follows, "We have enough rockets left to destroy a large number of American cities, but we know that if we did this America might retaliate by destroying all of our cities. Therefore, we are going to hold our fire and we propose to negotiate peace. We concede that the power balance has now shifted in America's favor and we are now willing to yield on a number of issues on which we took an inflexible stand prior to the outbreak of hostilities." If this were to happen America would have won a victory even though it may be a victory in a limited sense of the term only.

In technical language this kind of a policy is called, "counterforce strategy" and it is my contention that the adoption of this strategy would have disastrous consequences.

As long as war is not abolished and force may be resisted with force it will be necessary to consider both the means that may be employed and the aims which may be pursued. Whether only conventional weapons are used, or whether atomic bombs are used also, may be an important question, but far more important is the issue of whether force is resorted to in order to discourage conquest by exacting a price, if necessary a very high price, or whether the aim is victory. I do not believe that in a conflict between America and Russia it would be possible to avoid an all-out atomic catastrophe if there were a resort to force and if the aim were to settle controversial issues in our favor through victory or something approaching victory.

Naturally, if there is a war and America resorts to the bombing of bases in Russia, one could not expect the Russians to sit idly by and watch America picking up step by step one base after another. It follows that America would have to start the strategic bombing of Russian bases with a sudden, massive attack

and to try to destroy all vulnerable Russian bases of known location in the first attack. Accordingly, a counterforce policy is of necessity, a "first strike against bases--in case of war"--policy.

There are, of course, people in the Department of Defense who have serious doubts that America would actually adopt such a strategy in case of war, yet they believe that--at the present juncture--it is a good thing to threaten to bomb Russian bases in case of war because, this is a more believable threat than the threat of "murder and suicide."

I do not know just how believable this threat is, but I do know that at best we are purchasing an increased restraint on Russia's part, for a year or two, and that we are purchasing it at a very high price. For whether we adopt a counterforce strategy or merely give Russia the impression that we have adopted such a strategy, we are provoking an all-out atomic arms race and may within a very few years reach the point of no return in this regard.

I believe that it is imperative to oppose: (a) the adoption of plans which provide for the bombing of Russian rocket and strategic air bases in case of war, and (b) the adoption of the policy of "deterring" Russia with the threat that America would resort to this kind of strategic bombing in case of war. I believe that the rejection of both these policies is an attainable political objective because there is sufficient doubt inside the Administration about their wisdom.

3.) America could and should resolve that atomic bombs and the means suitable for their delivery which are supplied by her and which are stationed in Europe, shall remain in the hands of American military units which are under American command, rather than be placed under the control of NATO. As long as America is committed to defend Western Europe, there is no valid argument for turning over bombs to the control of other Western European nations.

Germany is going to put increasingly strong pressure on the United States Government to turn over such equipment to NATO control, and I would be in favor of balancing any such pressure by bringing domestic political counter-pressure to bear on the Government.

America should stand firm in opposing the production of atomic and hydrogen bombs by Germany as well as means suitable for their delivery. It is conceivable, of course, that all attempts to achieve arms control may fail and that in the end it will not be within the power of the United States to prevent Germany from producing its own bombs and rockets. At about the same time the United States may, however, also free herself from her commitment to defend Germany against external military intervention. But our concern here is primarily with the present and not with developments that may conceivably occur in the unpredictable future.

4.) Not every issue can be solved by Congress passing a law, and there are borderline issues where political action alone can bring no solution because the specific knowledge is lacking of how to go about the solution. The issue of general disarmament seems to be such a borderline issue.

I believe that, at the present time, little could be gained by bringing pressure on the Administration to enter into formal negotiations with Russia on the issue of General Disarmament, because--as they say, "You can lead a horse to the water, but you can't make him drink."

I believe that no substantial progress can be made towards disarmament until Americans and Russians first reach a meeting of the minds of the issue of how the peace may be secured in a disarmed world.

American reluctance to seriously contemplate general disarmament is largely due to uncertainty about this point. If it became clear that a satisfactory solution of this issue is possible, many Americans may come to regard general disarmament as a highly desirable goal.

On the issue of how to secure the peace in a disarmed world, progress could probably be made reasonably fast, through non-governmental discussions among Americans and Russians. I believe that such discussions ought to be arranged through private initiative, but with the blessing of the Administration.

It remains to be seen whether the newly created Agency for Arms Control and Disarmament will be in a position to mobilize the imagination and resourcefulness which is required and whether it may be necessary for a major private group to help them out or to prod them along--as the case may be.

The Russians know very well that America is not ready seriously to contemplate general disarmament and this, to my mind, explains why, in spite of being strongly motivated for disarmament, the Russian Government displays in its negotiations on this issue much the same attitude as does the American Government. As far as negotiations on disarmament are concerned, hitherto both governments have been mainly guided by the public relations aspect rather than by the substantive aspect of the issue.

The Soviet Union's attitude might change overnight, however, if it became apparent that America was becoming seriously interested in disarmament.

The Russians are very much aware of the great economic benefits they would derive from disarmament, and I believe that the Soviet Union would be willing to pay a commensurate price for obtaining it. It stands to reason that this should be so, for the Soviet Union spends on defense an even larger fraction of her industrial output than America does.

America is at present committed to protect certain territories which are located in the geographical proximity of Russia. In the case of general disarmament, America would not be able to live up to such commitments. Disarmament will therefore be politically acceptable to America only if it is possible for her to liquidate most of her present commitments--without too much loss of prestige and without seriously endangering the interest of the other nations involved.

Khrushchev seems to be very much aware of this. Therefore, it is quite possible that if it came to serious negotiations on the issue of disarmament, and if it became manifestly necessary to reach a political settlement in order to permit America to liquidate her military commitments, then the Soviet Union would go a long way towards seeking an accommodation.

The so-called Berlin Crisis, which centers around the commitments which America made to West Berlin, might very well be a case in point.

5.) General disarmament will, if we are lucky, eliminate war, but it will not end the rivalry between America and Russia.

It is a foregone conclusion that American efforts towards creating an orderly and livable world will be frustrated in Southeast Asia and Africa because of our failure to devise forms of democracy which would be viable in these regions of the world. The task of devising forms of democracy which would be suitable to the needs of such areas is not a task that the Government can handle. Various forms of democracy may have to be devised which are tailor-made to fit the various areas. A major private group could tackle and ought to tackle this problem. If it is not solved more and more under-developed nations will become dictatorships;

some of them may have a rapid succession of dictator after dictator and, in the end, the people may have to choose between Chaos and Communism.

It is also a foregone conclusion that America's efforts to raise the standard of living of under-developed nations may be frustrated in those areas where the birth rate is high, infant mortality is high, and there is little arable land left. Improvement in the standard of living will initially lead to a fall in infant mortality, and if the birth rate remains high, the population will shoot up so rapidly that economic improvements will not be able to catch up.

Our failure to develop methods of birth control, suitable for the needs of such areas, is responsible for this state of affairs. The development of such methods is not a task which the Government can undertake. The Government could not create research institutes which would attract scientists who are ingenious and resourceful enough to come up with an adequate solution. A major private group could and should tackle this problem.

If it should turn out that it is possible to formulate a set of political objectives on which reasonable people could generally agree, and if these objectives could count on the all-out support of a sizable, dedicated minority--then I should be impelled to go further, and I would plan to do so along the following lines:

I would ask about fifteen distinguished scientists to serve as Fellows of a Council which might be called Council for Abolishing War or perhaps Council for a Livable World. The Fellows (who would all be scientists) would elect the Board of Directors of the Council, but membership on the Board of Directors would not be restricted to scientists.

This Council would, first of all, assemble a panel of political advisors, whose identity would be public knowledge, and in close consultation with these advisors, it would formulate two sets of objectives. To the first set belong those objectives which cannot be attained at the present time through political action because it would take further inquiry, and perhaps even real research to know, in concrete terms, what needs to be done. To the second set belong those objectives which can be pursued through political action because it is clear what needs to be done.

The Fellows of the Council would set up a research organization aimed at the pursuit of the first set of objectives and they would elect the Trustees of that organization. The Fellows of the Council would also set up a political organization aimed at the pursuit of the second set of objectives, and they would elect the Board of Directors of that organization. Membership on the Board would not be restricted to scientists. Because one of the major functions of the second organization would be to lobby, we may refer to it for our purposes tonight as the Lobby.

The Lobby would hold hearings, perhaps once every four months, and would subsequently proclaim in detail the immediate political objectives it proposes to support. It would communicate these objectives, perhaps in the form of a series of pamphlets, to all those who are believed to be seriously interested. Those who regularly receive the communications of the Lobby would be regarded as members of the Movement, if they are willing actively to support at least one of the several specific objectives proclaimed by the Lobby.

It seems to me that there is no need to enlist those who are interested as members of an organization. What one needs to create is not a membership organization, but a Movement.

The articulate members of the Movement would be expected to discuss the relevant issues with editors of their newspapers and various columnists and other opinion makers in their own community. They would be expected to write to, and in other ways keep in touch with, their Congressman and the two Senators of their own State.

One of the functions of the Lobby would be to help the members of the Movement clarify their own minds on the political objectives they wish actively to support and to help arrange appointments for those members who come to Washington to see Congressmen, Senators and certain key members of the Administration.

The members of the Movement would be regarded as pledged to vote in the primaries as well as in the elections. As far as federal elections are concerned, they would be pledged to cast their vote, disregarding domestic issues, solely on the issue of war and peace.

Further, the members of the Movement would be regarded as pledged annually to spend 2% of their income on campaign contributions. The members would be asked to make out a check payable to the recipient of the campaign contribution but to mail that check to the Washington office of the Lobby for transmission. In this manner the Lobby would be in a position to keep track of the flow of campaign contributions and to maintain a more effective contact with the recipients of these contributions.

Those in high income brackets may be left free to contribute 3% after taxes rather than 2% before taxes. There would be a provision for student members of the Movement that would permit them to spend a lesser amount on campaign contributions than adult members. All members of the Movement would be free to wear an emblem that would identify them as members of the Movement if they wish to do so.

Those who wish to support the Movement but do not want to go so far as making political contributions in the amount of 2% of their income, may regard themselves as supporters of the Movement if they spend either 1% of their income on political contributions or $100 per year, according to their own preferences. Such supporters of the Movement may expect to receive the advice and guidance of the Lobby and may make use of the services rendered by the Lobby on the same terms as the members of the Movement.

So that each member of the Movement may know where his contribution should go, in order to be most effective in furthering the political objectives which he has chosen to pursue, the Lobby would keep in touch with each member. The Lobby would keep the members informed about the particular contests for seats in Congress which are of interest to the Movement; it may advise one member to take an interest in one of these contests and another member to take an interest in another of these contests.

This does not mean the Lobby would explicitly endorse anyone running for office. It may be assumed that if the importance of a given contest is brought to the attention of a member, the member will have no difficulty figuring out for himself which of the two candidates for office he ought to support.

For covering the operating expenses of the Lobby and the Research Organization (which would be maintained independently and operated parallel to the Lobby), one would look to the members of the Movement. Each year a certain group of the members would be asked by the Board of the Lobby or the Trustees of the Research Organization to contribute 2 per cent of their income to them, rather than to spend it for political contributions. One year this group might be composed of those whose names start with the letter "C." Another year it might be composed of those whose names start with the letter "R," etc.

The influence of the Movement would be greatly enhanced if the Lobby were able to say not only how many votes it represents, in toto, but also how many

votes it represents in each state and in each congressional district. So that the Lobby may not make false representations concerning the votes it may be able to deliver, the Board would from time to time ask all those who regularly receive its communications, to say which of the political objectives proclaimed by the Board they propose to support and if they intend to perform with respect to those objectives as members of the Movement are expected to perform.

The Movement must not wield the power that it may possess crudely. People in Washington want to be convinced, they do not want to be bribed or blackmailed. He who gives consistently financial support to certain key members of Congress may evoke their lasting friendship and may count on their willingness to listen to him as long as he talks sense. He who talks to members of Congress, but does not talk sense, will not accomplish anything of lasting value, even if he temporarily sweeps some members of Congress off their feet by making huge political contributions to them.

There are many intelligent men in Congress who have insight into what goes on; the Movement could help these men to have the courage of their convictions. There are others in Congress who are not capable of such insight; the only thing to do with them is not to return them to Congress, and to replace them with better men. This may make it necessary to persuade better men to run in the primaries and to stand for election. To find such better men must be one of the tasks of the Movement, and the Lobby must be prepared to help the members of the Movement to perform this task.

As I said at the outset, I did not come here to enlist any of you in such a Movement or to launch such a Movement. I came here to invite you to participate in an experiment that ought to show whether such a movement could be successfully launched.

First of all, I ask each of you to look into your own heart and try to discover whether you yourself would want to participate in a political movement of the kind described, provided the objectives--as formulated from time to time--appealed to you and you thought that the Movement could be effective.

Those of you who wish to participate in the experiment are asked to show a copy of this speech to people who might be interested and to determine who of these would be likely to be part of a dedicated minority that would give all-out support to a movement of the kind I have described.

I would appreciate your writing me, as soon as possible, how many people you have talked to, and how many of these and who of these (name and address), you think could be counted upon.

As soon as the result of this experiment, and other experiments of a similar nature, indicate that such a Movement could get off the ground, provided it were started in the right way and on a sufficiently large scale, then the Council for Abolishing War would be constituted. Presumably the Council would attempt to identify 25,000 to 50,000 individuals who would be willing to make campaign contributions in the amount of 2% of their income as long as they approved of the political objectives advocated by the Council and as long as they thought the Movement would be effective. Presumably, if the Council is successful in this, the Fellows of the Council would proceed to establish the Lobby.

By the time the Movement attains 200,000 members it would represent about $20 million per year in campaign contributions or $80 million over a four year period. Whether such a Movement could grow further and come to represent not only a significant amount in campaign contributions but also a significant number of votes, would then presumably depend on the future course of world events.

COUNCIL FOR A LIVABLE WORLD

LEGISLATIVE REPORT

AUGUST 1963

National office: 301 Dupont Circle Building, 1346 Connecticut Avenue N.W., Washington, D.C., 20036

STATEMENT PRESENTED ON AUGUST 27, 1963, BY MATTHEW MESELSON

before

THE SENATE FOREIGN RELATIONS COMMITTEE

on the Test-Ban Treaty

Treaty Banning Nuclear Weapon Tests in Atmosphere, in Outer Space, and Underwater

Mr. Chairman, Members of the Committee:

My name is Matthew Meselson. I am an associate professor of biology at Harvard University. I am here on behalf of the COUNCIL FOR A LIVABLE WORLD, whose adherents lend their support and contribute one or two percent of their incomes to a program for reducing the risk of nuclear war. I believe that some of you are already familiar with the COUNCIL and with its founder, Dr. Leo Szilard, one of the initiators of the Manhattan Project and co-inventor with Enrico Fermi of the nuclear chain reactor. Copies of our program will be filed with the Committee.

I strongly support the test ban treaty. It will stop nuclear tests which seriously contaminate the atmosphere. The treaty will inhibit the spread of nuclear weapons and can act to slow the arms race itself.

Possibly most important of all, the treaty may open the way to far more satisfactory relations with other nations including our adversaries and our allies.

Because I am a biologist, I would like to begin by saying something about the health hazards of radiation from nuclear tests. To my knowledge, those of my colleagues who have attempted to evaluate the hazard have arrived at estimates similar to those I shall present. Nevertheless, and although our fundamental understanding of radiobiology has grown rapidly in the last decade, it is important to realize that our estimates of radiation hazards are still based on incomplete knowledge and therefore are subject to uncertainty. Bearing this in mind, a reasonable estimate for the number of children with gross mental or physical defects who will be born in the world because of the genetic effects of fallout from tests conducted to date is about 50,000. These defects include muscular dystrophy, blindness, dwarfism, and other major deformities. There could be considerably more, perhaps ten times as many children either with milder defects or with such very severe defects that they would

die as embryos or infants. About 2,000 of these 50,000 grossly defective children may be expected to be born to persons now alive and the rest will be born in the next few generations.

These estimates leave out the defects caused by radioactive carbon from bomb tests. Such defects may be at least ten times more numerous than those from fallout if no protective countermeasures can be devised against them. However, the radiation caused by radioactive carbon will be spread over hundreds of generations and in that time protective measures may be developed. The estimates I have given are in general agreement with the reports of the Federal Radiation Council and the U. S. National Academy of Sciences-National Research Council Committee on Biological Effects of Atomic Radiation and with similar British and United Nations reports. They are also in accord with the two most recent individual estimates of which I am aware: those of Dr. Linus Pauling and Dr. George Beadle.

The estimates I have presented refer to genetic health hazards and not to the possibility that bomb test radioactivity may induce malignant diseases such as leukemia or bone cancer. Because of a serious gap in our knowledge, the Federal Radiation Council in its 1962 report was able only to say that in the U. S. the risk to individuals now alive of developing leukemia or bone cancer due to all tests through 1961 lies between zero and one in 100,000.

The prevention of additional radioactive contamination of the atmosphere is an important reason for supporting the test ban treaty. To me, an even stronger reason is that after the test ban agreement is concluded we will be in a better position to solve some of the most urgent problems facing our species.

A second reason for supporting the test ban treaty is that it will act to halt the spread of nuclear weapons to other nations. I do not think that a nation yesterday bent on a nuclear weapons program will desist tomorrow, although that might happen later on. Rather, in undecided nations, the test ban treaty greatly strengthens the hands of those who argue against building nuclear bombs. And for nations who might build bombs because they fear their neighbors might build them, the test ban treaty can facilitate mutual restraint.

But the third, and possibly the most important, reason for supporting the test ban treaty is that it may open the way to a far more satisfactory military and political environment.

In the years since 1945, the rate of testing has grown geometrically, doubling approximately every three years. With continued testing, I see no reason to expect a halt in the accelerating arms race. Bombs would grow bigger. The fever of the arms race would stimulate the rapid development of forces even more destructive than those we have now. Some of the possibilities which can be foreseen, like giant bombs and mines or cheap missiles, could work powerfully to our disadvantage even if we should possess them ourselves. Vast anti-missile systems which would necessitate rigorous civil defense programs may come into being and societies would harden as a result. But the offense would almost certainly continue to outstrip all defensive measures. In my view, this could take the world beyond a point of no return in the arms race. It would be a gross distortion of the traditional search of nations for strength with which to offset the strength of others. There was a time when we could defend our citizens by our military strength. But great military strength no longer insures the defense of our nation. Although our strength has grown tremendously since the arms race began, so has the number of Americans grown who would be killed in a general nuclear war.

And in the years since World War II, the international scene also has changed profoundly. The principal communist nation is nearing the living standards of Western Europe and its society is opening. Meanwhile its satellites have recovered significant, even if partial, independence. Our allies have become less and less dependent upon us. Half the world's population has been reorganized under new national governments of great variety. The energetic people of China are unified under a government whose intentions concern both ourselves and the Soviet Union.

Spread throughout this restless and varied international scene are American responsibilities and interests and also American troops. Ultimately those troops are backed up by nuclear arms which are widely deployed and of many types. Today wars could break out and become nuclear without premeditation by any of the nuclear powers. It is clear that this course is not taking us where we would like to go and that we must develop better alternatives.

Although deterrence is still needed, the arms race and a policy of simple containment of our adversaries would not only fail to meet today's great challenges, but would greatly aggravate them. When adversaries have the power to annihilate one another within hours and might be brought to do so by the force of unpremeditated events, they simply cannot afford isolation. In place of containment we must substitute growing inter-dependence even side-by-side with deterrence. Beneficial political changes we have been unable to bring about by containment and isolation may be fostered by new forms of cooperation and competition.

We might begin in this direction in Europe. A year ago, there seems to have been under discussion between ourselves and the Soviets some reasonable measures for securing greater stability in Europe. These measures appear to have included Soviet guarantees for the continued presence of American troops in Berlin and for insuring the continued viability of West Berlin, the exchange of non-aggression pledges between the NATO and the Warsaw pact nations, an agreement between the Soviet Union and the U. S. not to proliferate nuclear weapons, and the establishment of East German and West German technical commissions to discuss relatively non-controversial matters of common interest, such as trade and reunification of families.

It was clear at that time that discussion of these matters was opposed by some of our allies. Now the system of control posts which has been suggested as a possible step to follow the test ban treaty could provide an atmosphere of increased confidence in which a mutually satisfactory stabilization in Europe might be negotiated. Such control posts--located so as to prevent surprise attack—can help to alleviate the fears which feed an appetite for independent nuclear forces and which have greatly impeded agreements in Europe which could benefit both us and our allies.

There are many measures which could follow the test ban: the creation of nuclear-free zones, an arrangement to cut-off the production of fissionable isotopes, an agreement on the non-transfer of nuclear weapons. Still other efforts might hasten the further opening of Soviet society: an expanded exchange of persons, the expansion of East-West trade, an enlarged joint effort in peaceful scientific research.

But whatever the next steps might be, the step before us now is the nuclear test ban treaty. We have held it open to negotiation for six years and we have given it pre-eminence among those arms control measures which we have sought. If we should renounce it now or accede to it half-heartedly, we may find the next step unavailable to us. We would then have squandered the greatest benefits of the

treaty. I hope that the Senate will ratify the treaty wholeheartedly. I hope that you will then go on to provide leadership to a nation and a world which would very much like to try a next step.

Council For A Livable World
301 Dupont Circle Building
1346 Connecticut Avenue, N. W.
Washington, D. C. 20036

Soldier to Head Peace Group

Retiring Colonel Enlists in Drive To Limit Armament Race

By Phil Casey
Staff Reporter

A much-decorated military man who has never believed that bombs bring peace is about to resign to lead one of the Nation's prominent peace group's.

Col. Henry Ashton Crosby, military adviser to Steuart Pittman, Assistant Secretary of Defense for Civil Defense, will take over officially as executive director of the Council for a Livable World, an organization of scholars and scientists hoping to halt the race and promote peace by "practical" means.

Crosby, a slender, youthful-looking man at 50 and a veteran of 22 years in the Army, takes over officially Oct. 31, the date of his retirement from the Army.

"I never felt that building more and more thermonuclear weapons was the way to build peace," he said. "The question is, where do you stop?"

Crosby, who was awarded four Purple Hearts, three Silver Stars and a Croix de Guerre in World War II for his service as commander of an armored battalion, said the Council for a Livable World seeks "ways and means of reducing tensions" and stopping the arms race without endangering U. S. security.

The Council, he said, hopes to influence Congress and initiate thought about the perils of the arms race and ways of halting it.

Its aim is not merely the abolition of war but to figure ways for the Nation to convert from a defense to a peacetime economy and help to build a peaceful, "livable" world, he said.

Nearly a score of the country's top scholars and scientists are the officers of the Council, created about two years ago by Leo Szilard, the famed physicist credited with a vital role in the development of the atomic bomb.

Szilard persuaded Albert Einstein to write President Franklin D. Roosevelt urging development of the Bomb in World War II. Szilard, along with the late Enrico Fermi, produced the chain reaction that led to the bomb. For the past decade, he has been an articulate and persistent advocate of arms control to promote peace.

Lois Gardner, of the Bulletin of Atomic Scientists, who has been acting director of the Council for a Livable World, said the Council has about 5000 supporters contributing money.

The Washington Post

COL. HENRY A. CROSBY
. . . to join peace crusade

The money is used to support political candidates the Council believes will work to halt the arms race and support ways of promoting world peace and economic stability.

Council for a Livable World
1346 Connecticut Avenue, N. W.
Washington, D. C., 20036