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Drawings by Martyl

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THE FACTS ABOUT THE HYDROGEN BOMB

Hans Bethe, Harrison Brown,
Frederick Seitz, Leo Szilard

On February 26 four scientists expressed their views on the hydrogen bomb on the University of Chicago Round Table program broadcast over the NBC network. Their remarks were later criticized by David Lilienthal, former Chairman of the AEC. Below we present the text of the broadcast, excerpts from Mr. Lilienthal's attack on it, and Dr. Szilard's reply.

After a few preliminary remarks in which the subject was announced and the speakers introduced, the discussion proceeded:

MR. BETHE: I was against talking about the H-bomb before the decision to make it was made, because, in this way, I think that we unnecessarily gave the Russians some information—the information that we consider it feasible and the information that we are making it. This, more or less, forces them to do the same.

MR. BROWN: You were against the discussion then. Why are you in favor of it now?

MR. BETHE: Now that this has already been announced, I think that the main thing is to bring before the public all the relevant factors which are necessary to form an enlightened policy on this matter.

MR. BROWN: On the other hand, you hear people saying, "Why should we worry about something which does not exist?"

MR. BETHE: I believe that the time to discuss this bomb is now. If we do not discuss it now, then thoughts about it will become frozen in our government and especially in our military department. This has been the case with the A-bomb. The A-bomb could now hardly be eliminated from our armaments, because most of our strategic plans are based upon it. I would not like to see the same happen to the H-bomb.

MR. BROWN: The general discussion of the H-bomb centers around its being a weapon—a weapon which possesses a great deal of potential destruction. Could we start off this discussion by asking of what the hydrogen bomb is made anyway?

MR. SEITZ: I suppose that everyone knows by this time that it is made of heavy hydrogen, which is used in cooperation with an ordinary A-bomb.

MR. BETHE: I want to say a few words on how long it perhaps will take to make this weapon. It has not been made. It has not even been conceived definitely how it will be made. And, connected with this, are all the uncertainties which you always have in a research development. You never know what will come out of it; and, in this particular case, we cannot predict whether the bomb can be made or not.

On the other hand, on the basis of the decision which has been made, we must conclude that our experts believe that it is probable that we can make this bomb. Even so, I think that we must be prepared to expect that it will take several years before the bomb has been completed.

MR. BROWN: What about the size of the H-bomb? One sees figures, varying all the way from two to a thousand times the explosive violence of ordinary atomic bombs. Is there really any limit to the explosive violence which could be obtained, assuming, of course, that it works in the first place?

MR. SEITZ: In the testing stages it is very likely that, while we are trying to find out whether or not it will work, the bomb will not differ a great deal from the ordinary A-bomb. But since the intention is to build something a lot bigger, I think that it is clear that this will be true only in the early stages.

MR. BETHE: That is certainly right. If we use the bomb in war—if anyone uses the bomb in war—then the bomb will certainly be very large. If you can initiate an H-bomb at all, then you probably can initiate just as easily a big one as a small one. How big it is will depend only upon the amount of heavy hydrogen which you can carry in a plane or in any other device which you may use to deliver the bomb. We can assume, I think, that it is certain that a bomb used in war will be at least a hundred times as big as the present atomic bomb. The figure of a thousand had been used, and I use it for the sake of argument.

What would it mean if you had a bomb which is a thousand times more powerful than the present atomic bomb? This would mean that the range of blast destruction would increase tenfold—that a hundred times the area would be destroyed as by an atomic bomb. If a bomb were exploded at some place, then ten miles away from it there would be almost complete destruction. That would mean that a city as big as New York, the biggest cities on earth, could be destroyed by one single bomb.

MR. BROWN: When you say New York, of course, you mean the greater New York area.

MR. BETHE: I certainly mean that.

MR. BROWN: Something in the neighborhood of three hundred square miles or so probably?

MR. BETHE: Yes. And this, I think, is not all.

MR. SEITZ: There is one factor which I would like to add which concerns itself with flash burn. It is generally known that about 30 per cent of the casualties at Hiroshima resulted from flash. The flash extended out to about two-thirds of a mile. Now, the indications are that the flash effect would be at least thirty times larger in the H-bomb. That means that the flash effect would extend out to twenty miles, so that people would suffer severe flash burn at that distance.

MR. BROWN: We have the possibility of constructing a weapon which is, let us say, of the order of a thousand times the destructiveness of the Hiroshima bomb, or thereabouts. What about the cost of this weapon? Will it be fantastically expensive, or will it be relatively inexpensive?

MR. SZILARD: It is a mistake, I believe, to talk about the cost of the weapon. If we are building H-bombs and if the arms race is on, what will cost us most is not making H-bombs but rather the defense measures which we shall be forced to take. Our coastal cities are highly vulnerable against bombs. We cannot have advance fighter bases to defend New York or Baltimore or Washington. If we go into this arms race at all, it will be lunacy not to take defense measures. In the case of these coastal cities, it means dispersal of the population.

MR. BROWN: To what extent do you feel that dispersal will have to take place? What scale of dispersal are you thinking about?

MR. SZILARD: If I try to figure out in terms of dollars what the President's decision means, I would say that within a few years we will be up to twenty-five billion dollars as a general defense expenditure—including fighter planes, fighter bases, radar screens. And for dispersal purposes I think that we will spend at least fifteen billion dollars a year. This makes a total of forty billion dollars. But when I talk of forty billion dollars per year for defense, I assume that we are balancing the budget, because, if we do not balance the budget, we will have inflation, and the figures in dollars will be very much higher.

MR. BETHE: I am surprised that you are using such a small figure as fifteen billion for dispersal. Do you not want to disperse the inland cities, too? Is it not likely that they also will be attacked by planes or, maybe, by guided missiles?

MR. BROWN: It seems reasonable that the inland cities are less vulnerable due to the possibility of setting up rather elaborate ground-base radar screens and so forth. I certainly agree with Szilard that our coastal cities are far more vulnerable. However, if we do think in terms of dispersing our inland cities, such as Detroit and Chicago, that will add enormously to the estimate of the expense which you have already made, Szilard.

MR. SZILARD: I was thinking in terms of dispersing within ten years, and I did not go beyond fifteen billion dollars, because I think that we cannot afford to pay more. If we want to disperse all our cities, we would probably have to spend something like twenty-five billion dollars a year; and in ten years we could have very good dispersal.

MR. BETHE: How much dispersal would you envisage? Would you disperse cities of a hundred thousand or not?

MR. BROWN: Does that not depend mainly upon the types of industries about which we are talking? For example, there are many cities which are relatively small but where one particular industry is enormously concentrated. In spite of the relatively low population, you would probably want to disperse that particular city.

MR. SZILARD: I would say that about thirty to sixty million people would have to move in a general dispersal; and I should think that, before we would do that, we would take care of our coastal cities. This other measure would be a later stage.

MR. BETHE: It certainly seems hardly to make sense to go into offensive H-bomb development without the defensive development to accompany it.

MR. BROWN: I wonder whether such a development could actually be accomplished. I have the feeling that there would be tremendous resistance upon the part of our larger industrial manufacturers. Certainly they could not be expected to carry on the operations themselves. It would have to be done entirely at government expense essentially. Then one gets into other factors. Let us suppose that a manufacturer in Pittsburgh is moved out to Kansas some place. Will he be able to compete? It seems to me that any marked dispersal movement would really cause an enormous economic upheaval in this country.

MR. SZILARD: It certainly would mean planned movement. It would mean controls much stricter than we ever had during wartime. It would be not a New Deal, but a Super, Super New Deal.

MR. BROWN: We have been discussing thus far the hydrogen bomb in terms of destruction by blast and in terms of delivering it over a target. One sees in the press, from time to time, statements concerning destruction by another source—namely, radioactivity. How would you look upon that particular danger? Will dispersal actually help if H-bombs are used not for blast but for radioactivity?

MR. SZILARD: In this case, it will not help at all.

MR. BETHE: You are certainly right when you emphasize the radioactivity. In the H-bomb, neutrons are produced in large numbers. These neutrons will go into the air; and in the air they will make radioactive carbon 14, which is well known to science. This isotope of carbon has a life of five thousand years. So if H-bombs are exploded in some number, then the air will be poisoned by this carbon 14 for five thousand years. It may well be that the number of H-bombs will be so large that this will make life impossible.

MR. SZILARD: Yes, that is true, Bethe. But that is not what I had in mind, because it would take a very large number of bombs before life would be in danger from ordinary H-bombs.

What I had in mind is this: The H-bomb, as it would be made, would not cause greater radioactivity than that which is due to the carbon; but it is very easy to rig an H-bomb, on purpose, so that it should produce very dangerous radioactivity. Most of the naturally occurring elements become radioactive when they absorb neutrons. All that you have to do is to pick a suitable element and arrange it so that the element captures all the neutrons. Then you have a very dangerous situation. I have made a calculation in this connection. Let us assume that we make a radioactive element which will live for five years and that we just let it go into the air. During the following years it will gradually settle out and cover the whole earth with dust. I have asked myself: How many neutrons or how much heavy hydrogen do we have to detonate to kill everybody on earth by this particular method? I come up with about fifty tons of neutrons as being plenty to kill everybody, which means about five hundred tons of heavy hydrogen.[1]

MR. BROWN: You mean, Szilard, that if you exploded five hundred tons of heavy hydrogen and then permitted those neutrons to be absorbed by another element to produce a radioactive substance, all people on earth could be killed under the circumstances?

MR. SZILARD: If this is a long-lived element which gradually settles out, as it will in a few years, forming a dust layer on the surface of the earth, everyone would be killed.

MR. BROWN: You would visualize this, then, something like the Krakatao explosion, where you would carry out, let us say, one large explosion or a series of smaller ones. The dust goes up into the air and, as was the case in that particular explosion, it circled the earth for many, many months, and even years, and gradually settled down upon the surface of the earth itself?

MR. SZILARD: I agree with you, and

you may ask: What is the practical importance of this? Who would want to kill everybody on earth? But I think that it has some practical importance, because if either Russia or America produces H-bombs—and it does not take a very large number to do this and rig it in this manner—you could say that both Russia and America can be invincible. Let us suppose that we have a war and let us suppose that we are on the point of winning the war against Russia, after a struggle which perhaps lasts ten years. The Russians can say: "You come no farther. You do not invade Europe, and you do not drop ordinary atom bombs on us, or else we will detonate our H-bombs and kill everybody."

Faced with such a threat, I do not think that we could go forward. I think that Russia would be invincible. So, some practical importance is attached to this fantastic possibility.

MR. BROWN: Do you think that any nation would really be willing to kill all people on earth rather than suffer defeat themselves? Would we be willing to do it, for example, do you believe?

MR. SZILARD: I do not know whether we would be willing to do it, and I do not know whether the Russians would be willing to do it. But I think that we may threaten to do it, and I think that the Russians might threaten to do it. And who will take the risk then not to take that threat seriously?

MR. BROWN: In connection with the production of radioactivity, we have discussed it thus far in terms of killing all people on earth. Can one visualize a mechanism by which one produces a radioactivity of, let us say, a short lifetime which can then be carried over an area in a more or less controlled manner, so that, for example, it would be possible for a nation to kill all people in the United States without killing themselves, or vice versa?

MR. SZILARD: This is a funny question, because this is what the situation is. Of course, it takes very many less H-bombs to kill all Russians by radioactivity or to kill all Americans by radioactivity than to kill all people. But you have to get this radioactive material to Russia or to America. Let us assume that we cannot deliver our H-bombs, because they are too big. Then the temptation will be great to rely upon the westerly winds to disperse the radioactivity over Russia or over America. But whether this is possible or not depends upon the answer to a number of meteorological questions, and that answer is not known to anybody. On this aspect of the question, I would say that we leaped before we thought when we decided to make H-bombs.

MR. BROWN: In that particular connection, would you like to express any opinion concerning the relative vulnerability of Russia and the United States? It would seem to me, offhand, that with our whole West Coast exposed to the westerly winds and having the whole Pacific Ocean to operate in, if that kind of thing can be done, we are placed at a considerable disadvantage, relative to Russia, in that respect because we have Western Europe to consider.

MR. SZILARD: This one factor is in favor of the Russians; but there are other factors involved. The whole question of getting radioactive elements to settle over a given territory is difficult. To know whether it is possible to rely upon the westerly winds in any given situation is difficult. The weather conditions change and have to be taken into account. It is uncertain, I think, whether this can be done; we will not know for a number of years.

MR. BROWN: But we are agreed that that is certainly a possible use of the H-bomb which cannot be ignored.

MR. SZILARD: It is not only a possibility but a very serious possibility.

MR. BROWN: Then we are faced with the ironical conclusion in this respect that it becomes easier to kill all people in the world than just a part of them.

MR. SZILARD: This is definitely so.

MR. BROWN: How did this question of the discussion of H-bombs start in the first place? It seems to me that I remember down in Oak Ridge and at the University of Chicago during the war we discussed the possibilities of thermo-nuclear reactions to a considerable extent. That was eight years ago. Scientists have recognized for eight years now that, essentially, a hydrogen bomb might be possible. Why has the discussion not come up until now?

MR. SEITZ: The most important factor in causing all the excitement at present is the fact that the Russians attained the atomic bomb in September, 1949. This fact indicated that we no longer had a monopoly and, as a result, that we have some reason to be concerned.

MR. BROWN: That is connected then with the fact that it requires an ordinary atomic bomb to set off an H-bomb?

MR. SEITZ: That is right.

Some of the scientists who worked on the project during the war were pretty sure that the Russians would have the bomb about this time; but this feeling was not very widespread, and naturally even those scientists could not be sure.

MR. BROWN: Do you not suppose that there was another factor involved in that—that some scientists themselves sort of had their stomachs full of bomb development during the war and just got away from it?

MR. SEITZ: That was a big factor. There is an interesting situation which is occurring at the present time. Scientists have a great many viewpoints, rather different, I think, from the situation that we had in 1939 and 1940 when there was a rather high degree of unanimity of viewpoint about working on the atomic bomb. There is one large group of scientists who feel that the most significant fact about the existing situation is that in 1945 the United States and England reduced their arms budgets by a factor of about ten. Essentially we became disarmed. Russia, in contrast, has continued her armament at the wartime level and seems to be devoting major effort to it—I would guess with tremendous effect judging from the speed with which they developed the A-bomb. Probably they are working three times faster than we are. There is a great danger, if this continues, that we shall fall into an inferior military position and lose our bargaining power. In order to circumvent this, this group of scientists of which I speak feels that we are going to have to speed up our military development. The H-bomb is one aspect of this. This group in the main feels that the H-bomb is not the entire situation. There are other things which have to be kept in mind which are every bit as important. For example, there is the problem to which Szilard referred of delivering the bomb. We have to know whether we can deliver the things which we make. I would say that the whole program of military development should be considered as one coordinated unit. Then there is another important point. I would say that all scientists feel that our primary goal should be peace and that any reactivation of military affairs which occurs now should be carried out as a tool to achieve peace through negotiation.

MR. SZILARD: It would be easy for scientists to agree that it is important to improve our bargaining power; but what disturbs many scientists I know

is that we do not see what we are bargaining for.

MR. BROWN: A few days ago, Bethe, I noticed in the paper a statement signed by you and eleven other scientists to the effect that the United States government should make a statement pledging us not to use the H-bomb first. Could you tell us a little bit about your considerations which went into that statement?

MR. BETHE: I certainly would like to. It was our belief that the main reason for us—perhaps the only reason for us—upon which it is valid to make the H-bomb is to keep our bargaining position and not to be confronted, one day, with an ultimatum from Russia that they have the H-bomb and can destroy us. If this is our only reason, then we thought that we would never use this bomb in an offensive war. Then we could contribute a great deal by stating this reason openly—by stating openly that we would not be the first to use the bomb in war.

MR. SZILARD: I read the statement, and I was really more impressed by the sentiment in it than by its logic. I think that what was behind the statement is a general uneasiness which I notice in many scientists. In 1939 when we tried to persuade the government to take up the development of atomic energy, American public opinion was undivided on the issue that it is morally wrong and reprehensible to bomb cities and to kill women and children. During the war, almost imperceptibly, we started to use jellied gasoline bombs against Japan, killing millions of women and children; finally we used the A-bomb. I believe that there is a general uneasiness among the scientists. It is easy for them to agree that we cannot trust Russia, but they also ask themselves: To what extent can we trust ourselves?

MR. BETHE: This is quite right, and one of the reasons which we had for our statement was to prevent the military of either country, either Russia or the United States, to start a war with the hydrogen bomb, just in order to be the first.

MR. BROWN: We are in agreement that if the hydrogen bomb works, world-wide destruction on an unprecedented scale will be possible. First, entire cities of the size of New York, Chicago, and London could be destroyed by the blast effect. But, far more important, radioactivity could be produced and could be scattered over the countryside in such a way that all life on earth, or at least most life on earth, could be destroyed.

The second point of importance is that the cost of such a hydrogen bomb will not be only the cost of the bomb itself but the fantastic cost involved in carrying out a proper dispersal program which will permit us at least to have more security than we would have without dispersal.

[1] If fifty tons of neutrons are absorbed by a natural element which is transformed into a radioactive element that emits between one and two gamma rays per disintegration having an energy between one and two million volts [like, for instance, radioactive cobalt], and if the radioactive substance produced is uniformly dispersed over the surface of the earth, then a person who is exposed to the gamma rays will receive an X-ray dose of the order of 10,000 r units by the time the radioactivity decays. If an X-ray dose is given within a short period of time, 1,000 r would be lethal; but if the dose is given over a period of years, a larger dose is required for killing.

Fifty tons of neutrons should be produced if about 500 tons of heavy hydrogen is actually "burned." Since not all the neutrons emitted will necessarily be "burned" in the explosion, the actual amount of heavy hydrogen that has to be accumulated might be considerably larger than 500 tons.

If 10,000 tons of heavy hydrogen were required, such an amount could be accumulated over a period of ten years without an appreciable strain on the economy of a country like the United States. The quantity of the natural element which has to be incorporated into the bomb in order to capture the neutrons will, however, increase correspondingly with the quantity of heavy hydrogen contained in the bombs, and there might be limitations on the raw material side for some of the otherwise suitable longer-lived radioactive elements. LEO SZILARD

Mr. Lilienthal's Criticism

Following is the New York Herald Tribune *report of Mr. Lilienthal's Town Hall address of March 1:*

"David E. Lilienthal, recently retired chairman of the Atomic Energy Commission, deplored yesterday what he described as the panic being spread by 'oracles of annihilation' who predict the end of the world through atomic or hydrogen bombs.

"Mr. Lilienthal said such pronouncements by the 'new cult of doom' served no purpose—neither the intimidation of Russia, nor the building-up of international trust, nor the cool appraisal of our military security needs. Rather, he said, they only spread a feeling of 'hopelessness and helplessness.'

" 'And hopelessness and helplessness are the very opposite of what we need,' he said. 'These are emotions that play right into the hands of destructive Communist forces.' . . .

"His denunciation of the 'cult of doom' singled out four top atomic scientists who discussed on a widely reported radio show last Sunday ways in which a hydrogen bomb might be built so as to disperse a lethal radioactive dust over the face of the earth. The four, who appeared on NBC's 'University of Chicago ROUND TABLE' conference, were Drs. Hans A. Bethe, Frederick Seitz, Leo Szilard, and Harrison Brown. (Dr. Albert Einstein made a similar warning last month.)

" 'Their concrete suggestions contained ideas the Russians may not yet have thought of,' he said. He also branded as 'highly intellectual nonsense' the speculations of the four on evacuating some 30,000,000 people from the big eastern cities. 'This can't be done, and every one knows it can't be done, so why scare the daylights out of every one?' he said.

"Mr. Lilienthal pledged himself to fostering a 'better perspective' on atomic energy by dispelling the 'black magic and hocus-pocus' connected with it as well as by stressing its vast peacetime potentialities. 'Knowledge of atomic energy has its very destructive sides,' he said, 'but so does all knowledge.'

"If people continued to regard the atomic bomb as the only aspect of atomic energy, he went on, then inevitably the bomb would become the only result of the new knowledge. Coupled with this popular feeling, he said, was the 'mountainous error that bigger and bigger bombs will make us safer and safer.'

" 'The security of this country is not a material thing but rather rests in the spirit of the people,' he said. 'We are a people with faith in each other, such a faith as has never existed in a nation before. We are a people with faith in reason and in God, but if we substitute for these a faith in weapons, we will be weakened and lost no matter how great our stockpile.'

"He concluded by calling for 'understanding instead of panic, sense instead of sensation, and courage and faith instead of fear.' "

Dr. Szilard's Reply

Leo Szilard replied to Mr. Lilienthal's criticism in the following letter to the editor of the N. Y. Herald Tribune, *published in the March 4 issue:*

"Mr. Lilienthal criticized statements which we made over the air, not on the ground that they were not true, but rather on the ground that the truth was frightening, and that scaring people served no useful purpose.

"What we said over the air we did not say for the purpose of scaring people, nor did we say it for lack of restraint.

(Continued on page 126)

agreed never to acquire the know-how which her rival would have retained, despite the destruction of his bombs. The second argument is that the search for responsibility is difficult, that only Pharisees ask for the culprit, that the truth is the same as it was in the past in the wars between Sparta and Athens: The growth of American power menaces the Soviet Union, and the growth of Soviet power menaces the United States. Perhaps the historians of the future will report in these terms the drama through which we live, and this version may contain a grain of truth. Two aspirants to empire over a part of the world, or over the whole planet, would feel directly menaced, one by the other, even if neither has aggressive intentions. But this interpretation *au dessus de la melee* has no exclusive claim to truth. The judge who sends away both litigants is no closer to justice than the one who finds that one of them is right and the other wrong. In fact, since 1944, one of the two giants bears the main, if not the exclusive, responsibility for the tension, and this is the Soviet Union. Why? Because she has used her victory to impose upon 100 million Europeans a regime which the vast majority of them did not desire.

That the Americans, in the depths of their souls, have a sense of guilt, I can well understand. They have reason for it. They have dropped two atomic bombs on Japanese cities at a time when this terrible weapon was not needed to achieve victory, and a cheaper victory at that. This error is excusable: the military believed (erroneously, it seems, in the light of information which we possess now) that Japan was still capable of resisting for months, and that she was firmly resolved to do so. They decided that the atomic bomb would permit them to reduce the costs of finishing the war. Now, American public opinion has doubts about the wisdom of this decision, and worries about the consequences of the way in which the atomic weapon was revealed to the world. The other cause for worry is the fate of Eastern Europe. In practice, the hundred million Europeans who were once promised liberation have been delivered to the Soviet Union. They were sacrificed during the hostilities, for very realistic reasons which could be justified as such—but also on the vague idea that Stalin would be "satisfied" with the sovietization of his satellites. In other words, like France and Great Britain before 1939, America has more or less confusedly attempted to buy peace at the cost of the freedom of small peoples. Frenchmen have no right to condemn such behavior. But, when an American tries to analyze the psychology of his nation, it must be a matter of serious concern if he charges them with error in what they have done well, and does not reproach them with the errors they have, in fact, committed.

Let us end by developing the story of the children told in Dr. Szilard's article. A boy, older than they, has come to visit them. Their father, attracted by the noise, opens the door and helps to stop the free-for-all. "What has happened?" he asks the elder of his boys, Peter. Peter answers, "Bill first took away little John's toys, and I let him have them for the sake of peace. But he wanted also to take Jim's things, and then the fight started."

Was it wrong of Peter to have sacrificed John's property or to have defended Jim's? Is it the fault of the United States to have sacrificed the liberty of the small peoples of Eastern Europe or to have defended that of Greece, Italy, or France?

Dr. Szilard's Reply to Lilienthal

(Continued from page 109)

"Whether or not America should develop hydrogen bombs has been under discussion by scientists, behind closed doors, ever since October of last year. Soon after the Atomic Energy Commission put the issue up to the White House, the news began to leak to the press. The scientists, not wishing to embarrass the Administration at a time when it had to arrive at a difficult decision, exercised great restraint and, with one single exception, no scientist made any comment until the President had made his announcement. This self-imposed silence might have been a mistake, but at least it serves to show that if some scientists speak up now, it is not for lack of restraint that they do so. The reason for speaking up now is rather this: neither the President nor the Atomic Energy Commission have explained to the American people what the decision to develop hydrogen bombs will involve, what the meaning of the "hydrogen bomb" is, or what the cost of the indispensable defense measures will be. Yet these are things the American people must know.

"I am inclined to agree with Mr. Lilienthal that no useful purpose is served by scaring people. I do not believe, for instance, that it would help people, who are looking for a hidden exit in a theater, to shout to them that the theater is on fire, and I would not be in favor of doing so. On the other hand, if the house is actually on fire, I am opposed to keeping it secret for fear of scaring some of the occupants.

"If it becomes possible to detonate practically unlimited quantities of heavy hydrogen, then it automatically becomes possible to release very large quantities of radioactive substances in the air, simply by incorporating into the hydrogen bombs natural elements which become radioactive when they absorb the neutrons that are liberated in the explosion of the hydrogen bomb. The temptation of so rigging hydrogen bombs will be all the greater the more difficult it is to deliver large hydrogen bombs to specific targets in enemy territory.

"It will not be easy to get across to the American people the possibilities and limitations of such radioactive warfare, but whatever we can say on the basis of published information, will have to be said.

"Mr. Lilienthal said that our con-

LOYALTY TESTS FOR SCIENCE STUDENTS?

ON March 1 the House of Representatives passed a bill to establish a National Science Foundation (H.R. 4846). Immediately preceding its passage two amendments proposed by Representative Howard Smith and by Representative Daniel J. Flood had been passed by voice vote and written into the bill. These amendments required the FBI to investigate and *to approve* all employees and fellowship holders in the Foundation, and to investigate all aliens associated with the Foundation, regardless of whether or not they had been certified by their own governments. Many scientists feel that these amendments seriously weaken the purposes of the legislation and are making strenuous efforts to have them removed in the Senate-House conference on the bill. The objections to these amendments were clearly voiced by Dr. Hugh Wolfe, President of the Federation of American Scientists in the following statement:

DR. HUGH WOLFE'S STATEMENT

The police-state methods and ideas of Hitler and Stalin got a majority vote in the House on March 1. The House adopted an amendment to the National Science Foundation Bill, H.R. 4846, providing that all holders of fellowships and all others whose research work is to be supported by the Foundation must be *investigated* and *certified* by the FBI (This means that the FBI is to be detective, judge, and jury[1]) and must never at any time have been members of any organization on the Attorney General's list. I can see only three bases on which a Congressman could support this amendment, and they are: (1) failure to appreciate its significance, (2) a desire to kill the bill by making it so vicious that its proponents could no longer support it, (3) a genuine advocacy of the police-state idea.

The Federation of American Scientists concurs in the necessity of clearance procedures for that large group of its own members who are now working on atomic energy projects where they must have access to secret data. But such investigation is totally improper for men working on non-secret, non-military basic science which is the area of the National Science Foundation. I believe that our government is justified in spending federal funds on a National Science Foundation because basic science provides the foundation for the industrial and military technologies that make our country strong. But I could not support a bill containing this new amendment.

We are not asking any special dispensation for scientists. One argument advanced is that federal funds are being spent and that therefore these elaborate loyalty checks are justified even though the work is non-secret. The same argument would apply with equal logic to the farm price support program. Should every farmer who benefits be investigated by the FBI? Our postal system operates at a deficit so everyone who mails a letter is receiving federal aid. Should everyone who mails a letter be investigated and certified by the FBI? The pattern set forth in this vicious amendment belongs only to the totalitarian system where the secret police keep a dossier on every citizen.

The bill should be passed, but without this amendment. It should be stricken out in the House-Senate conference committee.

* * *

If the bill should be passed with its present amendments, scientists may decide to press for a Presidential veto. (The President has already vetoed an earlier version because of its unsatisfactory administrative structure.) And, if the bill becomes law, universities might well decide to refuse to make use of federal grants proffered under conditions so deeply and needlessly offensive to academic freedom.

[1] Spokesmen for the FBI have expressed their reluctance to accept this "un-American authority."

Loyalty Provisions in H.R. 4846

H.R. 4846. *Section* 10 *(b)* "No part of any funds appropriated or otherwise made available for expenditure by the Foundation under authority of this Act shall be used to make payments under any scholarship or fellowship to any individual unless there is on file with the Foundation an affidavit executed by such individual that he does not believe in, and is not a member of and does not support any organization that believes in or teaches, the overthrow of the United States Government by force or violence or by any illegal or unconstitutional methods. The provisions of section 1001 of title 18, United States Code, shall be applicable in respect of such affidavits."

Section 14 (1) [Amendment passed by voice vote Feb. 28, 1950, introduced by Rep. Howard W. Smith, Dem., Virginia] "No person shall be employed by the Foundation and no scholarship shall be awarded to any person by the Foundation unless and until the Federal Bureau of Investigation shall have investigated the loyalty of such person and reported to the Foundation such person is loyal to the United States, believes in our system of government, and is not and has not at any time been a member of any organization declared subversive by the Attorney General or any organization that teaches or advocates the overthrow of our Government by force and violence."

Section 14 *(m)* [Amendment passed March 1, 1950, introduced by Rep. Daniel J. Flood, Dem., Pa.] "No person a national of a foreign country shall be associated with the Foundation in any capacity whatsoever unless and until the Federal Bureau of Investigation, independent of any investigation made by the government of such person, shall have investigated such person and reported to the Foundation that such person is not and has not at any time been a member of any organization that teaches or advocates the overthrow of the Government of the United States by force and violence."

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