State of Iowa
1952

IOWA CITIZENS INVESTIGATE THE ATOM

What Adult Iowans Have Done and May Do to Prepare Themselves for the Atomic Age

Volume V

The Iowa Plan For Atomic Energy Education

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IOWA CITIZENS INVESTIGATE THE ATOM

(A handbook for adult education in atomic energy)

Volume V

The Iowa Plan for Atomic Energy Education

**Issued by the
Department of
Public Instruction,
Jessie M. Parker,
Superintendent,
Des Moines, Iowa**

Published by the State of Iowa

WHAT IS YOUR ATTITUDE?

"The hard fact is that the American people simply cannot ignore the split atom; it will shape our destinies irrespective of our wishes. There is simply no halfway house. We control the atom or it controls us."

—A famous U. S. Senator.

MAKE UP YOUR MIND, MADAM!
(Courtesy Des Moines Register)

—A famous Iowa cartoonist.

"It seems to me that informed public pressure, which of course must be the product of education and which *is* the democratic process, should come to be exerted. . . . It is the imperative of practical education."

—A famous Iowa member of the U.S. Atomic Energy Commission.

You know, of course, at first-hand, how important I think the work you are doing in Iowa is to all of us. I think the Iowa development is one of the most heartening and imaginative programs in the entire country.—David E. Lilienthal, Former Chairman, Atomic Energy Commission.

Ever since Hiroshima I have worked at driving home the idea that *all* the American people must know the essential facts about atomic energy. I want you to know how impressed I am with the dimensions and objectives of the educational project you have formulated; it is exactly the kind of thing we very badly need.—Brien McMahon, Former Chairman, Joint Congressional Committee on Atomic Energy.

IOWA PLAN FOR ATOMIC ENERGY EDUCATION

Central Planning Committee

G. E. Holmes, Iowa State College, Ames, *Chairman*
M. J. Nelson, Iowa State Teachers College, Cedar Falls
Barton Morgan, Iowa State College, Ames
Hew Roberts, State University of Iowa, Iowa City
Emil Miller, Luther College, Decorah
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G. E. Holmes, Iowa State College, Ames
Barton Morgan, Iowa State College, Ames
R. O. Borreson, Superintendent of Schools, Sheldon
M. J. Nelson, Iowa State Teachers College, Cedar Falls
Emil Miller, Luther College, Decorah

AN OPEN LETTER

To Fellow Iowans:

As your elected Superintendent of Public Instruction, it is my constant endeavor to see that every young Iowan is fitted to inherit and cherish our American way of life. In an age when our store of knowledge increases with such bewildering speed, this means constant revision and improvement of our program of studies, and most of my time is inevitably occupied with problems of the schools.

Adult citizens of Iowa are conscious of the difficulties in trying to think maturely in these times. If we fail of that maturity, the heritage we bequeath to the coming generation will not be bright and shining, but rusty and obsolescent.

For this reason my Department has long shared with other Iowa people and institutions the effort of carrying public education beyond the school age and the formal requirements of diplomas and degrees. It was gratifying to find that the Committee of fellow Iowans whose thoughts and experiments helped to generate the Iowa Plan for Atomic Energy Education shared my view. From the start it was always conceived of as a plan for education at <u>all</u> levels.

It is a pleasure to tell you that our State was the first to undertake the task of producing a program that would be both unified and comprehensive. With the publication of this bulletin that task is complete.

Sincerely yours,
JESSIE M. PARKER,
Superintendent of Public Instruction

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INTRODUCTION

This little volume is a how-to-do-it book. It is also a why-you-should-try book. If there had not been distinguished Iowans with strong views about the latter problem there would have been no book at all.

Why should anyone try to understand atomic energy? The answer is simple: because we live in an age when atomic war is a possibility and we'll hand on to our children an age in which the forces of atomic energy will be extensively used in peacetime in what we hope will be a free and peaceful world. It may be objected that we have lived in a steam age, a gasoline age and an electrical age without having been asked to understand those sources of power. True. It is also true that the technology that has risen from all this power has created problems that have destroyed democracy in some parts of the world and, some believe, threaten it in the United States. In its early and difficult deliberations, the Production Committee came to the conclusion that you cannot separate the scientific nature of power from the social problems it generates or from the social solutions best fitted to these problems. This started the Committee on its first major piece of research, a consultation with the nation's leading scientists, social scientists, congressmen, members of the Atomic Energy Commission, elder statesmen and reputable journalists as to what the public should know and why. The study strongly confirmed the Production Committee's opinion. You may not agree. The first chapters of this publication give everyone a chance to argue his views against those of the national leaders.

The fact that people ask questions should be sufficient reason for trying to disseminate knowledge. People still ask a lot of questions, especially during periods when new weapons are being tried out on the various proving grounds. As well as reflecting a great variety of interest, these questions reveal fears such as the deep seated belief that there is no defense against an atom bomb; confusions such as the identifying of atomic energy as synonymous with the atom bomb; prejudices such as the hostility to all scientific inventions; and dangerous fixations such as the theory that great issues are beyond our understanding and our control. Blind fear can make impossible the organization of adequate civil defense. The belief that national problems are beyond the individual understanding or control can destroy democracy by default. Accordingly the Production Committee made a study of the questions asked in a variety of situations, recording all questions asked at lectures and film showings in various places and sending agents out to conduct "spontaneous" interviews in cafes, clubs, and private homes. These questions proved a most useful guide in planning adult education experiments.

While making its inquiries the Production Committee also tried a series of experiments in making information available to adults both directly and indirectly. These experiments were quite extensive, one of them occupying almost two years. As well as carrying out experiments of its own design, the Committee made contact with other groups of Iowans who, in their own localities, had carried out projects for atomic energy education of adults without any outside prompting. The record of these projects and the Committee's experiments forms the substance of this booklet.

Finally came the problem of this booklet itself. It is easy enough to sit at a desk in Iowa City and write a series of suggestions and instructions that would all be perfectly clear to other members of the Committee who, in four years of working together on a common problem, have come to know and understand each other very well. It is not so easy to be sure that these instructions and suggestions will be understood by a reader 300 miles away who is conscientiously planning an adult education project in atomic energy for his own neighborhood. Accordingly the booklet was first put to work in manuscript form. Wherever possible its recommended activities were tried out by volunteer groups with no outside assistance and no preparation. The writer was privileged to observe all these tryouts and to plan with the volunteer groups the changes that seemed most desirable in rewriting the manuscript. Many anonymous Iowans have therefore shared in the making of it. It is not perfect, but it is the best that we can do.

For the Production Committee
Hew Roberts, *Chairman*

(Courtesy *Hawk-Eye Gazette*)

THE ATOMIC DAY BEGINS EARLY

"I guess all this adds up only to the familiar conclusion. Education needs to be pretty fast." (W. W. Waymack). Social inventiveness in distributing atomic energy information is well demonstrated in this picture.

CHAPTER I

THE "OUGHT" OF THE ATOMIC AGE

Some Questions for Mr. and Mrs. Iowan

HOW TO USE THIS CHAPTER: Nothing is more offensive to a free American than the statement: "You *ought* to know something (or do something) about . . ." In our tradition what we think and do and say is our own business. As one of the few nations where the citizens control their own schools, this is particularly true of education. If we don't like the ideas of our educators we get up and say so. Or we send our children to another school or college, for there are many different ones to choose from. And particularly, once we have grown up, we resent being told, especially by professional educators, that we ought to study modern art, or the latest in science, or classical music, or anything else that somebody else seems to think important.

Yet there is one "ought" about which we are all convinced. We ought to be good citizens, better citizens—especially the other fellow!

This chapter doesn't *tell* anybody to do anything. It is simply an open inquiry into the relationship, if any, between some knowledge of the developing atomic age and good citizenship. Not good citizenship for the other fellow, but for all of us in Iowa.

You can use this chapter in several ways. You can simply read it alone, sit back in your rocker and ask yourself if it makes sense. You can raise the questions with your family, and see how they react to the answers—if you have children in school, they may already have studied atomic energy through the Iowa Plan. You can raise the questions without the answers given here and see how nearly your own answers agree or disagree with these. If you disagree it is interesting to try writing down clearly exactly why you disagree. You can raise the questions with your club, church or social group in the same way as with your family. You can spend an evening on the problem at a meeting of the P.T.A. In any of these groups you may take turns to ask questions, read or volunteer answers, discuss points further. Thus everyone is involved. Or your group may set it up as a debate, panel discussion, or "sounding board."[1] You can divide your group into small groups, each discussing a different question and reporting back to the whole.

So this problem, our personal involvement in the atomic age, is an open adult question to be handled by modern methods of communal inquiry instead of accepting the dogmatic views of "authority." For this reason it is written in the form of question and answer. *Every one of these questions has already been asked by Mr. or Mrs. Iowan.*

Q. The A-bomb was a terrible shock to me, especially when I listened to the stories about it and read John Hersey's "Hiroshima." The whole thing makes me sick with fright and I'd rather not think about it. If it makes me feel this way why should I try to understand it?

[1]A full description of how to use these techniques and what to guard against is given in Chapter IV.

A. We all had a big shock when the first atom bomb fell. But only some of us were shocked when the Russians exploded their first atom bomb in 1949. Even those of us who were shocked must have known that that was coming sooner or later. Our leaders told us that Russia would have an atom bomb definitely in at least ten or fifteen years. And Molotov himself had told the United Nations that Russia already had the atom bomb. There was no reason to disbelieve him, we simply wanted to disbelieve him. It was the same as not believing what Hitler said in *Mein Kampf* before he came into power—we simply did not want to think the future could be so uncomfortable. Those of us who understood only a little bit about atomic energy were prepared for the Russian explosion. We did not like it but we were already gearing ourselves to living in an age where other nations would have an atom bomb, too.

Q. But Russia got the atom bomb because of spies and traitors. Isn't it possible that Russia would never have had an atom bomb if we had had better security regulations?

A. It is true that Russia might have taken a little longer to develop the bomb if there had not been spies and traitors. But the idea that Russia could indefinitely be kept from developing a bomb simply springs from our ignorance of what atomic energy is and our strange idea of what is an atomic secret. The secret of the atom bomb is not a little formula that you can lock away in a safe as they do in the movies. Foreign nations knew that an atom bomb could be made actually before we did in America. They simply had not mastered the vast technical arts of making it. Because all modern nations have scientists and scientific laboratories, any nation can develop almost anything it likes in time. The only real security, short of international control, is the ability to stay in the lead.

Q. If it's a matter of scientists and scientific skills we are all right in America. America has more scientists than anybody else in the world, and they are the best scientists, aren't they?

A. American scientists themselves would probably answer "No" to that question, but it is not a case of having the best scientists in the world, but having as many scientists as we need. And also, of giving them all the equipment they need to work with, and then directing them to work towards ends that make us most secure. Because we are a peaceful and democratic country we are probably the quickest country in the world to adapt new scientific ideas to our own comfort and to turn the inventions into mass production. But when it comes to security, it is conceivable that other nations may be ahead of us. Let's have a look at some of the things we borrowed during the last war or since. The engines we used in our fastest fighter planes came from

Great Britain. The jet engine that we use today was invented in Great Britain. The radio that made it possible for us to have an air transport all over the world we all know came originally from Italy. Radar that was used in both defense and offense was invented in Wales. Guided missiles originally came to us from Germany. Penicillin was discovered by an Australian and some of the major antibiotics by doctors of the London hospitals. These are just a few of the things that not only made it possible for us to win the war but also helped our boys to stay alive. They remind us how interdependent we are not only for basic scientific work but also at times for its application.

Q. But we invented the A-bomb, the winning weapon. And we are still in the lead in atom weapon research, aren't we?

A. Let's hope we are. But the real point is that the atom bomb was invented as a result of the discovery that you could split an atom. And that discovery was not made in America. In fact it was not made in any one country. Greece, Germany, Italy, France, Poland, Sweden, Great Britain, New Zealand—they all had a hand in discovering how to split an atom. You can't gather all that knowledge up and confine it now to America.

Q. This doesn't make me any less afraid. In fact, learning about it simply makes me more afraid. There isn't much sense in studying things that make you afraid, is there?

A. It depends on what you do with fear. You can simply do nothing, like the ostrich, in which case you are an easy mark. You can run away—but where to in the modern world? We used to think that it would be pretty safe on a Pacific Island. Would you like to be sitting on Bikini today? Or on Eniwetok? Or, we can use fear in a sensible way, which is as a stimulus to make us strong enough to be secure. Being strong is not simply a matter of having a big pile of bombs and very fast airplanes, but of having a good enough educational system, enough trained scientists, enough well-equipped laboratories and so on, and the proper attitude to scientific work.

Q. I'm a housewife and mother. I don't see that my attitude makes any difference. This business of a scientific attitude is surely a matter for the schools. I feed and clothe my family well, teach them to be decent youngsters by taking them to church and Sunday school, and I see that they always attend school unless they are really sick. It seems to me that the rest of it is up to the school.

A. Provided we can keep out of war and keep enemies out of America if we do have war, that ought to be nearly enough. It is unlikely that the Atomic Age will make much difference to you and me who are already half way through life. On the other hand, we can actively help or actively hinder our schools, especially in studying subjects that we know nothing about ourselves and even more if we are afraid of those subjects.

Q. I don't see how I could possibly hinder the schools. They teach what they like.

A. On the contrary, most schools welcome the opinion of school patrons as to what should be taught. The program of our schools, because we influence them through our elected Boards and our P.T.A. groups, is pretty much a mutual concern. That is more true in America than in any other part of the world and we want to keep it so. In Iowa there is an atomic energy program available to all elementary schools and high schools in the state. If we really believe that Atomic Energy Education is important for our children, then we should see that they have a chance to know something about it.

Q. I suppose that is right. And I would go along with the idea of putting atomic energy into the school program. But that doesn't mean that I have to know anything about it myself, does it?

A. We can't answer that with a simple Yes or No. A home can do a lot to help a school or a lot to hinder it. How often does this occur: Your child asks you a question and you reply, "I don't know. Go and ask your teacher." That's fine, that's what teachers are for. But how many of us actually ask the child later whether he did ask his teacher for the answer, and then let him explain it to us? Most of us probably hope that he will forget all about it on his way to school and cease embarrassing us by finding out how ignorant we are. This sort of thing is an everyday occurrence and probably doesn't do much damage. But if we never listen to our own children, never try to answer their questions or to help them find answers, and show hostility whenever they raise any questions we do not understand or are not interested in, we may begin to destroy their own curiosity or change their own attitudes. We should remember that parents are the natural heroes for their children, and if we parents are hostile to scientific inquiry, our children will probably get that way also. In the long run, this could mean that many a young scientist may be lost to America simply because he does not discover himself. Or it may mean that we will lose control over a section of our education itself, simply because the whole of America is a little bit afraid in this Atomic Age.

Q. How would fear cause us to lose control of our schools?

A. In our American democracy, based as it is on religious faiths, the core or foundation of our education has always been the thing we call the Humanities—Religion, Morals, History, American Government, the social studies, something in that line. In Russia the core or foundation for all children is science. In their philosophy the mind of God has been replaced by the mind of man and the mind of man expresses itself through science. So every Russian child begins to learn science even in the kindergarten. This may eventually give Russia the edge on us in scientific personnel.

Q. Do you mean to suggest that there are people in America who want to replace religion with science?

A. They do not want to replace religion with science, but they may wish to develop special science schools and to segregate those children who have special scientific ability. The suggestion has been seriously made in America that children who have good scientific ability should be taken out of their ordinary classes at the age of nine. They should then go to special classes. At the age of twelve they would go on to special high schools devoted only to science. From there they would probably go on to institutes of science which are not necessarily public, but may be run by the Army and the Navy. In this way we could develop highly trained scientists and

scientific workers at greater speed than through the normal school channels, but they would be very highly specialized and possibly biased. If you segregate people in special schools, they may cease to be ordinary Americans like ourselves, because they lose the other influences and the contacts with people in other fields of learning. We should remind ourselves that Hitler did just this. He segregated the specially bright at the age of nine. And in later years the German scientists seem to be just as content devoting their time to science for war as they might have been in devoting it to science for peace. If this occurred in America we would in effect be losing control of part of our educational system and actually losing control of our children themselves. Let's remind ourselves that this suggestion was seriously made in order that we could keep ahead in the arms race; in other words the suggestion is a product of fear. We can counteract it by seeing that our school programs are up-to-date and by encouraging, or at least not discouraging, the natural curiosity of our children in their own homes.

Q. I happen to be a Quaker and all this talk about atom bombs and arms races is very distressing to me. I want to do the best I can to prevent war in the world and am prepared to work hard at that aim. But I don't see that that involves any understanding of atom bombs. How can they possibly concern me?

A. You are making the common mistake of confusing atomic energy and atom bombs. In 1763 an English boy named James Watt tried to hold the lid on a kettle of boiling water and so discovered the first steam engine. Subsequently, steam was used for ocean-going liners. It was also used for battleships, but because we originally knew it as something of peacetime usefulness, we remained interested in steam engines, although we might have been hostile to battleships. The same was true of the automobile which first sputtered down the streets of Paris in 1770. Even though the automobile engine has been used for tanks, which we may not like, we still remain interested in Fords and Cadillacs. The point is that we were able to watch automobiles and steam engines and airplanes growing up and we knew them first as interesting peacetime experiments. But atomic energy first came to us as a bomb and most of our news about it since has been about atomic weapons. Actually there are hundreds of peacetime uses for atomic energy for every one use that there is in war. If we could solve the problems that make for war and have perpetual peace in the world, it would not do away with atomic energy. In fact the atomic age would probably come to us a great deal faster, because we could spend all our money and all our brains on these peacetime uses, which may be so important. But even assuming we devote all our energy to atom bombs, there is still some reason why an ordinary housewife should know something about atomic energy. This is true whether the housewife is a Quaker, or a Catholic, whether she is a person who believes in fighting for our country or believes in conscientious objection.

Q. I'm a housewife, and I simply don't believe I could learn anything about atomic energy. I never was any good at all at science. What should I know about atomic energy?

A. If there should be a war, we will probably be fairly safe in Iowa. Not because airplanes will not fly over us, but because there are no serious military targets in the state. It is unlikely that an atom bomb will fall on you or me. On the other hand, it may fall on one of the big cities nearby, and you and I would like to help take care of the injured or homeless. That is only natural because we are all good Americans. When it comes to opening up your home and offering your spare bedroom to an evacuee from a big city you may find yourself faced with an unexpected problem. When the evacuee is brought to your home, he may turn out to have his face badly burned by exposure to atomic rays. At once the question arises in your mind: Can I let this person use the same plates and cups and knives and forks as my children use? Can I let him sleep in linens that I may subsequently use on my own bed? Are burns and wounds from atomic rays likely to cause infection in my house? In the event of a disaster the kindness and mutual self-help which is so characteristic of America may be actually affected by ignorance of atomic energy. We can get along fine now without any knowledge of these things and the time will never come when all of us need to know *everything* about atomic energy. But in a crisis it begins to look as though all of us may need to know *something* about atomic energy.

Q. What are some of these peacetime uses of atomic energy?

A. We can answer that best by asking ourselves a series of other questions. How many of the housewives use floor wax and furniture polish? How many of the young girls use hand lotion and face cream? How many wish that the floor wax or the face cream would only last a little bit longer than it does? The enduring qualities of floor wax, furniture polish, hand lotion, and face cream are tested these days by modern methods which involve the use of atomic energy. How many of the farmers use engine oil in their tractors? How many of us wonder whether we should change the oil in our automobile this month or let it go a few weeks longer? Atomic energy is used in the most modern methods of testing the lubricating quality of automobile oil. How many of us live in houses that have a steel beam across the basement to support the kitchen floor? By the use of atomic energy we can test the quality of steel and find flaws in steel beams much more easily than we could in the past. How many Iowans every year die of cancer? At our own University, atomic energy is involved in modern methods of seeking to locate and to cure cancer and a great many other diseases. How many of us who have farms or back yard lots wish that the grass would grow faster once the snow has gone and that the vegetables and flowers would remain free of moles and fungi that destroy them? Atomic energy is helping us to find out exactly how plants grow and the Atomic Age may yet see us double the quantity of disease-free food and disease-free stock that are raised in this bread-basket of the world. These are peacetime uses in research to improve the every day things around us.

Q. What about atomic power?

A. Like the bomb in Russia it may come sooner than we expect. It isn't likely that you and I will drive atomic-powered cars, but we may live to ride on an atomic-powered train or ship.

Q. I couldn't drive a diesel-powered train or ship. I don't know how my television set works and when my automobile goes wrong I simply get somebody to tow it into the garage. If they ever get atomic power I suppose there will be service stations and trained people to look after it just as they look after the automobiles now. I can't see that it will make any difference to atomic power whether I myself know anything about atomic energy or not.

A. That's perfectly true. Our personal *knowledge* as ordinary adult citizens of Iowa isn't going to make much difference as to whether we have atomic-powered automobiles tomorrow or the day after. Our *attitude* will make some difference. If we are looking forward agreeably to commercial peace-time uses of atomic energy it will come somewhat faster than if we are afraid of it. There was a time when you couldn't use a road-roller without having a man walking in front of it with a red flag. That does not really encourage the use of modern road-making machinery. But we have long got over that stage of being afraid. But these are not the sort of questions and problems that we as adult citizens will be called upon to consider and help find answers to.

Q. What sort of peacetime problems connected with atomic energy are we likely to be asked to solve?

A. Well, they are questions like these: Should we continue to have an Atomic Energy Commission or should we turn the whole business back to private enterprise? That question was actually raised by Governor Dewey of New York in the presidential campaign of 1948. We Iowans, after all, are co-owners with all other Americans in the Atomic Energy Commission, which is not just another government department but a public corporation. It may seem rather odd that in this nation which is the bulwark of private enterprise we should establish a public corporation to deal with the production of atomic energy. Why? If we understand just a little about atomic energy we can understand the reason why. That is a matter of local control of production of atomic energy, but what about international control of it? Our attitude toward this problem was expressed in the Baruch plan, which suggested international ownership of the means of producing atomic energy. That also is a revolutionary idea for Americans. The Russians, who are supposed to believe in socialism, had quite a different plan and our representatives at the United Nations had to decide whether to stick by our own plan or to adopt the Russian plan. There was no reason to believe that the Russian plan was insincere. It was the sort of plan that might have worked in the production of anything but atomic energy. And why is the production of atomic energy different from the production of steam or electricity or oil?

Q. Those issues are on a pretty big scale. Most of us feel that we couldn't do anything about them anyway. Iowans don't actually govern America. In what way would atomic energy influence us?

A. Well, here is something that happened in Iowa that did cause a certain amount of stir. On the campus of our State College at Ames there is a major research project connected with atomic energy. A certain number of people in Ames tried to have this project removed. Some farmers also tried to have it removed because they thought it would blow up the whole State College and destroy our research in agriculture. The same is true of Idaho. The first atomic breeder is located in Idaho in a small town. A number of the people in this small town were glad to see the plant because it brings employment and therefore money to the town. But a number of others also felt that at any moment the breeder might blow up the whole town and it would be far better if they could see that it was pushed into some town other than their own. Now if you don't know what a breeder is, if you don't know what sort of research is done at Ames, if you don't know whether these things are safe or unsafe, how can you make intelligent decisions about them?

Q. But we are not consulted in matters like this. If we had an actual say in what goes, maybe it would be a great stimulus to understand what it is all about?

A. We actually do occasionally have a say in what goes. In 1948, for instance, we were consulted about American policy relative to atomic energy. That was the year, if you remember, when there was a fuss because we were exporting radioactive isotopes to Norway. These isotopes were made at Oak Ridge. There was a big fuss in Congress and throughout the country when it was found that these were being exported to Norway, because Norway has a common boundary with Russia and could conceivably be captured by Russia in the event of a war. In any case secrets could be easily smuggled across the border. We know that many Iowans asked questions about this and a great many wrote letters to their congressmen, requesting that the export of radioactive isotopes be discontinued.

Q. What's wrong with that?

A. Let's look at the facts and see. Radioactive isotopes are also made in the Chalk River Valley plant in Canada which is a bigger plant than that at Oak Ridge. They are made in the two atomic piles in England. They must be made somewhere in Russia. But you do not even need an atomic pile to make radioactive isotopes. They can be made in a cyclotron and there are cyclotrons in Switzerland, in Great Britain, in Germany, in Italy, in France and possibly in Norway herself. The only difference is that it is cheaper to make them in an atomic pile than it is to make them in a cyclotron. If we cease to export radioactive isotopes to Norway, she could get them from somewhere else or she could manufacture them herself. It would mean some delay while she made the plant or changed her contracts for importing them, but it certainly would not mean that Norway could not get radioactive isotopes. Yet there was quite a big stir in America about this. If we had exercised the power of public opinion and stopped the export of isotopes, as seemed to be the case at the time, we would simply have demonstrated to the other part of the world that the American public is uninformed, and that democracy can make a fool of itself in public. Let us remind ourselves that we are the people who ran away from an Orson Welles' broadcast concerning an invasion from Mars. The world laughed at that. So perhaps we ought to know what a radioactive isotope is before we decide whether it should be exported or not.

Q. Isn't that a matter exclusively for the Government?

A. In the American ideal who is the Government? In this matter of isotopes, we the people were actually consulted. We should remember that some of our political representatives are no better informed about atomic energy than we are and are often just as much afraid. And most of our representatives respond readily to our wishes when we express them and they have been known to consult us on issues concerning atomic energy. This is true of Iowa as well as other states. Senator Hickenlooper has had things to say to us and has consulted us and some of these things can be found in the next chapter.

Q. But if the public did make an uninformed decision, the Government really wouldn't take any notice of it, would it?

A. Possibly not, and then what is happening to democracy? Because the public is not sufficiently well informed about these things to make up its own mind or to direct its political representatives intelligently, Dr. James B. Conant, President of Harvard University, suggested that we establish tribunals of experts, not elected representatives, to whom all legislation should be submitted for criticism before it was passed. This suggestion we could have known about in Iowa because it was reported at some length in the *Des Moines Register* on January 12, 1950. The interesting feature of the proposal was that Dr. Conant suggested that if a representative proposing legislation, or the agency head proposing new regulations, chose to disagree with the advice of the tribunal he should be required to state his reasons. In other words, the legislative power goes to the tribunal which is not elected.

Q. Is there anything wrong with using experts in that way?

A. Not necessarily. It depends on how much power the experts actually have. In Russia there is a committee of experts which is called the Politburo. None of these people are elected but all legislation in Russia has to be referred to them and in fact we all know they are the government of Russia. Now if we establish a system of taking young scientists out of school at the age of nine and making them hopelessly over-specialized people and then erecting tribunals in which they might serve and have an ever increasing amount of power, what is happening to American Democracy? Making decisions outside the level of the public's understanding tends to lead to dictatorship. For us the choice is still in our own hands.

Q. These are social or political questions. I'm pretty much interested in these social problems but I'm not interested in science and I never really could understand it. Is there actually a connection between science and politics?

A. Just look at a few of the terms we have used during this discussion: atomic pile, atomic breeder, radioactive isotope, Baruch Plan, Atomic Energy Commission, scientific advisory tribunals. The last three of these are easy to understand because they are social issues but they rise out of the first three and unless we understand what the first three are we cannot even understand how the social problem arises, let alone how it can be solved. As Dr. Conant remarked, science and politics are no longer two unrelated activities. We have to find some sort of system for synthesizing them without ourselves losing control of our democratic way of life.

Q. I think I begin to see the connection between scientific facts and political life but that doesn't help much. I just never could understand scientific things in school. I'd probably be worse now because it's years since I left school. There must be a great number of men and women just the same as I am. What hope is there for America if so many of us find modern science completely beyond us?

A. There are two things involved in this question. First, I think a number of us think we are stupid at science because we used to find science dull as we were taught it in school. Science was taught to us as though we were all going to become professional physicists or chemists. It was also taught to us without any reference to its meaning in our everyday lives. Yet we have all accepted the scientific age. If we took away the automobiles, the ships, the airplanes, the tractors, the telephones, the radios, the washing machines, we simply could not live today. Steam, electricity, gasoline, were all revolutions. They were all new when they arrived just as atomic energy is new. The public in each case was either skeptical or even hostile. And every discovery raised social problems, such as temporary unemployment resulting in the smashing up of machinery in England in the last century. These social problems were solved when people understood basically what steam was and how it could be put to work. Understanding what steam was and how it could be put to work didn't mean that we all had to become steam engine designers or engineers. And understanding enough about atomic energy in order to quit being afraid of it and help put it to work does not mean that we all have to be nuclear physicists. It does not mean that we have to be trained scientists at all. We need never go into a laboratory. Anyone can understand what an atomic pile is or how radioactive isotopes are made though we could neither work a pile nor make an isotope. The people who make the latter have never actually seen them. In other words what we seem to need is a series of new concepts about certain things in science. We need to be able to take a look into the mind of a scientist and see how it works. This is actually not difficult at all. Nor is it dull, if we are to judge from the reactions of nearly a thousand Iowans who voluntarily submitted themselves to lectures in the science of atomic energy and the relation of this science to the social issues arising from it.

Q. I read a bit about some lectures being given somewhere but they weren't given anywhere near here. How can I get hold of some stuff that I can understand in this atomic energy business?

A. Actually this isn't really a problem at all. Getting to know about anything is merely a matter of having the skills and getting hold of the material. We Iowans have the skills very highly developed. We are the most highly literate state in the Union; we all can read whether we do or not. There are plenty of books on atomic energy but there are also frequent articles in the newspapers nowadays. Provided we get to know the meaning of some of the new words, these newspaper articles discuss everything, both scientific and social, and sooner or later our favorite columnist or editorial writer will have something to say to us about it. As for the new words, there is a high school teacher somewhere quite close by who knows what an isotope and an atomic pile are and another high school teacher who probably knows what the Baruch Plan is and another what the Atomic Energy Act has to say.

Most of us go to the movies. Commercial movie houses are scattered all over the state and almost all of us live near one. Also a good many of our schools have equipment for showing movies. There are a great number of movies about atomic energy, both commercial ones made by such organizations as the March of Time and educational films especially made to teach with. Most of these films are available from agencies right here in Iowa.

A great number of us listen to lectures at the service clubs, or at women's clubs. Most of us learn quite a lot from the lectures we hear. We have a habit of talking over what was said and comparing it with what somebody else says on the same subject later on. In a state with so many high schools and so many colleges scattered all over it, there is probably an opportunity of arranging for a lecture or two on the subject of atomic energy by some local person.

A great many of us also belong to study groups in one or another of the clubs such as the Women's Club, the AAUW or the League of Women Voters. We have learned how to study for ourselves or in groups through these clubs. There is plenty of material available to such groups.

Also most of us are used to conventions and conferences, and to special periods when we concentrate our ideas about one topic, such as American Education Week or United Nations Day. It is perfectly possible to arrange an atomic energy week or an atomic energy day. Both have been done in several places in Iowa.

So it appears that we already have the necessary skills to learn all we want to know about atomic energy and probably the people and the materials are closer than we think. The rest of this bulletin is devoted to explaining how close these materials and people are and how we can best use them individually, through our clubs, or through our entire communities.

Q. I happen to know that my next door neighbor is pretty much interested in atomic energy. His hobby is electricity and he made a Geiger counter on instructions he got from the Atomic Energy Commission. One night when we were over there for bridge he showed us how it would click when a clock with a luminous dial is brought close to it. Could we arrange a program next week, possibly using him as the expert?

A. You probaably could but would it not be better to do a little thinking first? We have been trying to answer some of the questions that are in people's minds. But there must be a great many more questions. Wouldn't it be a good idea if first of all we tried to go on from where we are, to find out how many more questions there are, and possibly to make a list of all the questions and all the worries that people have about atomic energy in our community? It also seems to me that it is a good idea to try to find out in advance what it is that we want to know. Different people want to know different things, so we might find that one program didn't actually fit the bill. Even the national leaders of America are not absolutely certain of what it is we should all know, as you may see if you read the next chapter. So we could best start our thinking with a pencil and paper to stop us going round in the endless circle that often results from casual conversation.

FURTHER ACTIVITY: In our spare moments during the next few days let us each write down the questions which occur to us when they occur. Sometimes questions rise in our minds right in the middle of work, whether we are cooking in the kitchen or doodling in the office, or sitting on the tractor trying to keep the furrows straight. So I suggest we pocket a dime notebook and carry it with us to write down the questions that might otherwise get lost or forgotten. At the same time we could write down the things that we would be most interested to learn, such as whether radioactive burns are infectious, whether atomic energy will grow lettuce six feet high, whether we can make a Geiger counter in the basement workshop, or whether we want to leave the whole business of atom splitting and world shaking to the other guy.

(Courtesy *Hawk-Eye Gazette*)

ADMIRAL STRAUS TALKS TO IOWANS

Admiral Straus, a member of the Atomic Energy Commission, addresses a mass meeting following a spectacular blackout in Burlington.

CHAPTER II

CONSULTING NATIONAL LEADERS

What Great Americans Expect of the Little Guy

HOW TO USE THIS CHAPTER: At the end of Chapter I we concluded that learning about atomic energy is simply a matter of applying skills which most of us already have to resource materials that may be more readily available than we had first believed. We also concluded that, before plunging into this rich and varied, not to say confusing field of knowledge, we should do a little clear thinking about what it is we want to know concerning atomic energy, what if anything we ought to know for the security of ourselves and our way of life. This type of thinking, which amounts to making our own philosophy of atomic energy education, is not easy. We begin to feel the need of advice; we would like to talk with national leaders whose experience in science and government is wider than ours can possibly be.

This chapter is a conversation with such leaders.

You may read it alone, pondering especially on the direct quotations it contains, some of which were expressly written for the Production Committee. Ask yourself how these opinions of great men fit your own circumstances, how this advice can be incorporated in your own thinking.

You may use it as discussion material in your club, church group or study circle.[1] A good way to do this is to dramatize the chapter a little. You will need a "Narrator" and several "Voices." The Narrator is responsible for the continuity and can either read from the chapter or paraphrase it into his or her own words. The Voices will each take a quotation and read it as printed, for these are direct quotations. Thus one member of the reading circle becomes the "Voice" of Mr. David Lilienthal, one of Senator Hickenlooper and so on. Dramatized, the chapter would then be read thus:

Narrator (reads): On August 6, 1945, President Truman announced to the world that a new type of bomb—an atom bomb—had been dropped on Hiroshima. Included in his announcement were these words:

Voice (reads): "The release of atomic energy constitutes a new force too revolutionary to consider in the framework of old ideas."

Narrator resumes reading from the chapter until the next quotation, when another *Voice*, that of Lilienthal, is heard.

Be sure to select people who can read aloud fluently and confidently. It is a good idea to use two books, the Narrator retaining one, the other being passed from Voice to Voice as each one's turn to read occurs. Before "presenting" this dramatization to a club group, every member of the "cast" should have had a chance to read the chapter, or at least her "part," and a rehearsal is not a bad idea. This method of dealing with the topic is good fun and at the same time stimulating of good open discussion to follow, for many of the listeners will be waiting their chance to argue with "Mr. Truman" or "Senator Hickenlooper."

[1]See Chapter IV.

You can use the above procedure to work up a presentation for a much larger audience than your club circle, or for a program on your local radio station. Many radio stations in Iowa have already carried programs on atomic energy supplied from the State University of Iowa, and will be willing to help you with your own local program.

Finally you can extract the conclusions from this chapter and use them as a guide for a series of study group meetings or short lecture series arranged in cooperation with high school or college teachers in your community.

A CONSENSUS OF LEADERS' IDEAS
(on what you should know, and why)

On August 6, 1945, President Truman announced to the world that a new type of bomb—an atomic bomb—had been dropped on Hiroshima. Included in his announcement were these words: "The release of atomic energy constitutes a new force too revolutionary to consider in the framework of old ideas."

All scientific developments and discoveries—in fact, all forms of knowledge—have a two-sided nature: they can be used for good or for evil, as man chooses. Atomic energy is no exception. Used constructively, it holds forth great promise for a better and happier life for this and future generations; used for destructive purposes, it holds—destruction.

Scientific discoveries and inventions have always created problems—social, political and economic. So, too, has atomic energy created new problems, intensified some old ones. However, because of the nature of atomic energy, the problems and issues which it has created are more acute, more critical than those we have been accustomed to in the past. Many of these will have to be solved by the present generation of adults, for the atomic age is with us *now*, and is *here to stay*. The solutions will be wise or foolish, enduring or transient, according to the framework of ideas in which they are made.

Public opinion polls have indicated, however, that in spite of the many newspaper and magazine articles continuously being written on the subject, the level of information possessed by the American public regarding atomic energy matters is rather low. We are pleased to note that an independent study has shown it is slightly higher in Iowa than in neighboring states, but misinformation and misconceptions abound. Furthermore, Iowans as a whole have not been much concerned with the problems and issues that atomic energy has raised. Indeed, there has been little awareness of these problems.

The Production Committee therefore consulted many national leaders in an attempt to determine what it is that the adult citizen should know about atomic energy, and why. The Committee believes that there are several important reasons why *everyone* should have a minimum of such information. These reasons, substantiated by the views of the consultants, are given below.

1. **Civil defense.** Under present conditions, civil defense must take the number one spot in any program of atomic education. It is simply a question of survival—our survival as individuals, as communities, as a nation. Blind fear and hysteria must be replaced, so far as possible, with information and understanding. It is in this way that we can reduce casualties to a minimum if sudden disaster should befall us.

Mr. David Lilienthal, former chairman of the U. S. Atomic Energy Commission, speaking before the Radio Executives Club, New York City, on February 5, 1948, had this to say about fear:

"We shall need good steady judgment and cool heads in the coming years. Public thinking that is dominated by great fear, by phantasy, or by indifference to one of the central facts of our century provides a sorry foundation for the strains we may find it necessary to withstand, and the hard decisions and courses of action that may inhere in this extraordinary situation. . . .

"Anyone experienced in human affairs recognizes fear as a dangerous state of mind. To those who have given little thought to such matters, it might have seemed a good idea to scare the world into being good, or at least sensible. But fear is brother to panic. Fear is an unreliable ally, it can never be depended upon to produce good. One result of intense fear may be panic, but another is likely to be phantasy, a dream-world. For men can stand great fear only so long. The sturdier ones look around for something specific they can do to overcome the cause of their fear. But most people, unable long to endure fear, turn to unreality. Things that are disturbing just don't exist. Other more pleasant objects are substituted. People who insist upon talking about unpleasant facts, and after a while facts of any kind, are condemned or avoided.

"If not fear, then what?

"Our answer is: understanding, comprehension, knowledge. . . ."

2. **Preservation of democracy.** Thinking people agree that it is essential for citizens in a democracy to understand current problems and issues. Many issues affecting our national life have involved and will continue to involve science and technology in one way or another, particularly atomic science. In fact, atomic energy has often been referred to as the greatest social issue of our time. Wise decisions regarding this great discovery require widespread discussions. Discussions cannot be carried on successfully unless the participants possess a minimum of essential background information about the subject being discussed.

What are some of the fundamental issues and problems of democracy that have been either created or intensified by the advent of atomic energy, and concerning which the people must form opinions and make decisions? We can readily mention the following:

a. Civil versus military control of our huge atomic energy enterprise.
b. Public versus private ownership of this multi-billion dollar industry.
c. Policies of the Atomic Energy Commission under the Atomic Energy Act.
d. International control of atomic energy.
e. Secrecy in atomic energy matters and its relation to our security.

Let us see what several well-known and responsible leaders have to say regarding the need, in a democracy, for public understanding on these matters.

In an address given on February 27, 1950, before the 76th Annual Convention of the American Association of School Administrators held at Atlantic City, N. J., Mr. David E. Lilienthal spoke concerning the danger to our democracy in this atomic age. He said:

". . . In the perspective of time, the terrible challenge to Americans of the release of nuclear energy does not lie solely in the incredibly destructive force of atomic weapons, including that form of possible nuclear weapons known as the hydrogen or super-atomic bomb; the chief importance may not be in the wholly new and almost boundless sources of energy to do man's work that in time will be ours, nor is it in the great advances in the conquest of disease and suffering, nor in the radical improvements in agriculture and in nutrition which are on the way as a consequence of these early atomic discoveries.

"As we meet here tonight, there can hardly be any doubt that a principal danger to the people of this democracy is that atomic energy in our hands can result in weakening our own institutions of freedom. It is not the plotting and design of evildoers from within or without of which I now speak. I speak of a more subtle hazard and an ancient one —a disregard of the injunction that the blessings of liberty are only for the vigilant, the eternally vigilant.

"In our diligent efforts the common goal of us all is to provide for this country the greatest possible security in a tough world, in which the release of atomic energy is no longer an American monopoly. We must not unwittingly or carelessly or in fright or hysteria adopt practices that are in reality authoritarian and totalitarian.

"You are all aware of the argument that the great modern advances of technology and science require the abandonment of essential individual rights and, with them, the whole dream of human dignity as the cornerstone of our institutions. At this very hour more than a billion people are being promised daily a higher material standard of living for this price: that they abandon the ideals of individual liberty.

"For more than a generation before the atom bomb exploded in Hiroshima we had been told that the consent of the governed is not compatible with modern technical progress. Indeed, the acceptance of this doctrine by the people of Germany and Japan and Russia and temporarily of China is the principal event of your lifetime and mine.

"This argument that technology dooms democracy can be simply stated. Democracy, it is stated, is founded on the idea that the people as a whole are capable of educating themselves, educating themselves sufficiently so that their judgment about broad courses of policy, public policy, will make sense and will be workable. Furthermore, democracy assumes that there is time enough for the people to educate themselves and then to translate that knowledge and that understanding into decisions and actions by their freely chosen representatives.

"Against this, it is argued that these assumptions of the people's capacity for education and for their own decisions may have been sound in a simpler world, but that science has changed all of this. Science and its offspring, the atom and the prospect of a super-atom bomb—these make democracy obsolete, so the argument runs, or make it a museum piece.

"Whether our ideal of democracy be explicity repudiated, as in Germany and Japan and Russia, or jettisoned by less candid and more subtle means—and this latter is what is predicted for us—the end of self-government is at hand, so it is asserted. The things we hate, we shall fix upon ourselves as a consequence of our own technical advance. This is what is foretold for us. . . .

Senator Brien McMahon of Connecticut, late Chairman of the Joint Congressional Committee on Atomic Energy, in a private communication to the Iowa Committee on Atomic Energy Education, states his views on this question as follows:

". . . The general public should know at least the facts which are necessary for the rational formulation of fundamental policy choices in the field of atomic energy. . . .

"The public should be concerned with [atomic energy] for the same reason that people are concerned with life and death. I can think of nothing that should interest Americans more than the state of our Nation's atomic energy program. Until such time as the Soviet Union agrees to an effective international plan for controlling atomic weapons (and naturally we must continue to work without ceasing to secure Soviet acceptance of such a plan) our survival as free Americans will depend in very great part upon our success in exploiting the military uses of atomic energy. And if the day comes when we are able to turn all our efforts to harnessing the atom solely for peacetime purposes, the health and prosperity of every one of us will depend in large part on the diligence and sagacity we display in leashing for constructive purposes the power of the atom.

"The hard fact is that the American people simply cannot ignore the split atom; it will shape our destinies irrespective of our wishes. There is simply no halfway house. We control the atom, or it controls us. The matter is altogether too fundamental to be left solely in the hands of the officials designated to direct our atomic program. They are deeply aware of their unique and profound responsibility to the American people, and it is this very awareness that makes them urgently want the help of Americans who know the facts that emphatically bear upon their survival as a free people."

Mr. W. W. Waymack, former Editor of the *Des Moines Register* and for several years a member of the U. S. Atomic Energy Commission, says:

". . . [There is] urgent need of carrying essential education about atomic energy development to all segments of our people. Without a rapid spread of factual knowledge there can be no foundation for understanding of the many problems and dangers involved. . . .

"The spreading of factual knowledge about the complex development that with characteristic oversimplification we call "atomic energy" is vital, as I see it, if we are not to risk disastrous defeat for everything that we are trying to do governmentally in the "new world" of the nucleus of the atom and indeed for everything that as a people we deeply want to achieve. Without it we shall be at the mercy of misconceptions, narrow stupidities, the emotional befuddlement of excessive fear, of cultivated hysteria, of weakness accumulated in the name of strength. . . .

"I say flatly that it is impossible in a free society to deal intelligently and safely with what we have unless there is spread widely a broad and general (not a detailed and technical) understanding of what science has brought us into. . . .

". . . Our hopes of moving promptly from a multi-camp world into a one-camp world have failed. We are stuck, for no one knows how long, in a two-camp world. Tensions are not noticeably decreasing. Time marches on, bringing us closer to new alarms. The timing of them is uncertain, but their nature can be guessed. . . .

"The problems and dangers raised by atomic energy development are not the whole picture, but they are a very significant part of it, they are of the same nature as the whole, and they probably are the acid test of our capacity to survive as a free, self-governing society, firmly attached to human rights, successfully rejecting any "fuehrer" principle."

Dr. Robert Bacher, also a former member of the U. S. Atomic Energy Commission, and now Head of the Laboratory of Physics, California Institute of Technology, has been very outspoken in advocating free and open discussion regarding basic policies of our government, particularly those pertaining to atomic energy. He has expressed himself clearly as to why the citizen should be informed on atomic energy matters:

"Few people have any doubt today that our national security is closely tied to atomic energy. Therefore the citizen needs to know enough about the possibilities of atomic energy and about the present status of its development to enable him to judge whether his government is doing a good job. . . .

". . . Democracy will work only if our citizens are well informed on vital issues. And the future of our democracy may depend upon what we do about atomic energy. . . ."

Dr. L. A. DuBridge, another physicist, now President of California Institute of Technology, has spoken in a similar vein:

". . . the public should know everything that affects the public welfare and security and they are entitled to know as much as can possibly be told. . . .

". . . The basic facts [about atomic energy] after all are not very difficult. It's a complex subject in all of its technical aspects but the basic things about it are relatively simple and there's no use pretending that it is beyond the understanding of the people of this country. It would be terrible if it were beyond the understanding of the people because they must understand it. If politicians are talking about it, this means that a lot of other people must be talking about it too, making decisions about it which are important and which will affect the future of the country and maybe of the world. . . .

". . . atomic energy is going to be for generations a problem which concerns you and me, every individual, every citizen of this country. Its applications and possible uses are going to be far-reaching in one way or another. It will be in part a political problem and so we might as well get used to the idea that we ought to be talking about it and be as familiar with the idea of nuclear reactors as we are with coal and oil furnaces and internal combustion engines in automobiles. Sooner or later it is going to catch up with us if we don't understand some of the problems which are involved in this field. For if we don't understand them we cannot treat them intelligently, and disaster might then result."

And this statement by Drs. Anatol Rapoport and Alfonso Shimbel, mathematical biologists of the University of Chicago:

"Democracy implies the ability of individuals to make and express a choice of action for their group. But a meaningful choice obviously implies some knowledge of probable consequences. Therefore, the formal mechanisms of choice, such as ballots, polls, referenda, etc., do not **per se** constitute democratic procedures. They must be supplemented by at least a minimal understanding of the issues involved."

Next we should like to quote Dr. Israel Light, a social scientist who has served as educational consultant to the United Nations, and as specialist in atomic energy education in the U. S. Office of Education. He says:

"Science is becoming so all-pervasive in our lives, individual and collective; science and technology are becoming so increasingly effective in making the world more of a unit; time, space, and distance are so rapidly converging, that the citizen's decision may have world-wide repercussion. He is truly a citizen of the World.

"In his personal life the citizen is assumed to be his own master. If he is not to forfeit this enviable status he must be armed with sufficient knowledge to help himself and fellow-citizens in making the material aspects of our culture serve their best interests. In this way only can life be of significance and satisfaction to the individual, and in this way only can democratic principles be preserved for the "better life" of the nation and the world."

Dr. F. H. Spedding, Director of the Institute for Atomic Research, Ames, Iowa, has this to say concerning the need for public education on the subject of atomic energy:

"I am firmly convinced that the discovery of how to utilize "atomic" or nuclear energy will have as profound an impact on our civilization as has the discovery of how to use electricity, steam, or the explosions of the internal combustion engine . . . .

"I . . . think it is extremely important that our average citizen be informed of these matters [basic principles underlying atomic energy, and the impact on our civilization of the scientific developments in this field] in every way possible. Our democracy is so constituted that most of our major decisions have to be made by public opinion. It is essential that this public opinion be informed, so that the public bases its judgment on knowledge rather than emotion. . . ."

Mr. Robert Blakely, former editorial writer for the *Des Moines Register*, and a brilliant young journalist who wrote the first series of popular explanatory articles to appear in an American daily paper, agrees with the views expressed by the authorities quoted above, and brings out a further reason why people should be informed on atomic energy matters. He is concerned with science in general, and mentions especially the importance of knowing something about the methods of science. Here is what Mr. Blakely says:

"The issues concerning atomic energy which the American people will have to decide will concern the use to which it is put. Examples are the proposals for world control of production, the share of the national budget devoted to scientific research, the proper relations between the civil and military authorities. These are not now and will not be scientific or technical matters. They are and will be matters for broad human experience and judgment. The broadest foundation of experience and judgment is the people themselves. However, more than good intentions are necessary for coping successfully with such issues. A high degree of understanding of the pertinent facts is indispensable. . . .

"Tests indicate . . . that there is little relationship between the number of facts of science a person knows and his understanding of the methods by which those facts were discovered. Yet an appreciation of the methods of science is essential for a number of reasons. The facts and theories of science are being constantly revised, but the methods of science are stabilized. A grasp of the tentativeness and dynamism of science helps one constantly revise his knowledge and attitudes. Also, if one does not understand the methods of science, he is likely to regard science as mystery and scientists as black or white magicians. He is likely to be afraid of scientists and to persecute or idolize them, and in any case not use and support science properly. Atomic energy is an excellent field from which to explain and illustrate the methods of science. It is new, it is spectacular and it includes some of the best examples of the workings of science.

"Even this is not enough. The methods of science properly applied to society are a possible way out of our perils. Our citizens should understand the meaning of the methods of science for society. . . .

"[They] can be given examples of what science has already done in the removal of tensions and what remains to be done. They can be helped to understand what the application of the methods of science to individual and social problems would mean—that is, the analysis of the situation and the definition of the problem, the forming of hunches, the testing of hunches, and the need for the individual and the group to cooperate in using these methods. An appreciation of the meaning of the methods of science for society is—or should be—the main objective. . . . Such appreciation can be promoted by the study of atomic energy because of the apocalyptic choice it presents us between creation and destruction. . . ."

3. **Individual Adjustments.** These have to do with living in the Atomic Age.

a. Dr. Lillian Wald Kay, social psychologist of New York University, in an article appearing in the April, 1950, issue of *Nucleonics*, mentions an important reason why people should know something about atomic energy. This reason is concerned with individual mental health. She points out that living in our modern complex civilization is not an easy matter. Changes come so rapidly that emotional plateaus are hard to find. The events and problems of the Atomic Age have been presented in extreme emotional terms. Dr. Kay then points out that the best way for the individual to avoid either undue despair or over-elation in the face of modern scientific achievements is to try to comprehend as well as he can just what these scientific achievements mean—to him, and to society in general. Information and understanding reduce fear and improve morale. This is of vital importance in these times.

b. The individual should become aware of new jobs and opportunities in this great field of atomic energy, and possibly prepare himself for one of these jobs.

c. There will be a long-range economic effect of atomic power, which may seriously affect our whole economy, and that of other nations.

d. There will be social and economic effects resulting from the use of radioactive isotopes in medicine and in research in biology, agriculture, and industry. People will live longer, more diseases will be cured, new and better products will be made, more food produced, etc.

e. Under the threat of war, individuals must cooperate in organization of defense at the local level, and actually take part in such defense when necessary. This requires that adequate and correct information be acquired. The whole situation imposed by the present state of national and international affairs must be evaluated, including such things as the strategy of modern war and the evaluation of propaganda. Fear and hysteria must be controlled.

4. **Cultural Value.** The Production Committee which planned this manual had still another reason for believing the adult citizen should be informed on atomic energy matters. It has to do with the cultural value of the subject itself. Knowing some of the elementary facts about atomic energy, being "up" on the terminology used in articles and discussions about atomic energy, being able to converse intelligently on the subject with others, including one's own children who are learning about atomic energy in the schools—all these tend to give one a feeling of personal satisfaction, a sort of "easy familiarity" with the Atomic Age in which we live. It helps to create a healthy adult climate for growth, development, and understanding of science and what it means to us as citizens of a democracy.

The need for an understanding of the basic vocabulary and concepts peculiar to atomic energy is indicated in a study made by the Iowa Committee. An analysis was made of all of the news items, editorials, and syndicated columns appearing in the *Cedar Rapids Gazette*, over a period of one year and in the *Des Moines Register* over a period of six months. In the several hundred articles examined, more than 125 separate atomic terms and concepts appear, which, if not understood, would make the articles themselves difficult and perhaps impossible to understand. Terms like nuclear fission, chain reaction, radioactive isotope, tracer, and Geiger counter appeared in many articles. It seems obvious that in this Atomic Age such terms will become as common as X-rays, penicillin, hybrid corn, fluid drive, streamlined, etc. In fact, in very few of the articles examined was there any effort made to explain the atomic terms used. It was assumed that the reader was already familiar with them. Such an assumption is becoming more and more common in all newspapers and magazine articles on the subject of atomic energy.

We have seen that there are very good reasons *why* the adult should have some knowledge and understanding of atomic energy and its implications. But just *what* does he need to know? Is there a body of basic knowledge and understandings, facts and concepts that every citizen should have? The Production Committee asked this question of several hundred authorities in various fields. Although the replies ranged from one extreme (the citizen needs to know nothing about atomic energy) to the other (he should know everything possible), nevertheless, a large majority answered in the affirmative and stated what they felt the people ought to know. The type of reply received from these leaders is well illustrated by the following statement which was prepared for the Committee by Senator B. B. Hickenlooper of Iowa, member and former Chairman of the Joint Congressional Committee on Atomic Energy, in answer to our questions as to *what* the public should know about atomic energy, and *why*. His statement follows:

"A layman's understanding of the basic physical and chemical processes involved in atomic energy in the hope that understanding will nurture interest.

"An understanding of the historical development of atomic energy so that the unique contributions of American and foreign scientists, engineers, and industrialists can be properly evaluated.

"A realistic appraisal of the past, present, and probable future prospects for international control of atomic energy so that the responsibilities of citizenship can be discharged.

"Specific knowledge of the basic provisions of the Atomic Energy Act so that an understanding can be gained of the need for, and philosophy of civilian control, as well as an understanding of our present organization for atomic development.

"An understanding of the proportion of money and effort in atomic energy being devoted to weapons in comparison to peacetime applications so that a realistic appraisal can be made of various proposals.

"An understanding of the emphasis which has been placed upon the security aspects of atomic energy by the Atomic Energy Act, the Congress, the Administration and the people, so that informed judgment can operate unswayed by hysteria on the one hand or subversive propaganda on the other.

"A realization of the priority in money, materials and human talent that was devoted to the development of atomic energy in the United States, so that the true cost of our achievement to date may be understood.

"Information concerning the development and application of atomic energy in foreign countries, so that proper judgments can be made concerning the emphasis to be placed on various aspects of our domestic program.

"General information concerning the destructive capabilities of atomic energy, so that the importance of development and control can be appreciated."

As a result of its survey of expert opinion and its experimental studies, the Committee recommends that any program designed to interest a broad cross-section of a community in atomic energy should contain the following material. (The topics need not necessarily be taken up in the order stated.)

1. **Scientific Aspects.** The Committee feels, as do most of the authorities whose opinions were solicited, that one just cannot understand adequately the social problems and issues raised by atomic energy unless he knows a *little* of the science of atomic fission. It is this sort of background that is needed, for example, for any real understanding of the plans for international control, or for a critical examination of such a policy as shipping radioactive isotopes to other countries. (This policy was discussed at length in the investigation of the Atomic Energy Commission in 1949.)

Elementary scientific topics to be considered under this heading are: historical sketch of atomic science; structure of matter; structure of the atom; chemical and physical change; transformation of matter and energy; nuclear fission; nuclear energy; chain reaction—controlled and uncontrolled; radioactivity and radiation; Geiger counter; radioactive isotopes; basic vocabulary of atomic science; emphasis throughout on scientific method.

2. **Misinformation and Misconceptions.** These have been mentioned previously in this chapter. Atomic energy is not only a bomb; it is not difficult to grasp the fundamental facts (an experimental fifth grade class at the Campus School, Iowa State Teachers College* learned a great deal about atomic energy); the basic facts are not secret—the "secret" of the atom bomb, if there was one, went up with the first bomb when it exploded on the New Mexico desert; the release of atomic energy was not a wartime near-miracle —the principle was known before World War II. The sun and stars get their heat and light from atomic energy—in that sense it is not new. Its release is new to man, yet is the result of a long series of atomic discoveries and much scientific research extending over fifty years, carried on by scientists from many countries.

3. **Military Applications.** The nature of modern war; principle of the atomic bomb; nature of an atomic explosion as compared with other explosions; effects produced; limitations of the atomic bomb—it is not an absolute weapon which will replace all other types; the hydrogen bomb—principle, potentialities, limitations; civil defense—there **are** defense measures.

4. **Moral and Ethical Implications.** Are atomic weapons different from other weapons from a moral viewpoint? Does the United States have any moral responsibility regarding the use of atomic and other frightful weapons? Should we ever be the first to use the atomic bomb again?

5. **International Control and Political Aspects.** The problem of world control; nature of atomic energy makes some form of international control scientifically necessary; the United Nations Atomic Energy Commission and its purpose; history of negotiations; the majority plan; the Russian plan; agreements and disagreements; present situation—armaments race; growth toward terrible weapons of warfare; nature of modern war; inevitability of some form of international control and world cooperation; atomic energy problem only one aspect of problem of general disarmament.

6. **Peacetime Applications and Potentialities.** Atomic power, principles and prospects; medical uses of radioactive isotopes; isotopes as tracers in medical, biological, agricultural and industrial research.

7. **Social and Economic Aspects.** Long range economic effect of atomic power, national and international; effect of increased life span, better health; more and better food and other products; possibility for better living in a world at peace.

8. **Hazards of Atomic Energy.** Hazards peculiar to atomic energy: radiation, dangerous radioactive materials, problem of radioactive waste disposal; need for complex and expensive remote control apparatus to handle dangerous materials; need for heavy shielding in atomic power plants.

9. **Domestic Control.** Why national control was considered necessary; civilian versus military control; the Atomic Energy Act of 1946—need for, revolutionary nature of; the Atomic Energy Commission—organization, functions, magnitude; problems of the Commission; implications of Federal control—public versus private enterprise, relation between government and universities, impact of government funds and sponsorship on scientific research and commercial enterprise.

10. **Secrecy, Security and Public Information.** Nature of a secret; scientific secrets and military secrets; effect of excess secrecy upon scientific achievement, relation to security; clarification of concept of security; problem of maintaining freedom of speech, opinion and information, accessibility of leaders; dangerous trend—more and more decisions being made by fewer and fewer people, without adequate public discussion; implications for democracy.

This is a formidable list. Like any list, it is a little alarming. Let us recall the context in which it is given: "any program designed to interest **a broad cross-section of a community.**" An effective community contains many specialists; the doctor, nurse and pharmacist, the plumber, carpenter and electrician, the superintendent, teacher, and custodian. Collectively they make it possible for a community to do many things. How effectively these things are done depends both on the special knowledge of the individual and on the general understanding of the total citizens who control the community by sitting on school or hospital boards, chambers of commerce, juries, community development councils and the like. Any one of us may be called upon to do any or all of these things. Knowledge of atomic energy is both individual and communal. In the event of an atom bomb falling on our water supply, the waterworks engineer would need special knowledge of how to decontaminate water, but everyone would need to know whether or not to turn on the faucet.

The list, then, contains something for every interest and a general understanding for us all.

And we should not confuse "knowing" with "understanding". Any person can follow a simple explanation of what a radioactive isotope is and how it is used. Only a few know how to set about making a radioactive isotope. Those of us who followed the explanation satisfactorily, i.e. "understood" it, can thereafter make rational decisions about the use of isotopes for we understand what it is we are trying to use without knowing how to produce it. By the same process, most of us have long understood how to use electric power in a house without knowing exactly what electricity is or how to set about producing it. This is the sort of understanding we might all try to acquire. Many of the items on the list can be explained at this level of understanding in a few sentences. If you doubt this, turn to Chapter VIII and read the first six paragraphs. See if you now "understand" the difference between two types of secrets without "knowing" what the secrets are.

FURTHER ACTIVITY: Obviously the most important thing to do now is to discuss the views of the national leaders who speak through this chapter and see whether you agree or disagree. You have noticed that there are four fellow-Iowans among them, so you are not being asked to follow blindly "outside" views. It may be well to invite in a couple of teachers from the high school to help if there is confusion. The next important thing is to act on good advice. Because it is not easy to know how to act, the rest of this bulletin is devoted to recounting what Iowans have already done. There is sure to be something that fits your community.

*See Volume II, Iowa Plan, *Preparing Elementary Pupils for the Era of Atomic Energy*.

In the meantime why not have a little fun? Make a habit of picking up the atomic energy words appearing in the paper, just as the Production Committee did, and listing them. Throw them at your unsuspecting friends. You will be surprised how rapidly you will increase your understanding merely by looking up the meaning of these words. And incidentally, making a friend of the dictionary is a mighty good habit.

This chapter has quoted a few of the 115 leaders, of whom 47 were scientists and 68 non-scientists, with whom the Production Committee made personal contact. You may have grown interested in what such famous people think and wish to explore views not quoted here. A full record of their views was kept by Emil C. Miller, of Luther College, Iowa, and forms part of his study "A Study of Atomic Energy Education for Adults." This is not available for general reading but may be obtained by your public library from the library of the State University of Iowa, Iowa City, on inter-library loan.

(Courtesy *League of Women Voters*, Burlington)

CHILDREN ARE READ TO. WHO DOES YOUR READING?

Teachers in public and private schools are reading to the young, but adults must learn to select their own reading.

CHAPTER III

ATOMS FROM AN EASY CHAIR

Some Help For Those Who Like to Learn Alone

HOW TO USE THIS CHAPTER: Atomic energy is an ideal subject for self-study. When a person "studies up" on atomic energy, he can feel that he is informing himself about one of the most important subjects of this generation. Furthermore, the subject is basically interesting. Contrary to a false impression that has become current, it is not concerned with dry scientific facts and formulas that are hard to understand. Actually most of the problems and issues arising from atomic energy are not scientific at all, but social and political. One can indeed start out with atomic energy and by following its various applications and implications, go as far as one pleases—into military problems, social problems, economic problems, moral and ethical problems, problems of government, and what-have-you. The subject of atomic energy is a good place to begin if one wants to acquaint oneself with some of the most important problems facing the world today.

We said above that atomic energy is interesting, and that it is not difficult to understand. Thousands of citizens have informed themselves on the subject since the atomic bomb dropped on Hiroshima in 1945. Members of Congress, especially those serving on the Joint Congressional Committee on Atomic Energy, have had to learn about atomic energy through reading and study; so have the Atomic Energy Commissioners, most of whom, like Iowa's W. W. Waymack, were not scientists. Mr. Waymack, farmer, journalist and good citizen, is an excellent example. Before serving on the U. S. Atomic Energy Commission, he had been for many years Editor of the *Des Moines Register*. When he was appointed to the Commission a few years ago, he immediately proceeded to inform himself concerning the atom. Today he bears testimony to the fact that such a thing can be done—and done well. Another Iowa example is Mr. Robert Blakely, former editorial writer for the *Des Moines Register*. Mr. Blakely was a young social scientist and newspaperman. But he educated himself so well on the subject of atomic energy that he was able to write a series of outstanding articles entitled, "You Can Understand the Atom" for the *Register's* editorial page, the first such series appearing in any U. S. newspaper.

What Mr. Waymack and Mr. Blakely did, anyone can do. All that is needed is an easy chair, a good reading lamp, a few long winter evenings, and several good books or other study materials. It is our purpose in this section to tell you briefly about some materials that we have selected from the large amount now available on the subject of atomic energy. These materials are recommended because, in the opinion of the Committee, they are useful, easy to understand, interesting and are either available from libraries or can be purchased at low cost.[1]

THE JUMPING-OFF POINT

Where does one start on a program of self-education regarding atomic energy? Most people who have done it agree that the best place to begin is with the atom itself, but there is no hard and fast rule. This is not with the idea of becoming an atomic scientist. Far from it. But unless one has a basic grounding in the simple, fundamental facts about the atom, knows something about the *nature* of atomic science and its methods, and is acquainted with some of the terms used in this new field, one is very likely to have difficulty understanding the applications and the various social and political problems that have arisen.

So let us start right out to understand the atom. The best book to read is Selig Hecht's *Explaining the Atom*.[2] It is the layman's textbook on the atom. In fact, this book has become almost a classic. What an atom is, how we learned about it, the steps by which we found out how to split it, and why it produces energy when split, as in the bomb—all these things are told in a clear and simple manner. There is almost a conversational tone running throughout the book. You will read this the way you do a novel; but when you are through you will feel that you have completed a most interesting course in the basic science of the atom.

There are not many diagrams in Dr. Hecht's book, but those used are excellent. Why not obtain, from your library or school, "The Atom—A Primer for Laymen," a reprint from the May 16, 1949, issue of *Life* magazine. This article has many large diagrams in color. It makes a fine supplement to Hecht's book.

If the book, *Explaining the Atom*, is not available, another one almost as good is Eidinoff and Ruchlis' *Atomics for the Millions*. This book has many diagrams, some of them cartoon drawings. It is especially good on the history of the atom.

Suppose neither of the above books is available in your library (although both should be). In this case, assuming you do not wish to purchase either of them, you can buy an excellent and inexpensive 32-page booklet which will give you the basic science of the atom, in addition to a great deal of other material on social aspects and applications of atomic energy. This booklet, which is the same one now used by the high schools in Iowa, is R. Will Burnett's *Atomic Energy Double-Edged Sword of Science*. It costs only 40 cents. It is well written, has many excellent diagrams and pictures, a glossary of atomic terms, and references to further readings. Even if you read one of the books mentioned above, it would still be very much worth while to have a personal copy of Burnett's booklet. It is highly recommended.

If, in spite of what we have said regarding the ease with which you can understand the atom, you feel that you would still like to start out with something of a non-scientific nature, it is suggested you begin with John Hersey's *Hiroshima*. If you have read it, read it again. *Hiroshima* is a classic in war literature as well as a gripping story. It is a vivid, detailed, and realistic account of what happened to six Japanese

[1]It is very probable that many are already in the library of your local high school.

[2]For your convenience, the names and addresses of publishing houses, and the publication dates of books mentioned, are listed at the end of the chapter so that your reading of it may not be interrupted by numerous scattered footnotes.

survivors of the Hiroshima atomic bomb explosion. This story will almost certainly impel you to learn more about the atom—where its tremendous energy comes from, how we can control it (which we must), what radiation is, and so on. Or you can start with Chapter VIII of this bulletin. Either will give real point to your reading of one of the books mentioned above.

THE ATOM IN PEACE

After you have become fairly well acquainted with the atom itself, and feel reasonably familiar with terms like fission, chain reaction, and isotope, the next logical step is to find out something about applications of atomic energy. Let us take the so-called peacetime applications first. Considerable material on this subject has appeared in magazines and periodicals, and several good books are now in print. They have been written expressly for the layman. One is by S. C. Rothman (editor) and its title is *Constructive Uses of Atomic Energy*. Potentialities of atomic energy for the service of mankind are set forth in this book. Nobel-Prize winner Dr. Arthur H. Compton, who has been heard from the lecture platform in Iowa, starts off the book with a thoughtful discussion of "Atomic Energy as a Human Asset." Other outstanding authorities describe in non-technical language how the atom is being put to work in industry, aviation, metallurgy, ceramics, soil fertilizers, and in chemical, biological, and medical research. A useful glossary of scientific terms involved in any discussion of atomic energy is included.

Another book in this category is *The Atom at Work* by Dr. Jacob Sacks of the Brookhaven National Laboratory. The purpose of this book is to present the whole story of atomic energy in a readable and understandable style. It is intended for the reader who wants to know what scientists are doing today to develop the constructive use of the atom. Dozens of applications are described.

A third excellent book is *It's Your Atomic Age* by Lester del Rey. It is an explanation in simple, everyday terms of the meaning of atomic energy to the "typical" citizen.

We have previously mentioned the booklet by R. W. Burnett, *Atomic Energy, Double-Edged Sword of Science*. Chapter V of this booklet gives a good account of peacetime uses of atomic energy.

THE ATOM IN WAR

Many words have been written about the atomic bomb. We have here selected several of the more significant books and articles on this subject.

One book that has received considerable publicity, partly because of its literary value (it is written in diary form) and partly because of the message which it delivers, is David Bradley's *No Place to Hide*. Dr. Bradley, a physician, participated in the Bikini tests as an official observer of radiological effects. This book is concerned mainly with the effects of radiation.

Another book, concerned with the same topic—the effects of atomic bombs—but more factual and less alarming, is Dr. R. E. Lapp's *Must We Hide?* Dr. Lapp states the facts about all aspects of the bomb—its destructive potential, the effect of radiation upon the body, possibilities of defense—all in language that everyone can understand. This book, by doing away with many misconceptions and substituting for them objective facts, helps to replace fear with understanding. It tries to present a realistic picture of what our problems in a world of atomic bombs are and may continue to be for some time.

Burnett's booklet, *Atomic Energy, Double-Edged Sword of Science*, previously mentioned, has two instructive chapters on the bomb and its effects. And we have also mentioned Hersey's *Hiroshima*, which is pertinent at this point.

As for the hydrogen bomb, there are two good references that we shall give here, and a third later in this chapter. One is an article by William L. Laurence, "The Truth About the Hydrogen Bomb," and a series of articles appearing in successive issues of the *Scientific American*, March, April, May, and June, 1950. These articles, written by Drs. Louis Ridenour, Hans Bethe, Robert F. Bacher, and R. E. Lapp, are highly authoritative and of the greatest value.

Under present world conditions, civil defense measures are being emphasized, and everyone should study up on this subject so as to be prepared for any emergency.

Several excellent low-priced booklets on civil defense have been published. One of the best and simplest is by Richard Gerstell, consultant to the National Civil Defense Office, entitled *How to Survive an Atomic Bomb*. It is a 25 cent Bantam Book and is available at newsstands. Another 25 cent booklet, also available at newsstands, is entited *The Authentic Guide to Atom Bomb Precautions*, published by Authentic Publications, Inc., New York City. This booklet contains less material on what to do, but explains more fully the various effects of the atomic bomb. It would be an excellent supplement to the other booklet.

Considerable publicity has been given to the government publication, *The Effects of Atomic Weapons*, available for $1.25 from the Government Printing Office. Although highly authoritative, it is written more in text book style and is quite technical for the general reader. The second booklet mentioned above, *Atom Bomb Precautions*, is based on this larger book and is much easier reading.

The National Civil Defense Office has recently published a number of booklets. A free pamphlet with a list of these publications is available from the Office, and is probably already in the possession of your county director of civil defense. Why not borrow it? There can be no more practical approach to the study of atomic energy in war. The simplest and best of the booklets is *Survival Under Atomic Attack*, which is obtainable for 10 cents from the Superintendent of Documents, Government Printing Office, Washington, D. C.

INTERNATIONAL CONTROL AND POLITICAL ASPECTS

More has been written on this aspect of the subject than on any other. A number of inexpensive government documents are available on this topic. You can get a list of these upon request to the Superintendent of Documents; ask for the pamphlet *The Use of Atomic Energy*. However, for a reasonably complete presentation of this whole phase of atomic energy, in one volume, the best reference is the new book *Minutes to Midnight*, put out by the Atomic Scientists of Chicago. This book, which costs only $1.00, gives the complete story of the attempts to reach agreement on international control of atomic energy. Important documents, such as the Acheson-Lilienthal Report and the Baruch Report, are reproduced either in full or in condensed form. Editorial commentary is introduced to make the text more clear and interesting. The material in this book gives the actual course of negotiations and presents an objective discussion of the disagreements that exist regarding control of the atom.

One of the most controversial books dealing with the military and political aspects of atomic energy is P. M. S. Blackett's *Fear, War and the Bomb*. Professor Blackett, a Nobel-Prize winner, is a distinguished British nuclear physicist. He contends that the atomic bomb cannot force a military decision; he also takes sharp issue with the Baruch Plan for international control. Having an obvious Russian bias, the book nevertheless is important in trying to understand the Russian viewpoint. One must read it very critically, however; weaknesses and flaws in Professor Blackett's arguments have been pointed out by reviewers in both the United States and Great Britain.

Burnett's booklet has a brief but good discussion on international control.

• A series of three articles by the Editors of the *New Republic*, appearing in the April 3, 10, and 17, issues of this magazine for 1951, constitute an excellent review of the present status of the control problem.

DOMESTIC CONTROL

The only book on this subject to date is *The Control of Atomic Energy*, by James R. Newman and Byron S. Miller. This book is a detailed study and interpretation of the Atomic Energy Act of 1946, and of the Atomic Energy Commission which was set up to control all aspects of atomic energy in the United States. The social, economic, and political implications of atomic energy are discussed. A copy of the Act is included, together with other documents, and there is a bibliography. This book is for the serious student. It is not easy reading, but is indispensable for an understanding of what has been called "America's most radical law," and the issues and problems that have arisen from its administration.

As an inexpensive alternative to reading the book just mentioned, you can obtain for 10 cents a copy of the Atomic Energy Act of 1946, from the Government Printing Office; then read the article on the Atomic Energy Commission, its organization and functions, in the July, 1949, issue of *Scientific American* magazine, and you will have a fairly good picture of how atomic energy is presently being controlled in this country.

After studying the Atomic Energy Act and the Atomic Energy Commission, you will be much interested in reading two relevant articles by David E. Lilienthal, former Chairman of the Atomic Energy Commission. These articles, entitled "Free the Atom" and "Toward the Industrial Atomic Future," appeared in *Collier's* on June 17, 1950, and July 15, 1950 respectively. In these articles, Mr. Lilienthal attacks the government monopoly idea in the atomic energy field and proposes that private, competitive American industry be given a major part in the development of the atom. You will be greatly interested in what Mr. Lilienthal has to say in these articles.

MISCELLANEOUS MATERIAL

Let us turn now to a few other magazine articles that certainly should be included in our reading program. The first is an article in *Harper's Magazine* for February, 1950, entitled "Science, Secrecy, Security." Written by Dr. Edward U. Condon, former Director of the National Bureau of Standards, it discusses the fallacy of uninformed belief in scientific "secrets," and stresses the danger of excessive secrecy while attempting to attain security.

One of the best discussions of the various aspects and implications of atomic energy is found in "The Atomic Era—Can It Bring Peace and Abundance?", a special supplement to *The Nation* magazine for May 20, 1950. This supplement contains a resumé of about 25 speeches given on the subject of atomic energy at The Nation Associates' Conference in New York City, April 29, and 30, 1950.

The school library in your town most likely gets the magazine, *School Science and Mathematics*. In the February, 1950, issue there is an extremely interesting and worthwhile article entitled "Atomic Energy in American Life and Education." It is by Dr. Paul C. Aebersold, Chief of the Isotopes Division, Oak Ridge Operations, U. S. Atomic Energy Commission. Dr. Aebersold discusses atomic energy in relation to such things as national security, material welfare, democracy, religion, and education.

Two sources of excellent low-priced (10 cent) pamphlets are the University of Chicago Roundtable and the Town Meeting of the Air. Write to these groups and ask for a list of available pamphlets. A number of these are on atomic energy and closely related topics.

Finally, we recommend, for somewhat more general reading, the following two books. Both of these express a deep faith in American democracy and the part that science can and must play in maintaining it. The first is Dr. Vannevar Bush's *Modern Arms and Free Men*. Dr. Bush, President of the Carnegie Institution of Washington, was the Director of the Office of Scientific Research and Development during World War II. In this book, a best-seller, he discusses the role of science in preserving democracy. He tries to allay the citizen's fears concerning possible wholesale annihilation of life and the destruction of our civilization. He claims that disaster is unnecessary if democratic people act wisely and courageously, and states that the future can be bright even with an atomic armaments race going on. Throughout the book there is present an optimistic view of the present situation and a deep conviction that scientific and technological progress is good. This book is a tonic after you have been reading so much about the destructiveness of the atomic bomb. It is a philosophical book that everyone should read. Your library will surely have it. Or buy the special one dollar edition and have your personal copy.

The second book of a general nature that we wish to recommend is David Lilienthal's *This I Do Believe*. Here again we find an expression of deep faith in the democratic way of life. Mr. Lilienthal, former Chairman of the Atomic Energy Commission, discusses such topics as "Freedom and Fear," "Science, Technology and the Human Spirit," "The Atom Can Be Used to Strengthen Democracy" and "Atomic Energy—A New Kind of People's Business." The book is a philosophic consideration of the problems of democracy in an age of science, technology, and specialization. It is interestingly written in an almost conversational style. You will enjoy it.

Now let us put all our suggestions for reading into a list for convenient reference when we want to trace that book we decided to read.[3]

FURTHER ACTIVITY: The first thing, obviously, is to read a book. If you are a wise investor, you will not spend money buying a book before you have glanced over a few and decided whether you want to own as well as read. Because it is easier to remember groceries than books, write down *on your shopping list* the name and particulars of the book you plan to explore. Then you will shop around the public library or the high school while marketing.

This may lead you to an unexpected duty. Some of the books and pamphlets mentioned in this chapter are included in "kits" on atomic energy available to

Iowa schools from the Department of Public Instruction. On calling to borrow one you may find that your district school offers nothing on the atomic age in which our children will most certainly live—or die. As an adult you are a trustee of the American child's future and should ensure that your schools are looking towards tomorrow. The Iowa Plan for Atomic Energy Education includes: "Preparing Elementary Pupils for the Era of Atomic Energy," "The Atom and You" (High School), "Scientific and Social Aspects of Atomic Energy" (College), and this volume. As we are all really "elementary pupils" of the atomic age, any one of these is a good starting point for adult reading. Once you "get up" on the facts and manifold implications of atomic energy, either by reading along the lines suggested or by one of the other ways outlined in subsequent chapters, it is easy to keep yourself informed. Current magazines and periodicals are a good source of information—better than newspapers, in general. Well-known magazines that often have popular articles on atomic energy are *Life, Look, Time, Collier's, The Saturday Evening Post, Fortune, Popular Science, Popular Mechanics, Scientific American,* and others of similar nature. We wish to call your attention especially to one unique magazine, dedicated to just one purpose: keeping the intelligent citizen informed on the latest developments in all aspects of atomic energy. This magazine is the *Bulletin of the Atomic Scientists.* It is an authoritative, unbiased publication on atomic energy and its political, social and economic implications. Its articles, non-technical in nature, are written by recognized authorities. There is no better way of keeping informed on the atom than to subscribe to this magazine.

Finally, share your reading. Chat about what you have found interesting, lend your books, discuss with your friends the advisability of collective study. Though this chapter is designed primarily for the person who likes to learn things alone, it is also a major resource for those who prefer to learn collectively.

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[3]This list is up-to-date. Every few years significant new books for popular reading will doubtless appear. A reader who has developed a continuing interest can obtain help from the Atomic Energy Commission, Education Service Branch.

Hecht, Selig; *Explaining the Atom*, New York: Viking Press, 1947, 205 p.

For the Reprint, "The Atom—A Primer for Laymen," send to *Life* Magazine, 540 N. Michigan Ave., Chicago 11, Illinois.

Eidenoff, Maxwell L. and Ruchlis, Hyman; *Atomics for the Millions*, New York: McGraw-Hill, 1947, 281 p.

Burnett, R. W.; *Atomic Energy, Double-Edged Sword of Science*, Charles E. Merrill Co., 400 S. Front St., Columbus 15, Ohio.

Hersey, John; *Hiroshima*, New York: Alfred A. Knopf, 1946, 117 p. Pocketbook edition, 116 p. 26¢. Oxford Book Co. publishes a school edition, containing study questions. 150 p. 60¢.

Rothman, S. C. (ed.); *Constructive Uses of Atomic Energy*, New York: Harper and Brothers, 1949. 258 p.

Sacks, Jacob; *The Atom At Work.* New York: The Ronald Press, 1950. 327 p.

del Rey, Lester; *It's Your Atomic Age.* New York: Abelard Press, 1951. 226 p.

Bradley, David; *No Place To Hide.* Boston: Little, Brown and Co., 1948. 182 p. Pocketbook edition, 148 p. 25¢.

Lapp, R. E.; *Must We Hide?*, Cambridge, Mass.: Addison-Wesley Press, 1949. 182 p.

Rabinowitch, Eugene (ed.); *Minutes To Midnight*, available from Bulletin of the Atomic Scientists, 53 W. Jackson Blvd., Chicago 4, Illinois. 132 p. $1.00.

Blackett, P. M. S.; *Fear, War And The Bomb*, New York: McGraw-Hill, 1949. 244 p.

Newman, James and Miller, Byron; *The Control of Atomic Energy*, New York: McGraw-Hill, 1948. 434 p. $4.50.

The Nation, 20 Vesey Street, New York 7, N. Y.

The University of Chicago Roundtable, Chicago 37, Illinois. Town Hall, 123 W. 43rd Street, New York 18, N. Y.

Bush, Vannevar; *Modern Arms and Free Men*, New York: Simon and Schuster, 1949. Paper cover, 116 p. $1.00.

Lilienthal, David E.; *This I Do Believe*, New York: Harper and Brothers, 1949. 208 p.

Bulletin of the Atomic Scientists, 53 W. Jackson Blvd., Chicago 4, Illinois. $5.00 per year.

(Courtesy *League of Women Voters*, Burlington)

FROM DISCUSSION GROUP TO SHOW WINDOW

What began as a discussion among an organized group of women ends as a challenge to the public.

CHAPTER IV

ATOMS AT THE CLUB

Some Help for Those Who Prefer to Learn in Groups

HOW TO USE THIS CHAPTER: Club life is characteristic of America. Service clubs, church societies and civic groups usually have some form of an educational program. Large organizations, such as the Federated Women's Club, the American Association of University Women and the League of Women Voters, embrace a variety of study circles. Listening to lectures is more characteristic of men's clubs, but they also devote continuous time to the study of various social issues of interest to their groups. A number of service clubs now devote themselves both to group fellowship and to considering important issues before the public. Even the more specialized agencies such as church groups or parent-teacher groups are today spreading their activities because it is impossible to divorce religion or education or living itself from the social problems which beset us. Atomic energy fits readily into any type of group activity, but it should not be introduced by the arbitrary decision of the program chairman. Because many people have the type of prejudices previously discussed, the decision to study atomic energy should be a social decision. As has been indicated in the first two chapters, the discussion of what we might study and why, can itself be so arranged as to form an interesting club program. Adult education is fundamentally a matter of establishing a good reason for undertaking any activity, and then of using wisely the resources available.

Our resources are books, films, and people. All of them are more readily available to Iowans than we may think. The chief difficulty in finding resources is not the fact that they do not exist in our neighborhood, as is so often thought to be the case, but that we ourselves have not defined clearly what resources we want and how and when we wish to use them. Planning is therefore our first group activity. First, we should be quite sure that we wish to undertake a program, and this we can do by reasoning with each other as indicated in chapter I. Having decided we wish to go ahead, we should then plan a program suitable to our own interests, and this we can do with the help of chapter II and possibly a few references from chapter III. Third we must fit our program to the sort of activity we have in mind. Is it a reading circle, review club, film discussion group, Farm Bureau, Bible study class or luncheon club? Is it a group of highly specialized individuals such as engineers or doctors who may already have a considerable relevant background, or is it a group of people of very mixed interests and educational backgrounds and achievements? Any group is liable to need all three resources —books, films and people—but they will use them in different ways. Obviously books will be used differently in a reading circle than they will be by the single individual who is going to give a formal lecture. Similarly the expert who normally lectures will be differently used by the reading circle which calls him in to answer a few questions. Films may be used to substitute for lecturers or books and thus form the central core of a whole program, or they may be used merely to supplement a reading circle or a lecturer's audience.

This chapter deals with the use of the resources and the way in which one resource very often leads naturally into another. You will find in it some useful ideas for the normal activities which your group may wish to try out.

The Group Use of Books

Because it is expected to offer a little of something for every taste, the community library epitomizes the group use of books; it reflects the total community as a group. For the same reason a small library seldom offers a very thorough coverage of a subject like atomic energy. Though a librarian may do much to stimulate thinking and reading, his budget for books on atomic energy will be at least to some extent conditioned by what citizens in his community do. Let us then turn first to the citizens.

Book review clubs have been common in Iowa for years. A considerable number of these are known to have included in their reading lists at least one of the best sellers on problems of the Atomic Age. In other words one person has read one book and transmitted a vicarious knowledge of it to a circle of friends. This is better than nothing but it is not going very far. By the time the reader has outlined the book on review there is little chance for discussing thoroughly the issues that may be raised. There is also a chance that the right issues may not be raised at all, or that no answers may be available for the questions asked. To cope with this problem a book review club in Iowa City undertook to review one basic book introducing the subject and thereafter as many books as seemed necessary to cover the problems. This was done with the minimum dislocation of the traditional program which called for the review of a variety of books on different topics. Everybody read as much as they could of the basic book before the club had its initial meeting. This initial meeting therefore became a general discussion of a subject on which every member of the group was at least partially informed. The discussion revealed two questions which no member of the group was able to answer and three problems that all wished to explore a little further. These were listed and the list taken to a member of the University faculty who was known to be interested in atomic energy education. In consultation with him three short books and two pamphlets were selected as being the best to provide the information required. Five members of the group undertook each to read one of these and to report to the group every second week. The regular program of the review club then went ahead on the alternate weeks. One of the books proved too difficult for its reader. A "guest reviewer" was therefore invited from the University faculty to review this book. Thus by sandwiching "atomic energy" into the regular activities of a book review club, every member was able to read one book and all members to become acquainted with five others; the subject was able to be considered rather more thoroughly than is usually the case; and the regular activities of the club were still completed.

It will be noted that two resources were used by this group, books and people. Because members of this group resided in Iowa City the resource people used happened to be faculty members of the University. The objection may at once be raised that not all Iowans keep a tame University lecturer in their back yards and that this example is not therefore typical. Actually it may be harder to find the available lecturer in a big college or university town than in a small town because where there is a large faculty the appropriate expert is less obvious. In a small town the experts are fewer in number and therefore more easily found. As will appear in the next section it is mainly a case of knowing where to look.

In Sioux City a book review club decided to devote all of one winter to reading about atomic energy but not necessarily to review an entire book for each meeting. Certain of the books were reviewed by several people each of whom had undertaken to read several chapters. A more thorough study of the books was thus possible without too heavy a burden being placed on any individual member. In Davenport several members of the women's auxiliary of a large church formed themselves into a reading circle to study and discuss three books suggested by lecturers whom they had listened to in a public series sponsored by the Davenport public schools. (Note again the reciprocal relationship between resources: reading can stimulate the use of people or listening to people can stimulate the reading of books.) These readers reported to the entire women's auxiliary resulting in the starting of several other reading circles. In Maynard the school superintendent read "The Atom and You" because he was considering inaugurating a program for high school youths. He found it so interesting that he passed it around among several of his friends. As a result of this collective reading a group of over 70 people, many of them farmers and farmers' wives, met once a week during the winter months to study atomic energy under the leadership of the superintendent, who was himself no expert but read diligently the recommended books. In this case films were also used as resources.

Reading "in the round" has already been proposed in chapter II. Wherever a book or article contains many quotations, this method can be used but a word of warning is necessary. Even people who habitually read a great deal do not necessarily read well aloud. People who have been talking with fluency and animation about a book open it, bury their noses in it, mumble and stumble over the words, glance up at their listeners and then can't find their places. Voices become flat and diction stilted because the words we read are not our own words. We trip over figures and dates. We hold up something for everybody to see, forgetting that the members of the audience do not have telescopes. We decide to refer back to a previous page and spend several minutes looking for it in vain. Any group which is going to read collectively aloud should do its listeners the honor of rehearsing. Each member should endeavor to read with some animation as well as with fluency, and the leader should be quite merciless in rejecting the services of those who cannot read aloud. The group should also sub-edit in advance what it is going to read, deleting passages that may be repetitive or of no real interest to the members of the circle. Unless it is actually presented in the form of a playlet, a reading "in the round" should be open to interruption just as an individual reading or review. People cannot always carry in their minds questions that rise spontaneously as they listen. Any question that cannot be answered should be recorded and the answer sought by further reading or by getting in touch with some person who may be expected to know it, and reported to the group the following week.

While reading circles are not directly connected with dramatics, they may decide to review a play instead of a book. The play "$E=Mc^2$," has been performed by several high schools and at least one dramatic group in Iowa.[1] The Wisconsin Idea Theater, an extension agency of the University of Wisconsin, has several duplicated skits and playlets, the most famous of which is "In Time of Fear." A reading circle might obtain these and review them with a view to interesting the local dramatic club in a presentation of one of them. The Wisconsin Idea Theater has done much to encourage people to write their own playlets, often of a humorous or highly imaginative nature. A reading circle or review club could be of great assistance to a dramatic club in finding and digesting appropriate material for the making of such a playlet, and could possibly do the writing.

Our book review club is now seen to be spreading out and becoming an influence towards other activities in atomic energy education within its community. Let us return to the public library. As we have noticed any public library, especially a small one with limited funds, is governed to a large extent by the interests of the community. This does not mean that a librarian should do nothing to influence those interests. A librarian is also a citizen. An up-to-date library of the mid-twentieth century is an active educational agency and its chief function is and will always remain that of service. A reading circle can be of considerable assistance to librarians by reviewing a number of books and pamphlets and helping the librarian decide which of these will be the most likely to create public interest and which the most useful for permanent placing on the reference shelves. A librarian may well initiate reading by asking a book review club to perform this service for him. Books do not become best sellers merely because they are well advertised. The best recommendation a book can have is that it is read by someone whom you know and whose taste is similar to your own and who suggests in conversation that you simply must read it. When books on atomic energy are thus talked about they are sure to be more widely read. For this reason even a single book can form a useful library exhibition. Put in a showcase or on a small table in a prominent position with an attractive show card saying, "Now being read and criticized by the So-and-So Club," this single book will attract a great deal of attention. You will be surprised by the number of people who stop, turn over a few pages, glance at the content and finally ask questions about it, and whether it is available to the general reader in the library. The librarian should know the names of those who have read it and be able to suggest in a casual way "Why don't you ask Mrs. Jones? She thinks it is just as exciting as a novel."

The single book exhibit may grow to a special exhibition of atomic energy reading material. This should be arranged cooperatively with the readers in the community who are well known as typical citizens. The

[1]"$E = Mc^2$", by Shallie Ferguson Flanagan, and others; a living newspaper (play) about the atomic age. 1948, Samuel French, Inc., 25 W. 45th, New York 19, N. Y. Copies cost 85¢ each. The authoress started her dramatic career at Grinnell College, Iowa.

local school system, and the college if there is one in or near the community, should also be asked to cooperate but not until it is known the exhibition is the result of citizens' actions. In a subject like atomic energy it is advisable to let it be known that ordinary citizens are taking the lead and to avoid the impression that the community is being "pushed" by those learned folks in the teaching profession who are so often regarded as being out of touch with the normal reading interests of grownup folks.

We might at this point emphasize the need for permanent cooperation between the schools and the library in the field of atomic energy education to avoid unnecessary duplication and to save the taxpayers' money. A number of books and pamphlets are available to the schools at special rates from the State Department of Public Instruction. Except in the case of books that have become extremely popular or of illustrated magazines which may be useful to stimulate reading, the library may wish to avoid duplicating materials available through the schools. This would be true also of films if the local library happens to have a film library.

The library exhibit may be as expensive as community resources permit and as people desire. Very dramatic and sometimes costly exhibits have been displayed by large city libraries and museums in such places as St. Louis, Mo., and Rochester, N. Y., but we should not confuse the size of an exhibit or the costs in its budget with its teaching value.

Our small town libraries are not equipped as teaching institutions and the main function of an exhibit in such places should be to encourage reading. However, the exhibit need not be confined to books, though books, magazines and pamphlets will play a great part in it. The exhibit can also contain diagrams and working models and it is of greater educational value to make these locally, possibly with the assistance of high school students, than to borrow or hire them. While diagrams, illustrations and models assist an exhibit to be self-educative, there are ways of further stimulating interest. The exhibit can be accompanied by film showings of some of the many good films in general circulation. If the local library sponsors its own film library, some of these films will already be in stock. If not, many films are available from the major film libraries of Iowa.[2] The local high school probably has equipment for running these films and an operator who will be willing to assist. Members of the book review club that has been reading in the field of atomic energy can lead the discussion which may follow. These readers may also assist the librarian by arranging a roster of volunteers who will spend certain hours in the library during the period of the exhibit acting as consultant to those who plan to read. At a special afternoon or evening session they may also give brief reviews of the books they have read, of the difficulty they encountered, and the enjoyment and reward they received.

Once again we find that our resources are getting inextricably tangled. Beginning with a wide-awake librarian who persuaded a few people to read a few books, we may end with a small community project centered around the library and involving literature, illustrations, diagrams, models, films and the people who are connected with all these things. Let us take a closer look at these other resources.

[2]See next section.

The Group Use of Films

The use of films is now so widespread that little need be said beyond listing some of the better films available in the state. However, there are two factors which we should not lose sight of. First, films are audio-visual *aids;* they are *not* complete substitutes for teachers. One can watch, understand and enjoy a film and still miss some of the important points. One of the ways of correcting this is to use a short quiz whose questions were actually answered by the film but may have been missed by the audience. The quiz should be simple and short. It can be used with audiences of any size, either through questions asked orally or by passing around mimeographed sheets. In order to make such a quiz, the film must, of course, be previewed by one or two people responsible for presenting it. In any case it is always advisable to preview a film. Here is a very short quiz used by an audience of over 500 in Davenport after they had seen the films *One World or None* and *Atomic Energy.* As a result of ten interest-packed minutes spent trying to answer this quiz, the audience asked to view one of the films a second time.

WE SAW THE FILMS—WE KNOW THE ANSWERS
(But do we?)

1. How many Hiroshima-type bombs would wipe out New York? 1 ...... 2 ...... 3 ...... 4 ...... 5 ......
2. From what type of atomic activity does the sun's energy come? Atomic fission .... Atomic synthesis ....
3. Could an atomic bomb be used effectively by a nation with inferior air power? Yes .... No ....
4. Was atomic fission an American secret until the recent Russian discovery? Yes .... No ....
5. By what percentage did the killing power of the old-fashioned atom bomb exceed that of old-fashioned V2? 50% .... 100% .... 500% .... 1000%.......
6. Does energy (light or heat) have weight? Yes ... No ...
7. Why do scientists advocate world control of atomic energy?
   Because there is no defense ....
   Because there is no secret ....
   Because defense is too costly ....

The purpose of showing a film is to teach, to arouse discussion and questions. This does not occur spontaneously. The more satisfying a film is artistically, the less it is likely to generate discussion. For this reason those who have previewed it and are presenting the film should be prepared in advance to make the transition from viewing to discussing. The quiz is one of the ways of doing this. Another is to begin by making a quick evaluation of the film. Does it quiet or increase our fears? Does it stimulate us to learn more or give us the feeling that there is nothing further to know? Would we have presented the problem in a different way if we were making the films ourselves for our own district? Does it have any mistakes? Following a banquet, a workshop of waterworks engineers viewed the film "You Can Beat the A-Bomb." They were then asked: "What is wrong in this film?" and given one minute to discuss the question with those sitting across the table from them. The film shows a householder washing his face and hands repeatedly from a faucet in his basement which may have been delivering radioactive contaminated water. In the minute allowed for discussion an animated conversation grew quickly around the table. By the time the single question had been answered a great many other questions had arisen for discussion.

The size of the audience will naturally condition the discussion. A small circle of people well known to each other will discuss more readily than a large group containing many strangers. With the small group the physical arrangements are often more satisfactory. After seeing the film, we can quickly rearrange our chairs into a circle so that the discussants face each other. Where the audience is large and possibly restricted by the fixed seating of an auditorium, the discussion will tend to degenerate into questions from the audience answered by the expert or experts on the platform. This procedure can be modified by the use of "Technique 66," which is a modification of the buzz session designed so that it is usable in a large auditorium with fixed seats. A question such as the one discussed by the engineers over their dinner table can be discussed by the large audience using this technique. The audience is quickly divided into groups of ten by taking five people seated side by side in one row and five people seated immediately behind them. The five in the front row turn around as nearly as they can in their seats and discuss the question with the five behind. After five minutes each group of 10 appoints its own spokesman to give its answer to the question. The leader on the platform need not necessarily call on a spokesman from every group if the audience is large. As soon as a consensus of opinion appears to exist, he can ask if any other group arrived at a very different conclusion and call on it to explain its point of view. If there is no marked difference, he can proceed at once to the next question.

There is audio-visual equipment in most towns and villages. Schools, libraries, museums and some churches have projectors and portable screens. Many high schools have trained operators among their staff or students. It is not difficult to obtain both equipment and the services of an operator where any group is serious in its purposes. There remain only the problems of where to get films and what films to choose. The two major film lending libraries in Iowa are at the State College and the State University, but many of the larger school systems have at least one film on atomic energy which they are willing to lend or show to adult groups in their own or nearby communities.

Here is a list of recommended films, with some notes to aid your selections:

(A) TO INTRODUCE THE SUBJECT

Beginning or the End.* The professionally acted and produced story of how America became aware that her enemies were working on atomic weapons and what happened thereafter. (One reel, 30 minutes.)

Atomic Power.* A historical account of the development of the atom bomb, including a discussion of atomic fission. (One reel, 17 minutes.)

Operation Sandstone. Produced by the U. S. Air Force for the U. S. Atomic Energy Commission. Describes the intricate and extensive preparation for the three test detonations at Eniwetok in the spring of 1948. The three detonations also are shown. (Eighteen minutes, 16 mm. Kodachrome, sound; free (rental); $121.00 purchase; source, available from the Public Information Service, U.S.A.E.C., 1901 Constitution Avenue, Washington, D.C.)

Tale of Two Cities. Shows, with many close-ups, the effects of the bombing of Hiroshima and Nagasaki and is therefore an excellent follow-up film for either of the two above. (One reel, 20 minutes. Produced by Army Signal Corps, available from Central Film Library, Ft. Sheridan, Illinois.)

*All films marked with * are obtainable from the State University of Iowa and many of them from Iowa State College.

(B) TO INTRODUCE THE SCIENCE

Atomic Energy.* An Encyclopaedia Britannica film which shows by diagrams what nuclear fission and fusion are, how a chain reaction works, etc. Simple, clear, and contains most of the science an adult needs to know. (One reel, 11 minutes.)

Inside the Atom.* Actually filmed inside the great atomic plant at Chalk River Valley, Canada, this Canadian Film Board movie shows how atomic energy is harnessed and used, how workers are protected and what nuclear fission is. (One reel, 11 minutes.)

Engineering for Radioisotopes. Produced by the Oak Ridge National Laboratory for the U. S. Atomic Energy Commission by a division of the Union Carbide and Carbon Corporation. Describes the chemical, mechanical, electrical and construction engineering skill and resourcefulness required to put production and processing of radioisotopes on an efficient, industrial basis. (Twenty-one and one-half minutes, 16 mm black and white, sound, free (rental). Available from the Public Information Service, U.S.A.E.C., 1901 Constitution Avenue, Washington, D. C.)

Matter and Energy. Discusses pictorially the different forms of matter and physical and chemical changes, including nuclear fission. (One reel, 11 minutes. Coronet Film Productions, 65 E. South Water Street, Chicago, Illinois.)

Unlocking the Atom. Produced by the United World Films, Inc., 1445 Park Avenue, New York City 29, N. Y. Produced primarily to acquaint students with the principles that govern the atom and its use. Describes chain reaction, atomic structure, properties of alpha, beta and gamma rays, operation of a cyclotron and contributions of various scientists. (Twenty minutes, black and white, 16 mm; sound; cost $95.00; source, United World Films, Inc., 1445 Park Avenue, New York 29, N. Y. Available for loan from Public Information Service, U.S.A.E.C., 1901 Constitution Avenue, Washington, D. C.)

The Atom and Medicine. Describes the increasingly important role of radioisotopes in hospitals, clinics, and doctors' offices. Clarifies misconceptions about the handling, cost, dosage, and alleged dangers of radioisotope diagnosis and therapy. (Twelve minutes. Encyclopaedia Britannica, Wilmette, Illinois.)

The Atom and Agriculture. Tells the important story of the use of radioactive tracers with phosphate fertilizers: the effect of the fertilizers on a variety of crops grown under a variety of conditions. Depicts other experiments with plants, soils, and animals. (Twelve minutes. Encyclopaedia Britannica, Wilmette, Illinois.)

(C) TO INTRODUCE THE PROBLEMS

The Atom Bomb—Right or Wrong? Professionally made for church use, designed by a clergyman and with a clergyman's commentary, this is an excellent film to introduce discussion of the moral issues of constant interest to adults old and young, in church group or general audiences. It should be previewed before showing and the audience warned that it does not disguise war's horrors. (One reel, 19 minutes. Produced by RKO Pathe for the Federal Council of Churches of Christ in America. Motion Picture Association of America, 28 W. 44th Street, New York, N. Y.)

God of the Atom. Produced by Dr. J. A. Moon of the Moody Institute of Science, 11428 Santa Monica Boulevard, Los Angeles, California. (Thirty-eight minutes, 16 mm. Kodachrome, sound; cost, unknown; source, The Moody Institute of Science, 11428 Santa Monica Boulevard, Los Angeles, California.)

One World or None.* Poses the problem from the point of view of world government and politics rather than moral issues. An excellent companion film to the above. (One reel, nine minutes.)

The Hiroshima Medical Cases. An unemotional Japanese film which tells a human story that is an excellent starting point for moral or political discussion. (Obtainable from the Army, Ft. Riley, Kansas.)

Centralization and Decentralization. There is no better example of these problems than the machinery for both centralizing control and decentralizing research and production of atomic energy. (Twenty minutes. Encyclopaedia Britannica, Wilmette, Illinois.)

World Balance of Power. Not specifically concerned with atomic energy, but raising a problem that is more vital in the Atomic Age than ever before. (Twenty minutes. Encyclopedia Britannica, Willmette, Illinois.)

Picture in Your Mind.* Is it less dreadful to bomb Japanese than to bomb Englishmen? Though it is not specifically concerned with atomic war, this very unusual film poses interesting problems of races, nations and prejudices. (One reel, 18 minutes.)

(D) TO KEEP UP-TO-DATE

Report on the Atom. This film, which is regularly revised, has the advantage of showing how the atom is being used for peaceful benefits in medicine, industry and agriculture. (One reel, 20 minutes. March of Time Forum Films, 369 Lexington Avenue, New York 17, N. Y.)

Survival Under Atomic Attack, Duck and Cover, Self Preservation in an Atomic Bomb Attack, Radiation Detection Instruments. These and other films are available from the Iowa Office of Civil Defense, Des Moines.

For a discussion group a film strip is sometimes more useful and informative than a film. The following film strips are all highly recommended:

Atomic Energy. New York Times School Service, Times Square, New York. $2.00, including script.

AEC Argonne National Laboratory. Twenty-one frames. Views of laboratory operations. Address: Mr. Howard Baldwin, U. S. Atomic Energy Commission, Chicago Operations Office, P.O. Box 6140A, Chicago 80, Illinois. Available on loan.

The Atom. Life filmstrip in color. Fifty-five frames with reprint of Life's article in the May 16, 1949, issue, included as Lecture Notes. $4.50. Address: Life Filmstrips, Time and Life Building, 9 Rockefeller Plaza, New York, N. Y.

The Atom at Work (color). Society of Visual Education, 1345 W. Diversey Avenue, Chicago 14, Illinois. $6.00, including script.

Let's Look at the Atom (color). Society of Visual Education, address above. $6.00, including script.

Atomic Bomb. Seventy-five frames. Visual Sciences, Suffern, New York.

How to Live With the Atom. Film Publishers, 25 Broad Street, New York 4, N. Y. $3.00, including script.

Man's Use of Power (Atomic Energy). Produced by Popular Science Publishing Company, Audio-Visual Division, 353 4th Avenue, New York 10, N. Y. Fifty frames. Includes teaching guide.

World Control of Atomic Energy. Film Publishers, address above. $3.00, including script.

Your Atomic World. Produced by The Council on Atomic Implications, Inc., 3518 University Avenue, Los Angeles 7, California.

Part I—Let's Look at the Atom—53 frames in full color. Emphasis on scientific principles of atomic structure and nuclear fission.

Part II—The Atom at Work—52 frames, full color. Emphasis on uses of atomic energy in scientific research looking toward peaceful applications in industry, agriculture, biology and medicine.

Recordings are one way of bringing to your group the expert lecturer who could not possibly appear personally. Lewellens Productions, 8 South Michigan Avenue, Chicago 3, Illinois, has produced two sets of recordings with accompanying discussion pamphlets and illustrations for audience use. These are *The Atom Bomb* and *Peacetime Uses of Atomic Energy*, two double-sided records each, recorded by Hollywood stars and famous scientists. They form an interesting and unusual program.

Remember that the larger school systems employ specialists in audio-visual aids who are enthusiasts always willing to help. If you want to chat over a program, why not visit with

Mark J. Flanders, Public Schools, Waterloo
Waldemar Gjerde, Iowa State Teachers College, Cedar Falls
Edward R. Lorenz, Public Schools, Dubuque
Don Scott, Public Schools, Ft. Dodge
Lyall Moore, Public Schools, Mason City
Ed Park, Public Schools, Burlington
Robert Paulson, Public Schools, Oskaloosa
Paul Imbrock, Drake University, Des Moines
Clifton Schropp, Public Schools, Des Moines
John Hedges, State University of Iowa, Iowa City
Herold Kooser, Iowa State College, Ames
Mrs. Katheryn Greene, Public Schools, Cedar Rapids
Amos Claybaugh, Public Schools, Davenport
Kenneth Paige, Public Schools, Ames
Dean Ferris, Graceland College, Lamoni

The Group Use of People

When thinking of people as resources in adult education we habitually think of the visiting lecturer, who is an expert. In the field of atomic energy these experts seem to be few and far away. We tend to think of them as remote scholars confined to the research station at Iowa State College or the radiological laboratory at the State University of Iowa. Even in the tradition of the arranged lecture, resource persons are very much closer at hand. Expertness is a matter of degree. Maybe the local authorities are not as expert as America's most famous scientists; maybe their expertness is in only one part of the whole field of atomic energy activities. But most of us are probably not expert at all. Even in a small town there are probably six people who are already much better informed than we are and will be glad to help us on the way.

Who are these people? First there is the doctor. We think of him only as a man who mends broken bones and cures sore heads, i.e., we think of him functionally. But we should also remember that he is the product of training in an applied science and that he conscientiously keeps abreast of medical discoveries that will improve his work and our health. His medical journals have supplied him with a great deal of information about research in cancer and other diseases and some of the spectacular cures that have already been effected by the use of radioactive substances. His civil defense training has made him an authority on radiological sickness and burns and he would be very glad to explain to us why these things are not half so terrifying as we have assumed. For the same reasons, our veterinary surgeon is a resource person. Third there is the waterworks engineer whom we remember only in spring when we like to complain about there being too much chlorine in our water. The chlorine is there because he is trained to decontaminate water from the natural pollutions which it carries. But water can also be contaminated by a bursting atom bomb way up stream. Your local waterworks engineer has probably attended an intensive course at the University to learn how to deal with this situation. He will be quite anxious to pass on this information. Then there are the school teachers to whom we traditionally trust the mental lives of our children though too seldom inviting them to share our own. In every Iowa high school both the social studies and the science teacher have access to a fully developed course in atomic energy along with the necessary books and pamphlets packaged ready by the State Department of Public Instruction. They are already used to working together in the preparation and adaptation of this material. Finally, there is the clergyman. What better person exists to lead our discussion on the moral issues of atomic war? Here, then, are six "experts" whom we could easily overlook by gazing at the far horizon instead of looking at the foreground. In large towns there are probably a number of other people who could help. It is a case of knowing where to look. The man who repairs the radio, the electrician at the power plant, the faculty of a nearby college, the local radio "ham," the pharmacist, these are people who may have unexpected knowledge of the subject, even if specialized. But you may find your leader, as the people of Maynard did, among people who are neither scientists nor in scientific trades.[3] The basic facts of atomic energy are not difficult to grasp nor to explain.

Not only do we have unduly stereotyped ideas as to where to look for experts but we also suffer from the traditional belief that the expert must always give a lecture. Not all experts are good lecturers and listening to lectures is not necessarily the best use that can be made of people. Their use as guest reviewers, discussion leaders and resource persons to answer questions raised by our reading circle or study group has already been suggested. People are the chief resource used by radio and television where they are seldom heard lecturing. They appear in plays, in debate, in round table discussions, in quiz programs and under interrogation. Anyone of these techniques can be locally developed for atomic energy education. The possibility of writing and presenting our own playlet has already been suggested. The high school debating team may stage a debate either against adults or against other high school students on some of the national and international issues related to the control of atomic energy. Two neighboring towns or two local organizations in one town may also arrange a debate to be followed by open discussion. A round table or panel discussion is not difficult to organize. Remember that we probably have at least six experts available. A good presentation is through an investigator. This involves the use of "experts," "laymen" and "investigator." The "laymen" consist of three or four members of the book review club who may be presumed to have no knowledge of atomic energy except from their recent reading. They sit on one side of the stage, and each is prepared to give a five minute summary of some book or article that he has read and to ask one or two questions rising from it. On the other side of the stage sit our "experts": the doctor, the engineer and the teacher, who are presumed to have some technical knowledge of the subject. The investigator sits between and his part may be well filled by a local newspaper or radio station staff member. It is the investigator's business to direct the questions raised by the laymen to the expert best able to answer and to make sure that he, the investigator, in summarizing will recommend a wise and workable solution. It will be seen that this is an animated editorial page in which the laymen may be regarded as those who write letters to the paper, the experts are the typical sources of consultation which every newspaper uses, and the investigator is the man who ultimately editorializes for the guidance and expression of the community's wishes. A public quiz program or an atomic spell-down in which the meaning as well as the spelling of the words used must be explained, are also entertaining and useful presentations by resource persons. Those who prepare such programs should endeavor to include items of interest to a diversified audience, such as the uses of the products of atomic fission in investigating the quality of floor wax, lipstick, and piston rings, and the applications in medicine and veterinary science. Even where a community proposes to use its resource people in the traditional way i.e., the presentation of a series of lectures, a quiz for use in club programs before the lecture series starts can be a stimulating method of advertising the series. Such a quiz was developed in Davenport before that city's major public lecture series and used in a great many luncheon and afternoon clubs. Printed on a colored folder over the famous photo of a mushroom of smoke, the quiz was also distributed to banks, stores, offices and hotel lobbies and people were encouraged to take it home and try it on their family and friends. A portion of this quiz is reprinted here. It will be noticed that, as this is an advertising device, the answers given are deliberately only partial answers with the promise of full information at the coming lectures.

THE DAVENPORT ATOMIC QUIZ

(If you don't know the answers, you are living on borrowed time!)

1. Can atomic energy improve the efficiency of your house and office polishing without your buying any new equipment? Yes . . . . . No . . . . .
2. Atomic energy in a controlled form is sometimes added to automobile lubricating oil. Does this improve the efficiency of your motor? Yes . . . . . No . . . . .

[3]See Chapter VI.

3. Is it true that Oak Ridge, Tennessee, and Hanford, Washington, are the biggest atomic plants in the world? Yes . . . . . No . . . . .
7. The leaves of the potted plant in your window are its stomach. Does atomic energy have any use in finding out about a begonia's digestion? Yes . . . . . No . . . . .
9. If you were burned by atomic rays would the burn be any different from one you got cooking, ironing or lighting your cigarette? Yes . . . . . No . . . . .

ANSWERS TO THE DAVENPORT QUIZ

1. Yes. Atomic energy can be used to measure how long furniture polish and floor wax remain effective after many washings and dustings. Learn how this is done in the Davenport series.
2. No. It is used to test how long oil retains its lubricating quality. It might improve the efficiency of your budget but not your motor.
3. No. The biggest atomic plants are not even in the U. S. Where are they? Come to the Davenport series and learn.
7. Yes. Atomic energy is being used right here in Iowa to find out how plants live. You can see this demonstrated at the series.
9. No. The burn might be deeper, but it would be just a burn. But are there other complications not connected with the burn?

A quiz to serve quite a different purpose has been originated in Iowa. This is the "talking quiz." It is designed for the use of small circles who enjoy discussing major problems but do not necessarily have the time or the inclination for serious reading. It can be carried out in a conversational atmosphere while women go on with their knitting or mending and men smoke their pipes. The quiz is arranged in three parts. The first is a series of questions with "clues" to the answers. These questions may be asked orally by the quiz master, who may be any member of the group, and answered by show of hands, or they may be answered in writing, in which case this section of the quiz should be mimeographed so that each member of the circle has a copy. The quiz master can urge them along and a good deal of innocent fun is generated.

The second part consists of an answer sheet from which the quiz master can call the correct answer without comment or explanation. Once again, a considerable amount of merriment and animation will be generated. Some members will exclaim delightedly at having got the right answer to a difficult question and others will wish to butt in and argue at once. The answers can be scored and a prize given. Everybody is thoroughly interested and on his toes which is precisely the atmosphere required for a good discussion.

Now comes the crucial part, the "talking" part. It consists of a very brief explanation as to why one clue is correct for each question and the others wrong. As can be seen in the example printed below, the explanations themselves end in unanswered questions which are the starting points for discussions in the group. Some answers are necessarily quite conclusive but others, such as whether we should use atom bombs on civilians without warning or who should manufacture instruments for civil defense, are open to considerable disagreement. The discussion will get very animated at times and the quiz master's main job is to watch the clock and use his judgment as to when to pass on to the next question. The quiz master may read each of these explanations himself or they may be passed around so that each question is introduced by a different member of the group. The latter procedure makes for a more natural discussion. At the end of the meeting anyone who so wishes should be able to obtain copies of the quiz, answer sheet and explanation, for many will wish to take these home to try out in their families or with friends. Talking quizzes have been successfully used by a reading group in Sheldon, a current affairs discussion group in Cherokee, a sewing circle in Tama, a Masonic luncheon club in Des Moines, a workshop in Council Bluffs, the AAUW in Marshalltown and a church circle in Bloomfield. There are no standard talking quizzes, though you may obtain samples from its designer.[4] The best talking quizzes are those locally made to suit the local interests. Here is a cooperative adventure for the book readers, the experts and maybe the high school students. Below is a sample.

SAMPLE TALKING QUIZ

PART I: THE QUESTIONS

1. The Americans proposed to the United Nations that the control of dangerous atomic projects should be vested completely in an international authority. The Russians proposed that each nation should retain its own control but that an international authority should be given power of inspection monthly. Why did the Americans reject the Russian plan?
   - —The Russian plan was obviously insincere
   - —The Russian plan was not scientifically sound
   - —It was impossible to agree as to who would be inspectors.
2. Many atomic products are actually produced through private enterprise under contract with the Atomic Energy Commission. These contracts are usually with the big corporations. Why?
   - —The Commission considers small business inefficient and costly
   - —Small manufacturers do not have an effective lobby in Washington
   - —Only large organizations have suitable conditions and equipment
3. Etc.

SAMPLE TALKING QUIZ

PART II: ANSWERS AND SCORE

1. Who marked the first clue? (Take a count) The second? (Take the count) The Third? (Take the count again). Those who marked the second clue are correct and may score ten points.
2. The same procedure, the third clue being correct. (Taking a count for each clue adds to the tension and scoring to the interest and fun. The added scores of all the wrong and right answers will often reveal very clearly how little we collectively know about the problems of atomic energy, how great the need for a little adult education.)

[4]Prof. Hew Roberts, State University of Iowa, Iowa City, Iowa.

SAMPLE TALKING QUIZ

PART III: THE TALKING POINTS

1. First ask those who chose the correct clue (the second) why they chose it—they may have merely guessed. If a correct explanation is not forthcoming the quiz master can explain: Because even minute quantities of certain atomic products are of enormous potential danger, it is vital to know how much of them is in existence, where it is and for what it is being used. Under the Russian plan of monthly inspections, any nation including our own could conceal products and falsify records at times when no inspectors were present. In other words, the Russian plan does not fit the scientific facts. The only plan that does is one which would let every nation share the making and use of these products, i.e., the American plan. The questions of sincerity and who would be inspectors do not arise. Even if both the Russians and Americans were quite sincere, the English, Canadians, or some other nation might not be, and any nation can manufacture dangerous atomic products. As the Russian plan was rejected, inspectors were not even discussed. (Talking over this problem on these lines leads inevitably to the questions: What happens to national sovereignty with international control? What did the Americans say on that issue? The quiz master raises these questions, but no answers are supplied this time with the Talking Quiz. The group has to find them itself, and may well deputize one of its members to consult a copy of the Baruch Plan at the library and report back to the next meeting. So the process of group education and self education begins.)

2. A similar procedure is followed. The correct explanation lies in the fact that all sorts of protections and precautions must exist in any plant before the Commission will let a contract involving work dangerous to the health of workers. Many of the safety installations are very costly and there is little or no profit at present in atomic products. Big corporations that traditionally spend vast sums on research are therefore the only private organizations interested. The Commission is not opposed to small business; the latter is simply not interested. What effect may the atomic age have on our economic organization?

The resource persons we have been considering know something of atomic energy, but there are at least two groups of resource persons who are vitally interested in atomic energy without themselves being experts in the field. They are the clergymen and the civilian defense leaders. Chapter IX is a bald statement of what we should know in civilian defense and the right of every citizen to know it. Clergymen have a considerable part to play in civil defense, but their main concern is with the moral issues that confront mankind now that he has developed such prodigious power for bringing death and destruction. The Indian religious leader, Mahatma Gandhi, and his 90 million followers were deeply shocked when Christian America used the first atom bomb. We have had our own misgivings but the problem is not whether the past was right or wrong, but how we shall mold the future world and how much time we shall have for the task. Insofar as communist leaders have some of the qualities of zeal and faith in their creed that are characteristic of religious leaders, the Russians appear to understand the question of time better than we do. Prior to 1945, Russia conducted its internal affairs in comparative isolation and let Marxian world revolution look after itself. But since 1945, Russia has done everything in her power to spread her ideology over the earth while Christian democracy has been inclined to shrink from the problem. It is an interesting one for discussion in any church, and will automatically lead to some effort to understand the nature of atomic energy. Films like "The Atom Bomb, Right or Wrong?" or books like Hersey's "Hiroshima" are excellent starting points for the discussion of moral problems. And it is entirely right and proper that groups should approach the subject of atomic energy through existing interests. Many churches, especially in Des Moines, have approached it through the moral problem. Oddly enough, a civil engineering club in Iowa City approached it from a similar point of view. Aware of the engineer as the man who, much more than the pure scientist, brings atomic theory into practical reality, they arranged a lecture-discussion series first to learn more of atomic energy and second to seek a philosophy of social responsibility for engineers. Masonic clubs in Muscatine and Iowa City approached it through the relationship of atomic war to problems of the United Nations, as did Rotarians in Des Moines and Muscatine. An industrial engineering club in Waterloo heard lectures on its relation to industry and economic change.[5] A larger and more heterogeneous group would probably prefer a more general approach through the use of resource persons as lecturers. Iowa's better known community lectures series are described in a subsequent chapter.

Finally we should remember that resource persons are not necessarily talkers at all. Atomic energy is always easier to understand if there are charts and models available. Many people have hobbies of this nature. If we do not find them amongst the adults, we will certainly find them amongst the high school students. The Science Club of the Winterset High School prepared such an exhibition of a quality which attracted the attention of the Atomic Energy Commission. Projects of this nature allow the young and the old to work together, an experience that is getting to be too rare in modern life.

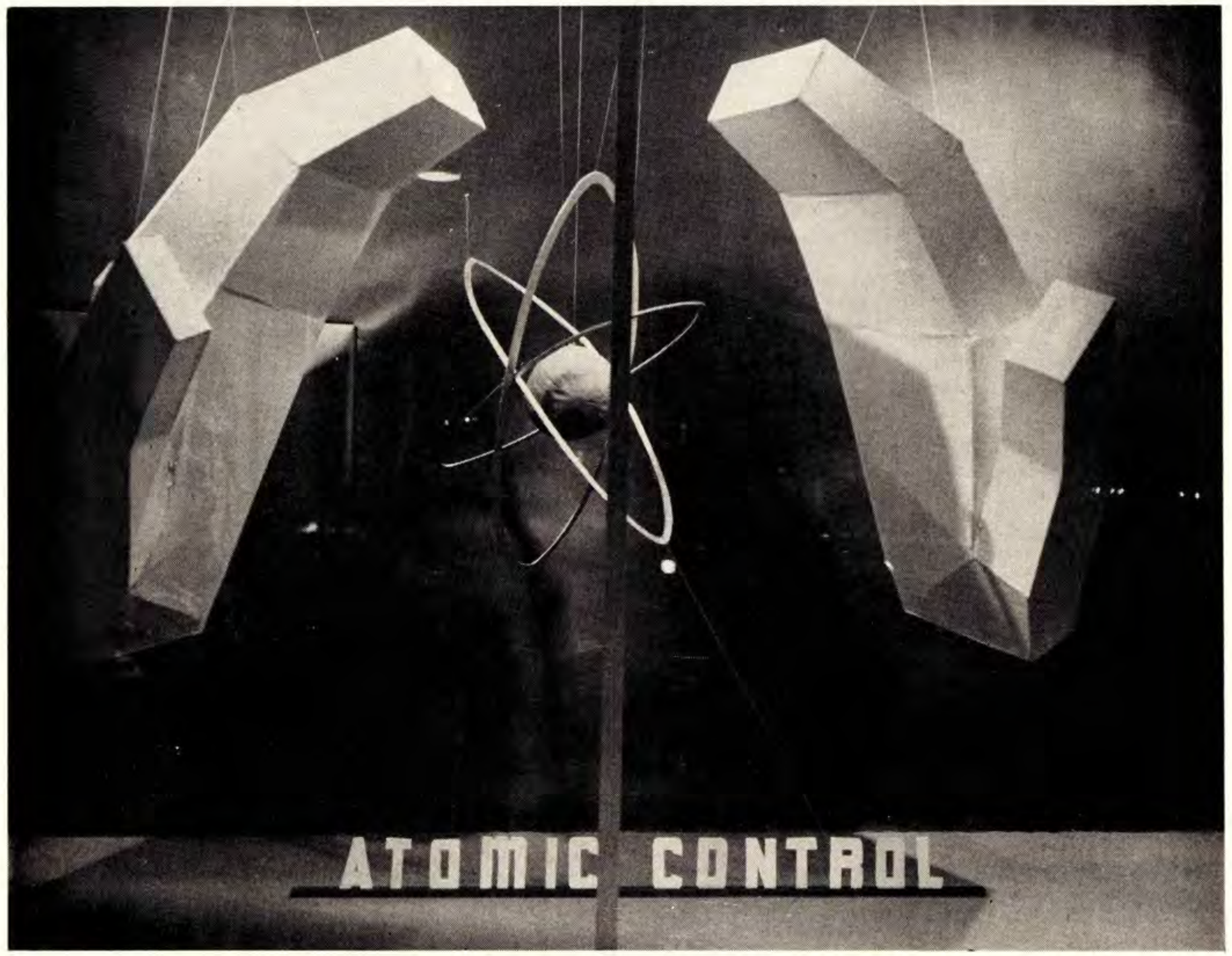
FURTHER ACTIVITY: At this stage the important thing is to try something in your own club. It need not be very advanced to begin with or require much effort on the part of members. As films are very accessible in Iowa, why not see a film? Or ask the local doctor to prepare a short chat and answer a few questions? It is very unlikely that he will refuse, for we know that doctors have cooperated in several Iowa towns, one of them giving an extensive lecture. (See Chapter VI.)

Thereafter some of your members might wish to pursue the subject further and do a little creative work. Why should Wisconsin clubs write their own playlets and Iowa clubs not try? The answer is that Iowa clubs also write. One of the examples is "The Atomic Challenge," written by members of the Peace and World Relations Committee of the Tri-City Sisterhood of Temple Emanuel, Davenport. This conversation piece was written and presented to the entire Sisterhood and proved successful enough to circulate among other clubs. A copy of it is available[6] for you to use as a model, but it is far more fun and of considerably greater educational value if you do it entirely yourselves.

[5]For a very specialized group, the Education Service Branch of the Atomic Energy Commission may have special material. An example would be a talk on mining to mining engineers.

[6]Write to Prof. Hew Roberts, State University of Iowa, Iowa City, Iowa.

There is a third activity for you to consider. Why should any club keep a good thing to itself? If your club finds its own explorations exciting, it may wish to do something for the whole community. The next two chapters describe community-wide programs which were initiated by small groups of people.



(Courtesy *League of Women Voters*, Burlington)

THE HANDS THAT ROCK . . . . ?

A department store window display designed to call attention to the greatest problem: Who shall control the new power and how shall it be controlled? The display is simple to construct.

CHAPTER V

BURLINGTON BROACHES THE SUBJECT

A Program Involving an Entire Community

HOW TO USE THIS CHAPTER: In Burlington, Iowa, the week of October 25-November 1, 1947, is remembered as one of unusual and dramatic happenings for a commercial city in the peaceful middlewest. During that week the city suffered a partial blackout. Army planes flew through the murk. Factory sirens blew ominously. Mysterious explosions were heard in several parts of the city. Strange, indelible symbols appeared on the sidewalks. In churches earnest groups of people met to discuss the future. At a mass meeting an admiral raised his voice in the shadow of many unknown flags, while a grinning skeleton stood in a large store window nonchalantly telephoning the world.

This was neither a revolution nor an undeclared war nor the well staged set for a Hollywood horror film. Yet it might in truth be described as having both elements of revolution and civil war, a war against the ignorance and apathy of civilians concerning the revolutionary age in which they will live better or die violently. For this was Atomic Energy Week.

The educational project of which the skeleton, signs and sirens were a well integrated publicity component was in reality an intensive and serious endeavor to orient a whole community toward the Atomic Age. Locally conceived and carried out before the Iowa Committee came into existence, it is still an exciting story. For this reason, you should first read it simply for pleasure—read it, and pass it on for friends to read. Then you should start to think about it and talk it over. Does it challenge you to attempt some sort of community program in your town? How do you set about organizing such a program? The Burlington program was a model of organization. It was also a gold mine of ideas for advertising and reaching large numbers of people who are frequently unaware of educational possibilities because they do not happen to belong to sponsoring agencies. Finally, if you and your friends feel like "doing something", is the Burlington model the one that you will adopt? Did it accomplish what you would like to see accomplished, what our national leaders recommended in Chapter II? Now you will want to re-read the story carefully and make an evaluation. But first let us read it for fun.

The Story of Burlington Atomic Energy Week

The Burlington project was originally planned by the foreign policy section of the League of Women Voters, but it was designed right from the start to include other organizations in the planning and operation. A first meeting, to which representatives of thirty organizations were invited, fixed the general policy as follows: "Atomic Energy Week in Burlington is to be purely educational, stressing over-all facts and problems and recognizing that international control and strong international political organization are essentials, but leaving it up to the individual to decide the final, specific answers. The peacetime potentials, as well as the destructive force of atomic energy should be covered by the program. No immediate legislative or political action will be requested."[1]

It is easy enough for a group of intelligent people to arrive through discussion at a general policy, but there is a tendency for leading citizens in midwest towns to separate their thinking from their acting. This mistake was not made at Burlington. The sponsoring group, the League of Women Voters, arrived at the first meeting with a number of suggestions for immediate action already prepared and an open mind for further suggestions. The type of activities designed for immediate action involved the other participating bodies. They included distribution of free material to members, using speakers in club programs, a definite financial contribution to the over-all expenses, advertising through club bulletins and house organs, distribution of tickets for a proposed mass meeting and a guarantee from delegates that they would raise the project with their own boards and attend the next meeting with suggestions and commitments from their own organizations. This original group constituted a steering committee.

Between meetings a letter was sent out from the steering committee to all organizations to make sure that the proposed discussion in the several boards would appear formally on the agenda and this was further followed up by a planned telephone campaign with a responsible telephone subcommittee.

A second meeting of the steering committee pooled the ideas of those boards which had discussed the project. By this process a greater number of minds was involved than were actually represented on the steering committee—the community was beginning to do collective community thinking. It was possible now to appoint a number of subcommittees to be responsible for the effective division of labor coordinated under the steering committee. Subcommittees were appointed for the distribution of informative material, the establishment of information booths, the making of visual displays, church activities, arrangements for a mass meeting and ticket distribution for it, arrangements for a blackout, and work through press, radio, theaters, schools, including the parochial schools, and the public schools in the county beyond the city limits. A subcommittee was given special charge of the promotion of the project in rural areas. As such promotion would necessarily have to be done mainly by word of mouth a speaker's bureau was created. The whole machinery of the city was thus put to work effectively with only two meetings.

A third meeting was able to gather the threads and plan the details and dates of Atomic Energy Week. By this time its success was assured. It had gone far beyond the original idea of a subsection of a single women's organization and had become identified with the city. It is the opinion of the League of Women Voters that this process not only achieved effective

[1]Report on Burlington Atomic Energy Week, League of Women Voters, Burlington, Iowa.

community participation but resulted in a better program as valuable additions and suggestions came from other organizations.

The implementation and operation of the program is described here exactly as set forth in the League of Women Voters report.[2]

Implementing the Program

1. Reading Matter.

(a) Various agencies and business organizations were asked to distribute fliers, and submitted estimates of the number of copies needed.

(b) Pamphlets were needed for doctors' offices and beauty parlors, and other material for information booths. A survey was made of all available material. The main sources were the League of Women Voters, 726 Jackson Place, Washington, D. C., and the National Committee on Atomic Information,[3] 1749 L Street N.W., Washington, D. C., although various magazines containing articles and reprints were included in the master list. The quality of material was found to be excellent; the quantity was insufficient.

(c) Three information booths were set up in strategic locations, and schedules worked out for the attendants.

2. Displays and Visual Devices.

(a) The Retail Bureau sent a letter to all stores urging their cooperation. Window display space was requested from downtown merchants. A committee composed of art teachers and others designed and executed the windows, assisted by display men from larger stores. The themes of Atomic Energy Week were worked out by the committee and the chairman.

(b) Permission to paint atom symbols on the sidewalks was granted by the city council, and the job was done by a group of Hi-Y boys.

(c) A limited number of large posters was made available from N.C.A.I. A small poster, designed and printed locally, was used to supplement and localize the large posters. It also proved usable in windows too small for large posters. It announced Atomic Energy Week, carried notice of the Mass Meeting, and a central atomic energy symbol with the words, "Watch, Read, Listen, Think". A committee of ten women distributed posters, each being responsible for one city district.

(d) Bus cards were similarly designed, and one large advertising company donated bus space for two weeks.

(e) Permission for a blackout was readily granted by the city safety department. The Reserve Officers Association arranged with the army to fly one or more planes over the city without cost. A group of men from the Kiwanis Club procured and were responsible for setting off "fire cracker bombs" in three city districts. Six industrial plants offered to blow sirens. The airport manager agreed to synchronize various factors. The Retail Bureau requested all merchants in the main business district to turn lights out for a five-minute duration.

(f) Theatres were also asked to co-operate. One theatre would take a movie of any length which had not been shown before, and two theaters would show any movie not more than 15 minutes in length. There was just one movie which filled all requirements that could be obtained after exhausting all possible sources.

3. The Spoken Word.

(a) The Council of Churches and the League presented to the County Ministerial Association a plan to include the subject of Atomic Energy in all sermons and to announce a mass meeting in bulletins. The plan was received with enthusiasm. All ministers including priests of Catholic Churches were supplied with a special supplement of the *Washington Post* on atomic energy. A letter was also sent by the Ministerial Association to all ministers in the county.

(b) A number of men and women who were supplied with speaker's kits (N.C.A.I.) spoke before groups. A copy of the film, "Operations Crossroads", a projector and an operator were loaned by the local Naval Reserve unit which prepared the speakers to talk to small discussion groups and to larger, more formal meetings. A panel was formed consisting of a minister, a science teacher, and a lawyer.

(c) It was decided to culminate the week's activities with a mass meeting and obtain, if possible, a speaker from the Atomic Energy Commission. Promotion for the mass meeting included posters, bus cards, extensive newspaper and radio publicity, free tickets distributed at meetings and through the mail by cooperating organizations, tickets given out by churches and high school. Downtown drug stores made tickets available also. Postcard announcements were mailed to all county Farm Bureau members, dairies urged attendance with the distribution of a local flier, and a county superintendent's letter carried the announcement to all county schools. Interviews were held with school principals and editors in small towns surrounding Burlington asking them to promote the meeting.

The Results

1. Distribution of Material: Ten thousand copies of the flier, "Twelve Points on Atomic Energy" (N.C.A.I.), were distributed with the monthly bills by the utilities company, and ten thousand copies were distributed by dairies when delivering milk to homes. Five thousand copies of the broadside, "Time Doesn't Stand Still for the Atom" (L.W.V.), were distributed by public and parochial school children and five hundred copies were used as follows: 300 at Farm Bureau meetings, and 200 in county schools. Forty-five hundred copies of the broadside, "Have You Caught Up with the Atom?" (L.W.V.), were given out by churches. Sixty copies of the pamphlet, "You Can Do Your Part" (N.C.A.I.), were placed in all doctors' offices and beauty parlors.

The three information booths set up in strategic locations were supplied with the above material, 100 copies of the September 1947 issue of Kiplinger's magazine which was obtained free of charge, and a variety of pamphlets obtained through N.C.A.I. The supply of material which consisted of about 2,000 pieces of literature was exhausted on the first day due to the demand.

2. Posters: Thirty large posters and 500 smaller ones were placed in the store windows in Burlington and the surrounding cities. Large cards were placed on the outside of all city buses. A street banner with atomic symbols and reading "Atomic Energy Week" was used.

3. Displays: All ten jewelry stores displayed time pieces and carried out the themes, "Time Won't Wait, Neither Can You," "Time Is Running Out," etc. Two bookstores displayed literature captioned, "Reading for Survival." A department store featured a large display based on "Ding" Darling's cartoon, "Eventually, Why Not Now?" which showed a skeleton in an atomic-war scarred world calling for anyone remaining to cooperate in the prevention of the next war. Another department store gave window space for a display on the control of atomic energy. A sporting goods store displayed a rabbit in a snowy landscape with a sign reading, "A Brown Rabbit in the Snow Is an Easy Target. Animals Who Can Adapt Themselves to Their Environment Survive. Those Who Can't Become Extinct. Can You Adapt Your Ideas to the Atomic Age? Or Are You a Brown Rabbit in the Snow?" Two windows were given over to the photographic montage display, "The World and the Atom" (N.C.A.I.). Atom symbols were painted on street corners, on sidewalks in front of all window displays with arrows leading to the windows, and various other places.

The Public Library used "The World and the Atom" table display with their reading matter on the subject. A bibliography of these materials was made available.

4. Speakers: As all forty of Burlington's churches cooperated, many excellent sermons were reported. Sixteen men and women from the speakers' bureau were called upon for major addresses. Over thirty groups heard talks and discussion circles carried out their own projects. Three of the programs were assembly meetings in high schools. In addition to these assemblies, the subject was discussed in government classes and for one hour in all home rooms.

The local radio station ran spot announcements and a program each day of the week. These included a broadcast by the speakers' bureau panel, interviews with the Chairman of Atomic Energy Week and the Associate Director of Information of the Atomic Energy Commission, and actual broadcasts with the "man on the street".

5. Press: A five-day build-up to the week was given by the local paper and daily publicity during its observation. Some of this took the form of statements about Burlington's project by Albert Einstein, David Lilienthal, W. W. Waymack, Senator Hickenlooper and others whose names are familiar to readers of this booklet. Labor and other house organs and school papers carried stories. The *Des Moines Register* ran an illustrated feature story and carried letters to the editor. County weeklies reported events. The A.P. wire service brought the story to national papers and it was printed as far away as Honolulu.

6. Mass Meeting: An hour before the mass meeting the blackout occurred. While sirens sounded and bombs exploded, the radio station gave an effective program urging people to learn the necessary facts before it was too late. Despite hard rain, the meeting, held in the Municipal Auditorium, was attended by 1,200 people. The mayor presided and the Farm Bureau representative explained the purpose of the program. Admiral Lewis Straus of the Atomic Energy Commission spoke on "The Atom in Civil Life" and Forrest Seymour, editorial editor of the *Des Moines Register*, spoke on "A Citizen's Responsibility in the Atomic Age." The speeches were broadcast. The stage was decorated with the assembled flags of the United Nations, and the ushering done by the Girl Scouts. With the close of the mass meeting Burlington's extraordinary and intensive Atomic Energy Week officially ended.

FURTHER ACTIVITY: The first line of activity to indulge in is a little serious thought. The program you have just read about was specifically designed "to bring to the people of Burlington (population 35,000) and Des Moines County the basic scientific facts and social implications of atomic energy through an intensive educational campaign, in the realization that the alternatives before us are informed action or obliteration."[4] These alternatives are still before us. What did the Burlington program accomplish that might help citizens face these continuing alternatives more easily?

The Burlington Committee made a series of spot inquiries at the conclusion of its work. They revealed general enthusiasm for the project, proving that if a "dull" subject is well presented it can be as attractive as a county fair. They revealed, as was to be expected, that much discussion had been started, sometimes in quite unexpected places. For some time atomic energy was the exclusive topic of conversation at business men's luncheons or among the postal employees sorting mail. There were other areas, also to be expected, where people still veered away from the subject, feeling it beyond their powers of comprehension or at least beyond the possibility of any action on their part. Whether these people became more frightened by the Burlington program or later changed their views is not known. It was hoped that a scientific investigation in the form of an Iowa poll would reveal ultimate facts, but this poll was never taken. As a result of another national poll (see Chapter VI) we know that Iowans are better informed about atomic energy than people of other states, and the Burlington program must have contributed its part. There were demands for information about it from many other places, and the report on which this story is based was written "to assist other communities in carrying out similar educational campaigns."

The next obvious activity is therefore a little thought about your own community and what it might do. At this stage we must ask ourselves whether we realize the strengths and weaknesses of a program such as Burlington's. It was remarkable in three ways. First, all the available literature on atomic energy was put into circulation in a *motivated* situation in which it was almost certain to be read and discussed by individuals and widely differing groups. Discussion based on and leading to reading is of permanent value, for it actually increases knowledge where discussion based on uninformed opinion does not. Second, it was a convincing demonstration that, given sincere and intelligent leadership, community cooperation and organization are as possible for intellectual endeavor as for a Red Cross drive.[5] We need look no further for a perfect model of organization. Third, although it was publicized through some really clever stunts, it was in no sense a stunt program but an intensive effort to stimulate extensive activity. It should, therefore, have been of much greater significance than many one-week projects, so often planned without thought of continuing endeavour. You cannot learn all there is to know in one week; you probably cannot even get all the problems lined up straight. So you must ask yourselves two serious questions: "What sort of program is possible in your type of community?" and

[2]For clarity, editorial changes have been made in the headings only.

[3]In the official report the letters "N.C.A.I." refer to National Committee on Atomic Information and the letters "L.W.V." to League of Women Voters.

[4]Report on Burlington Atomic Energy Week, page 1.

[5]Final list of sponsoring and cooperating agencies: Council of Social Agencies, Boy Scouts, Naval Reserve, Lions Club, the Moose, Churches of all denominations, county schools, Navy Mothers, Y Mothers, League of Women Voters, American Legion and Auxiliary, Odd Fellows, Burlington Council of Churches, Reserve Officers Association, YMCA, Building and Trades Council, Rotary, Veterans of Foreign Wars and Auxiliary, Junior Chamber of Commerce, Daughters of Isabella, Daughters of the American Revolution, Eagles, Chamber of Commerce, Hi-Y, Business and Professional Women's Club, American Business Club, Kiwanis, Girl Scouts, YWCA, Parent-Teacher Association, Farm Bureau, Des Moines County Ministerial Association, Public Library, Public and Parochial Schools.

"What sort of program, within the range of the possible, will have the most permanent results?"

In Burlington, local leaders agreed that there should be a continuing committee to promote further education in atomic energy. This committee did not eventuate. After an intensive program, that is not surprising. People have a satisfied feeling, like having seen a very good movie; people are also very tired. The committee does not get appointed and the follow-up is lost. Thus we know that Atomic Energy Week started many discussions, for that was revealed by the spot check-up. But how permanent did the habit of discussing atomic energy become? In Marengo, another town with a community program, we know that discussions are still running after three years, for the long term check-ups were part of the original plan. When you are doing your planning, then, let the initial plans include the final plans. Burlington had special school programs, but does it have a permanent course in atomic energy? We know that Maynard does.

There was a second weakness in the Burlington program, its leadership. This may sound anachronistic, for the leadership was thrillingly effective in terms of the project undertaken. Leadership is of two types, general and special. Those who inspired, initiated, and carried the major burden of the Burlington program were generalists. In American democracy, they are the most indispensable leaders. Informed, intelligent, alert to coming crises of every type, socially responsible and public spirited, they are the working watchdogs who alert the public and point the way. But it is the nature of their social function, since alerts are many and ways diverse, that they must initiate and pass on. To the specialist falls the role of continuing where the generalist must inevitably leave off. Atomic energy is no exception. It will not be the organizing committees but the isolated individuals whose hobby is atomic education who will present the long-term programs or give the annual "keep-up-to-date" lectures. A Mr. Miller of Decorah, a Mr. Palmer of Maynard would have solved the difficulty and set the seal on the otherwise excellent Burlington program. In Decorah, Mr. Miller is a sort of a permanent resource person who is invited by a number of groups once a year to bring them up to date. The next chapter describes how Mr. Palmer made himself a specialist for the atomic leadership that came his way.

Has every community such specialists? If not, they have to be made. This cannot be done by any intensive program however good. The next chapter describes the slow-moving, extensive programs of Marengo, Iowa City, Davenport and Maynard. They also were not perfect. Perhaps the ideal answer for community-wide programs lies in a combination of all. At any rate, your next suggested activity is to incorporate their story in your thinking.

(Courtesy *H. W. Swift*, Marengo)

GROUP-MEMORY NOTES AT WORK

Professor Roberts of the State University of Iowa distributes the special notes used at Marengo and students refresh their memories before a lecture.

CHAPTER VI

"WHO IS MARENGO?"

Some Help for Those Who Plan a Community Program

HOW TO USE THIS CHAPTER: Since it was listed by the Atomic Energy Commission as "foremost amongst university sponsored adult education programs",[1] the Marengo Experiment has occasioned the writer considerable private amusement on being asked frequently, "Who is Marengo? Is he a member of your faculty?" It is true that experimental work conducted by university people frequently gets attached to the name of the director. It is also true that the atomic energy educational work done at Marengo was carried out by a group of faculty members of the State University of Iowa. But in this case Marengo is a typical Iowa county town of some 2,000 inhabitants situated on Highway 6 about 30 miles east of Iowa City. On the principle that so lethal a pill as atomic energy education should be well coated with sugar the original eye-catching title for the work done in Marengo was "Up a Mushroom of Smoke" with the sub-title "An Experiment in Adult Education in Atomic Energy". It was one of the plans of the Production Committee for reaching adults with information about atomic energy and at the same time learning how this can best be done. The plan involved presenting a series of carefully prepared lecture-demonstrations to three types of audiences, a rural audience, a college-town audience, and an urban audience. Each audience was candidly informed of the experimental nature of the work and asked to share in making the experiment a success by various forms of participation. By this means it was possible to secure an adult audience of 434 students in Marengo, 267 in Iowa City, and 537 in the city of Davenport who voluntarily attended the series and made an evaluation.[2]

Such was the enthusiasm of the Marengo students, the first experimental audience, that the series eventually became known as the Marengo Experiment. As such it received the personal attention and approbation of the Atomic Energy Commission. As such it somehow caught the popular imagination of America so that at least one couple heard of it originally on their automobile radio while driving through the hills of Pennsylvania. The first part of this chapter tells its story. The story is told that you may judge whether a similar series of lecture demonstrations could be produced in your town. If such a project seems worthy of consideration, the second part of the chapter tells you how to set about it.

Part I: The Story of the Marengo Experiment

Every fall the Marengo public high school opens its doors one evening a week to adult students from many miles around who come to study a variety of subjects for non-credit purposes. The session lasts for ten weeks. Its program is organized by a council of forty members, ten country women and ten country men, ten city women and ten city men. They are not necessarily residents of the Marengo Independent School District. The usual program consists of two-hour classes, but three times during the session there is a visiting speaker or debate for the second hour when classes are abandoned and the student body meets collectively in the high school auditorium. It was this council of forty members which, on a night of blizzard, met with a representative of the Production Committee and decided to launch the Marengo Experiment. This meant an inevitable dislocation of the usual program. It was decided to hold classes for the first hour, and thereafter to close all classes that the entire student body might assemble to hear the lectures, ask questions, and offer criticisms. It was also decided that between the presentation of the lecture and the opening of the question period there should always be a brief but definite break, to allow the departure of those who came from considerable distances —one family came from thirty-five miles away. It is interesting to note that, although this practice was originally adhered to, fewer and fewer people left immediately after the lecture. Many would remain as late as the lecturer, who also had to gather his equipment and drive thirty miles, was prepared to stay. In one case this was after 11:30 p.m.

Apart from the necessary change in the evening school time-table, every effort was made to keep the conditions under which the Marengo Experiment was run as near to normal as possible. Local arrangements were left exclusively in the hands of local people. No special publicity was prepared either by the Production Committee or by the University. Even the names of the people who were to present the lectures were withheld, to emphasize to prospective students that they were to study atomic energy rather than to listen to famous people. Lecturers received a short introduction on the evening on which they presented their lecture. The printed program of the Marengo evening school took its normal form, announcing the beginning of classes first and the University's work second. Between the winter meeting to discuss arrangements and the opening of the Series in September, no member of the committee or of the lecturing staff visited Marengo. The avoidance of any "build-up" was deliberate, for little of real value can be learned from an adult program which is carried out in an atmosphere of fanfare and ballyhoo.

There was nothing accidental, however, in the preparation of the series by the lecturers at the University. The self-appointed faculty consisted of a chemist, a physicist, a bio-chemist, an educator and a journalist.[3]

[1]*Atomic Energy Educational Programs, 1947-1949*: Atomic Energy Commission, Washington, D. C. 1950.

[2]The Series was presented in Marengo in the Fall of 1949, in Iowa City in the Summer of 1950, and in Davenport in the Winter of 1950-51. Owing to the icy conditions on several occasions, the Davenport audience varied considerably in size. In no city was the evaluation completed by all students, but in Marengo and Davenport several of the evaluations were marked "for the whole family." Another interesting feature was that evaluations continued to come in six months after the Series ended. Many of these late evaluations had a note attached to them to say that the family had deliberately refrained from making an evaluation until they felt able to say that there had been some permanent results.

[3]The Marengo lecturers were: Dr. George Glockler, Professor and Head of Chemistry; Dr. Joseph Routh, Associate Professor of Bio-chemistry in the College of Medicine; Dr. Arthur Roberts, Associate Professor of Nuclear Physics; Hew Roberts, Associate Professor of Education; Robert Blakely, then Editorial Editor of the *Star Times*, St. Louis, Missouri.

It will be noticed at once that there is no social scientist among this group of lecturers. This was not an oversight. Though the Iowa Committee was unanimous in its belief that the ordinary citizen is concerned not with the details of nuclear physics but with the social problems that arise from its application, there was also unanimous belief that some scientific understanding is necessary before the social problems can be fully understood. There is a logic in the way these problems reached the public, and the Marengo Experiment was designed to follow closely the realities of adult experience, though condensing a period of years into several weeks. Not only did the problems facing citizens arise from the work of scientists and engineers, but they were first presented to the public by scientists who realized the nature of the new discoveries and went out on the lecture platforms of America to inform the public. Naturally the newspapers were next in the work of public information. Great newspapers realized that these problems could not be presented unless newspapers themselves had personnel capable of understanding the issues. The first daily newspaper to undertake the task of instructing the public concerning atomic energy through its daily columns was the *Des Moines Register*. Its morning articles were not written by a scientist but by an editorial writer whose background was in the field of literature and history. To write about atomic energy he had both to study the subject itself and to make those individual adjustments which are typical of the adjustments most adults must make to live intelligently in the atomic age.

The information that is available through newspapers, speeches and broadcasts becomes part of American conversation. Before conversation leads to social action, it has to be concentrated and pointed. This normally takes place through a whole series of activities which may be loosely described as adult education. The activities take shape in the discussion groups that exist in such organizations as Farm Bureau Clubs and Chambers of Commerce, study groups in women's organizations, and evening school classes. If government of the people by the people is to survive in the confusion of modern technology, this process of concentrating discussion and pointing up problems clearly is most important. It is equally important that the public shall be deliberately asked to make its own decisions, which means first asking it to acquire the relevant information and to make the relevant personal adjustment. This was the conscious aim of the Marengo Experiment. Hence it was presented by scientists, a newspaper man, an adult educator and much recorded conversation.

The collective experience of the lecturers summarized the existing situation in America. They represented pure scientific theory and research, research in science applied to medicine and animal and plant health, engineering, the informing of the public, and the organizing of discussion. Two of them were not scientists but had made personal adjustments to "get the hang of" the broad scientific facts. All of them were motivated by the Jeffersonian belief that only an informed public can remain free. Otherwise they were very ordinary citizens. Married and with families, some of them go hunting, some fishing, some play tennis, one composes humorous songs, one is the president of a Kiwanis Club, one the program director of a Masonic luncheon group, and all have basement workshops or gardens for their spare time.

The lectures presented also followed the logic of events. First came a series of lectures revealing the scientist doing his thinking, the scientist at work in his laboratory. Second came lectures dealing with those things that first brought to public consciousness the existence of atomic energy. They dealt with the bomb, the proposed power plants, the new research on cancer and on other plant and animal diseases. Next came the great social issues that concern all the public and were originally raised by the scientists themselves, issues such as the nature of secrecy and of security, of national and international control of atomic energy. There is no satisfactory answer to these problems as yet. No satisfactory answer was even attempted by the lecturers at Marengo. But there can be no serious attempt to answer these questions until everyone is at least sufficiently adjusted to face them squarely. So the lecture series concluded with an attempt to analyze these adjustments and show how they can be made.

Your bedside book may be either the latest detective story with its subtle links connecting first chapter to last or a book of independent short stories written by several people. A lecture series presented by several people may easily become the latter type of book; lectures may not have any connection one with the other. To insure that the Marengo series would be a completed whole and not a series of disjointed parts, a great deal of careful collective preliminary preparation took place. It was decided to "produce" the program. There should be a moderator who would open the program, who would spend five minutes at the beginning of every lecture gathering together the threads, and five minutes at the end of each lecture again bringing things up to date, and who would manage the final evaluation and pass on its results to the people concerned. He also would be responsible for the production and editing of weekly notes in such a way that they should be written in a single style and contain the cross references that tied lecture to lecture. Lecturers not only planned what each would do and when, but read each others notes. The links that tied lecture to lecture and first lecture to last lecture were carefully considered so that everyone could emphasize them. The lecturers were also aware of the illustrations each would use so that different people could sometimes use the same illustrations to add to the continuity. Finally each lecturer had a series of notes as written by the moderator made available to him in addition to those notes which he chose to make himself. As note taker and thread gatherer, the moderator therefore was as much a part of the audience as of the lecture staff. Apart from his five-minute appearances on the stage at the beginning and end of lectures, he always sat with the audience and mingled with them before and after the lectures. Moreover he recorded every one of the questions asked and these also were later mimeographed with their answers and handed back to the audience by the moderator, as a further identification of his role with theirs. Though each lecturer prepared his own demonstration material, some of it was collectively used and each lecturer knew what the other would be using. Some of this demonstration material was specially made in the University's laboratories for the Marengo Experiment. Finally, occasional staff meetings were held throughout the presentation of the lecture series for progress evaluation, and meetings were held between the conclusion of the Marengo Experiment and

its second phase in Iowa City and third phase in Davenport.

If the Marengo lectures were unique in any way, it was due to the fact that the lecturers used both the known interests and inhibitions of adults as points of departure. Familiar and homely illustrations were planned to relate the scientific material to the everyday lives of those in the audience. But the group also accepted the fact of two existing inhibitions. First of these was the knowledge that adults had consciously avoided the topic of atomic energy as a result of the continual effort to frighten them, which was characteristic of the first efforts at public information, and possibly because of a certain feeling of guilt resulting from our being the first nation to use the atom bomb.[4] The introductory lecture was designed as an attack upon this inhibition, and included two films to give the audience something of the background of the discovery of nuclear fission and its application to the bomb and also films to show how an audience could be deliberately frightened by a film which was in itself completely unconstructive. The audience was at once involved in the project by being given a quiz which revealed how little they had actually learned about anything as a result of seeing the films, and an evaluation form to be filled out during the week.[5]

The second inhibition, believed to exist widely, was the fixation of adults that they cannot understand science or that science is intrinsically dull. The cause of such an attitude has no place for discussion here, but the Marengo lecturers believed that this inhibition should also be faced at once. The audience was simply told that it would be asked to follow scientific thinking but not to make any effort to understand complicated apparatus or to remember theories of formulae. At the same time it was warned that no effort would be made to render science "easy" or "popular" and that their maximum concentration would be called for. As the moderator, who gave the introductory lecture, was not a scientist he was able himself to demonstrate that broad concepts of science can be grasped without a detailed knowledge of its methods.

Following the introductory lecture were three lectures in straight physics and chemistry, starting with concepts of matter and energy and passing through Einstein's basic formula to the fission of the atom and its application to the production of power. The emphasis was on scientific thinking throughout, the logic whereby one concept led into another. Diagrams, slides, a few formulae, and demonstrations were used. Both the instruments and symbols were shown as conveniences, not mysteries.

The fifth lecturer dealt with two types of secrets, the ones that can be locked away in a safe under guard and the ones that are really "public secrets." Illustrations for this lecture were deliberately simple. Any housewife's kitchen cookies were taken as a typical example of the open secret; once cookies have been made by one person and eaten by others who know how to cook, the others may make similar, if not identical, cookies. The only secret in this case is whether cookies can be made at all. As nuclear fission was neither an American discovery nor an American secret it can be readily seen that the atom bomb belongs to the public type of secret. Once any one nation has publicly used an atom bomb, any other nation with physicists and chemists and laboratories and factories can eventually make a bomb of its own. It may not be quite so good, it may be better, but it can be made. The public conception of a scientific secret was traced through fiction and movies and shown to be an absurd travesty of the reality of scientific knowledge.

It is obvious that this disillusionment about the nature of scientific secrecy is bound to raise again in the adult mind the element of fear. Nothing is more calculated to stir and spread the feeling of insecurity than the knowledge that the secrets underlying our military preparedness cannot be kept for an indefinite period. At this stage some lecture courses have proceeded at once to a discussion of the ways and problems of maintaining peace. The Marengo lecturers believed that this is a negative approach to world peace. It can be shown historically that fear has never been a stable basis for peace. As one of the major aims of the Marengo Experiment was to replace fear in the minds of the public with a feeling of easy familiarity with the atomic age, it was at this stage that the curtain was raised on the peacetime uses of atomic energy, thus emphasizing by contrast that atomic knowledge, like most scientific knowledge, can be used for human good as well as for human detriment. Two lecture demonstrations were devoted to the use of radioactive isotopes in research for the improvement of agriculture, industry, medicine and safety. Using materials from the University's biochemical laboratories, it was possible actually to trace the movement of radioactive isotopes in plants and rats and mice, and to point up in a demonstrable fashion the practical value of such research in the everyday life of the farmer, the industrialist and the citizen of the future. These demonstrations proved fascinating to the audience and the question periods which followed lasted until very late. Members of the audience crowded the stage and gathered around the lecturer. An observer could not but regret the years that had been spent in presenting to a public which is always interested in something new and beneficial only the frightening side of atomic energy.

With fear again allayed by the presentation of the concept that atomic energy is not of itself bad, the problem of war was now presented simply as an alternative. No effort was made to disguise the fact that atomic discoveries had revolutionized war and added to its possible horror, but this familiar ground was rehearsed merely to stress the necessity of a revolution in our thinking about peace. An audience that had attended all the lectures found no difficulty in grasping the fact that, because secrecy is only relative and scientific leadership in any one country transient, the only hope of avoiding mutual devastation through warfare is to preserve peace, to prevent war. The traditional approaches to the prevention of war or to world organization for peace have been based on humanitarian ideals. The Marengo Experiment went beyond these approaches to show that world control of a world shattering force is not merely desirable in humanitarian ideals but is something which is also scientifically necessary, the sort of necessity which sometimes causes men to forego the ideals of liberty in exchange for the fact of safety. As the problem arises from scientific discovery, a scientist rather than a social scientist was deliberately chosen to present it. Against the backdrop of the audience's new knowledge of what atomic energy really is, the various plans for its national and inter-

[4] A sense of guilt as well as a strong feeling of compassion is quite apparent in such books as John Hersey's "Hiroshima."

[5] The content of this and other characteristic lectures, together with some notes on their presentation, forms the substance of the next chapter.

national control were examined and explained, but no conclusions were arrived at by the speaker.

Because in a democracy decisions about public policy are the responsibility of citizens, whether they operate individually or through political parties and pressure groups, the onus of debate and decision was deliberately laid on the audience at Marengo. But it was at once pointed out that in the making of public policy many traditional attitudes are brought to bear. These traditional attitudes form what we call the cultural framework in which decisions are made. An example is the traditional opposition of Americans to government enterprise and the traditional resentment of government control. The question arises as to how far traditional attitudes fit contemporary facts. Does the production of dangerous fissionable materials fit into the same framework as the production of corn and clothing? Is the scientific nature of the substance we are producing to be at the center of our thinking about how to produce it, or is the debate on how to produce to be confined to general principles of political science divorced from the products of practical science? At this stage in the lecture series it became quite clear to the audience that the scientific lectures they had listened to were already conditioning their attitude to public policy. The problems of public and private control of atomic energy within the nation, of the Baruch Plan and the Russian Plan for its control in the international sphere, were not discussed from the point of view of what is right or wrong but rather from the point of view of what is safe or unsafe.

To the Marengo lecturers, this was the logical point for the introduction of some broad facts about the Atomic Energy Act. Many lecture series begin with the Act, the Commission, and their ramifications in modern America. The Marengo lecturers, however, felt that legislation is the result of forces rather than the creator of them, and the Marengo series had led logically to the fundamental problem of people and government. Because it created an enormous government corporation in the midst of a nation most fervently dedicated to private enterprise, the Atomic Energy Act was revolutionary. Because it proposed to surrender to international authority some of the sovereign power of this nation which has for so long been the champion of national self-determinism, the Baruch Plan was revolutionary. We live as much in the midst of a revolution as did the Americans of 1776.

What is the public attitude toward this revolution? And what is actually involved? Is the public faced with a categorical choice of either private enterprise or government enterprise, or can the two co-exist? If so, what are the limits of each? Is America to surrender all its sovereignty in the hope of world peace, or is it possible to reconcile international control of atomic energy with national control of other matters of policy? Can individual citizens contemplate such tremendous and frightening problems rationally or will we all slip into emotionalism? Are Americans willing and able to attain the sort of knowledge necessary to maintain public control over such governmental and inter-governmental issues? If not, will our government, whose first duty is the security of the nation, cease in effect to be democratic because it cannot obtain intelligent direction from its citizens? The political attitudes of every citizen have a bearing on government. The final lecture, therefore, was concerned with these attitudes and adjustments and was presented by the journalist who, himself not a scientist, had already made such adjustments. With this philosophy of the individual and his world, the Marengo lectures closed.

It will be seen that the Marengo lectures were designed to involve each individual automatically in the problems of the Atomic Age, presented without solution. Four devices were used for maintaining the listener's feeling of being personally involved. First was the "experiment psychology," the instilled idea that students and leaders were working together in the hope that the end result would be useful to other people in other places. As has been stated, the Marengo Experiment was given by invitation of the Marengo Adult Advisory Council and the audience was aware of itself as a "guinea pig audience" in an experiment which the Production Committee would report to the Atomic Energy Commission. By arrangement with the Information Bureau of the State University of Iowa, an intern in science journalism attended the series and turned each evening's events into a press and radio release. These releases recapitulated the material presented by the leaders and quoted the more significant questions raised by the audience in discussion. By this device the Marengo group was aware of itself as part of a more extensive public program of information concerning atomic energy.[6] There was considerable evidence of an intangible nature that the Marengo people developed a proprietorial attitude toward their own program. One story will serve to illustrate. Some time after the conclusion of the Marengo Experiment, Dr. David Lilienthal was featured speaker at a convention of the Iowa State Education Association in Des Moines. During the course of his address he referred to the Iowa Plan for Atomic Energy Education and to the work of the Marengo people done in that connection. At the conclusion of his address a group of people scrambled informally over the footlights and introduced themselves to the speaker. They were members of the Marengo audience who had driven 90 miles on a wet cold night to listen to the chairman of the Atomic Energy Commission, and to introduce themselves to him. None of the group were school teachers who would normally be attending the convention.

The second device for helping the audience to feel personally involved in the study was that of note taking. As has been stated, the moderator was responsible for the production and editing of notes designed to represent not a digest of each lecture but a continuity of the series from beginning to end. Much of the necessary note taking was done by the moderator because he was in touch with the lecturers and familiar with the material, but an effort was made to involve the audience in such a way that they would develop a sense of proprietorship in regard to these notes. Volunteer note takers were called for before each lecture. At least ten men and women would undertake to write notes for one lecture. Notes taken by these adults were handed to the moderator for his editing. Generally speaking, adults are far removed from their note taking days, and the results from this experiment were not very fruitful. The average note taker very soon forgot his job and became absorbed in what was being said. However the sketchy notes were incorporated in the more complete record available to the moderator, and were written up as "group memory notes." Samples of these notes may be found in Chapter VII. As can be seen, they are written in the first person plural, each paragraph beginning "We remember that . . . ." Each student received a copy of each week's notes and was encouraged to file it. The first person plural was used because the finished collection of notes at the end of the Marengo Experiment would thus appear as a "book" written by all the experimenters rather than a book dictated by the lecturers. Whether this desirable result was obtained is an open question. But it is interesting to observe that throughout the experiment there was a 100 per cent distribution of notes. Students who for some reason were obliged to miss one of the lectures invariably asked for the notes of it or sent for them in order to complete their files.

[6] This material was used by one hundred thirty-seven weekly rural papers and radio stations. This wide distribution may account for the fact that an America-wide survey of public information about atomic energy made by Social Research Service of Michigan State College revealed that the level of public information was higher in Iowa than in neighboring states.

The third device used to develop a feeling of personal participation was the recording of all questions asked and answers given. These were mimeographed and distributed weekly to each member of the audience along with the group memory notes. Questions stimulate memory. With a few minutes to run through the questions before the coming lecture, the reader was able to recall the intellectual mood of the previous session, and the gap of a week's events was thus more easily bridged. In a group situation, questions also stimulate more questions, the beginning of group thinking. Reading through his questions, the student was unconsciously thrust back into the group situation and ready for working with the lecturer on the new topic, rather than being left alone with his individual thoughts.

For the moderator and lecturers, the recorded questions were an indication of existing and growing interests on the part of the audience. Through them it was possible to make last minute adjustments in the carefully laid plans. Eighteen months later, when the questions recorded at Marengo were compared with those recorded in Iowa City and Davenport they corroborated other evidence pointing to quite marked distinctions in the interests of rural, academic, and urban audiences. These differences conditioned the preparation and presentation of atomic energy lectures, and locating them had been one of the chief aims of the Production Committee. They are discussed in the next chapter in the section entitled "The Questions People Do Ask!"

The fourth device was an "evaluation." This was not a test of the factual knowledge gained by the members of the audience; it was not a test at all in the educator's sense of that word. In formal public education concerning current issues, the writer inclines to the belief that the usual process of factual testing is meaningless at best and disruptive at worst. So far as it is educational instead of merely informative, the public study of events creating social change is concerned with attitudes rather than with facts. The facts are used to change or modify attitudes, and the results are successful if the attitudes remain modified though the facts be forgotten. As has been frequently stated, attitudes are of primary importance in atomic energy education. If the existing fear and indifference can be modified, the understanding and control of the atomic age will be easier for the coming generation. The adult educator must be content to cast his bread upon the waters in the hope that it will return to him after many days.

A true test of knowledge is necessarily external to the teaching situation it examines; the Marengo evaluation was an integral part of the teaching program. In style it followed the group memory notes. Its primary purpose was to encourage people to ask themselves if they already felt any fundamental change in their attitude toward atomic science and its social problems, and if they anticipated such change would be enduring. The evaluation was therefore left to the students to complete in their own time. Many of them completed it collectively, as a family unit. Its completion probably resulted in considerable discussion; such was intended. So far from being a memory test, it was hoped that answering some of the questions would cause students to refer back to their group memory notes before expressing confidently their faith that they understood the points asked. It was quite candidly designed to suggest future activities. There is no guarantee that a student who undertakes to "watch newspaper references with greater care" will do so, but if he actually undertakes so to do the stimulus may last a little while. It may even become a habit.

The evaluation questionnaire consisted of five sections. The first section asked for a minimum of personal data, including the scientific reading habits of the audience. The second was concerned with the concepts students had been asked to grasp and included questions such as: Do you understand why scientists use symbols and equations to express their findings? Was the general construction of an atom made clear? Did you understand the difference between an ordinary atom and an isotope of the same substance? Did the scientific words become continually more clear as the lectures progressed? Do you understand how isotopes can be used as tracers in medical work? Could you explain why the "secret" of atomic energy is different from the traditional secret? Do you understand why the control of atomic energy is involved with national and international policy? And so on.

The third section dealt with the presentation and included questions such as: Are lectures with demonstrations a good way of explaining atomic energy? Should more films, diagrams and slides be used? Were the lectures arranged in correct order, i.e., did they "follow on"? Was too much time devoted to explaining basic science before reaching the specific topic of atomic fission? Were the verbal illustrations, e.g., coal burning, milk turning sour, sufficiently "down to earth"? Were the notes of lectures really useful for "jogging" your memory?

The fourth section was concerned with reactions and attitudes and included such questions as: Have you already found yourselves discussing these things with family and friends? Will you watch newspaper and magazine articles with greater care? Will you look for the published remarks of members of the Atomic Energy Commission or the Joint Congressional Committee? Will you attempt to answer your children's questions or help them find answers? Would you go out of your way now to listen to an occasional "one-night stand" lecture on these topics? Do you still feel the questions are too big to worry about?

The final section was a personal evaluation of each of the lecturers in terms of his personality, voice, enunciation, arrangement of material, mannerisms and conduct of question periods, concluding with the test question: Would you go to hear this lecturer again on a similar but not identical topic? Spaces were provided in each section for comment, and a drop-out study was also made.

It will be seen that the answers to these questions are quite subjective and, indeed, could be outright lies. Their reliability is dependent on the general "tone" established throughout the series. They must, of course, be answered anonymously. Apart from the fact that they deliberately suggest continuing activities, their fundamental value is their intimation to the staff of areas of needed improvement and the "feeling" they inevitably reflect of satisfaction or dissatisfaction—the receptive mood is of considerable importance in adult education.

Part II: A Lecture Series for Your Community

Because atomic science contains so much "stuff" that has to be condensed, simplified and explained before we can really see clearly the problems for us all to discuss, a lecture series is one of the best ways of providing the whole community with the information that subsequently forms the matter of innumerable continuing private thoughts and discussions. Almost any Iowa community, from big city to consolidated school district, can organize such a program. What are the steps to be taken?

First, since there is inevitably preliminary organization, it is advisable to find a sponsor or sponsoring group. A club or study circle may undertake the work, but any group of citizens, not necessarily from one organization, may serve. In Burlington it was the League of Women Voters; in Marengo, the Advisory Council of the evening school; in Maynard, the Superintendent of Schools single-handedly; in Iowa City, a group of interested professors; in Davenport, the Vocational and Adult Education Department of the public schools; in your town, who? You know who its leaders are. Call a meeting and form a planning committee.

Second, a regular meeting place will be required. In the typical Iowa town the public high school immediately comes to mind. It has the space, the facilities, and the tradition of community use. But there are Legion halls, community buildings, church basements and other places. Whatever is chosen, it should be a place that may be entered by all sorts of people without a feeling that they are transgressing or incurring an obligation they cannot discharge; a place in which a speaker may talk without strain and where equipment for demonstration, films and other aids, may be easily handled. Finally, it should be a place that can be reserved for a regular night each week until the series is complete. For this reason, planning should begin in ample time to arrange for the use of premises before schedules are filled for the year.

Third, a co-ordinator or "producer" should be appointed. This should be done before the lecturers are found. Ultimately the continuity and "shape" of the total program will be the responsibility of one person who must be prepared to make this his hobby for several months. Before the lecturers are found, the tentative (not final) shape of the program can be outlined by the co-ordinator and committee. The plan described in the first part of this chapter will serve if the local committee has no differing ideas. It will be found that volunteer lecturers are usually much more willing to work with groups who know where they are heading than with those who have no idea of what they want. To have some purpose is indicative of sincerity. The final plans will be made with the lecturers, and the co-ordinator's job then becomes the difficult one of steering the program through and gathering all its loose threads. For this reason, he must be interested in an intellectual as well as in a managerial capacity. There are such persons in all towns. The local newspaper editor, the local radio commentator, the school principals and superintendent, the clergy, the club program directors—they are all good potential co-ordinators.

Fourth come those who will do the talking. Plans for lecture series have sometimes been abandoned because committees think only of the state institutions of higher learning as sources of competent lecturers. This is a fallacy. The work done for the Iowa Committee by these institutions was experimental work designed for the widest possible use by the greatest number of people. Its results are incorporated in the State Department's Iowa Plan for all to use. Iowa is extraordinarily well-off for colleges and good high schools, and a faculty of lecturers may well be found in one or a combination of these in the locality of the planned program. Two of the privately-endowed colleges, Cornell and Luther, already have experience. Over five hundred high schools have already taught the subject to youth and a great many schools are also using the elementary program which is replete with ideas that can be used at the adult level. In seeking the co-operation of lecturers, the committee should be already in possession of all the bulletins of the Iowa Plan. They contain ideas, references, illustrations, complete sample lectures and everything to ease the burden for both local planners and resource persons.

Finally, there is the matter of publicity. Much on this problem is scattered throughout these pages. It is sufficient here to remind local committees that it is not effective merely to let it be known that there is to be a series on atomic energy—that does nothing to remove the fears and prejudices discussed in earlier chapters. Many people would react by deciding that they could not understand and therefore would not attend. Good publicity is the offering of *samples*. The Davenport quiz for club programs, preliminary film viewings, radio interviews, a special Sunday with sermons on moral issues involved, ten "talking-points" mimeographed and delivered with the morning paper or the milk, after-bridge talk initiated by members of the committee, the pertinent questions on family civil defense (see Chapter IX) and the emphasis continually placed on the items of human interest—cancer cures, face cream testing, lubricating oil efficiency, better corn and bigger begonias—rather than bombs and war; these are the types of publicity that remove the fixations people have developed about atomic energy. Publicity should uncover the unexpected fact that atomic energy is intrinsically interesting. The unexpected is often the best publicity.

Part III: Proof of the Pudding

"The proof of the pudding is in the eating." Is it true *any* community can produce an atomic energy series for adults, as advocated above, on its own initiative and with its own resources? In Iowa, the proof is the Maynard program.

Maynard is a village of 430 people in the farming area of northeast Iowa, a typical small rural town. A group of 80 men and women from the village and surrounding farms decided in the winter of 1950-51 that they wished to know something of the Atomic Age. They approached the superintendent of the consolidated school, Mr. Donald D. Palmer, who usually teaches commercial law and has no special training in atomic energy. Together they discussed what they would like to know—the good things that may be expected, possible civil defense activities, etc.—but no one was quite sure how to set about learning these things. In the words of Mr. Palmer, "Here is where I stuck out my neck and said I would try and teach the class if they could put up with me." This being satisfactory to all, the group then planned the following interesting series of meetings:

1st Meeting: **Introduction—Adult Education and the Atom**
1. Adult Education and the Atom
2. Survey of class to find out what they would like to know
3. Film Strip F-729

2nd Meeting: **Exploring the Facts**
1. Review the book "Hiroshima" by John Hersey
2. Film, "Atomic Power"

3rd Meetings: **Atomic Energy "What Is It?"**
1. Film "One World or None" and Atomic Energy
2. Why We Need World Control

4th Meeting: **The Atom "Where Is It?"**
1. What is the Basic Structure of Any Atom?
2. What Are Some of the Characteristics and Properties of Matter?
3. Film "Report on the Atom"

5th Meeting: **Principles of an Atomic Explosion**
1. More Powerful than T.N.T. Bombs
2. Nuclear Fission
3. Chemical Explosion
4. Film Strip "F-731 or F-726"

6th Meeting: **An Evaluation of Radioactive Isotopes**
Dr. C. C. Hall of Maynard

7th Meeting: **Destructive Power of Atomic Energy**
1. Is Atomic Power Here to Stay?
2. What Are the Benefits Other Than Destruction?
3. Is It Necessary That We Have an Understanding of Atomic Power?
4. Film "Tale of Two Cities"

8th Meeting: **What Is the Atomic Furnace?**
1. The First Atomic Furnace Was Built in 1942
2. Other Projects, Oak Ridge, Tennessee and Hanford, Washington
3. Film "F-727"

9th Meeting: **What Are Our Chances of Survival If an A-Bomb Is Dropped on Our Town?**
1. Know How to Protect Ourselves
2. Learn the Limitations of an "A" Bomb
3. Film "Where Will You Hide?"

10th Meeting: **Summary of the Course**
1. What Have We Learned?
2. Atomic Energy Is Here to Stay
3. Atomic Energy Will Serve Man If Man Will Use It Right

What is most convincing, as well as encouraging, about the Maynard program? First, it is the community itself. It is so genuinely a typical rural Iowa Community. What Maynard can do hundreds of similar communities can do also.

Second, is the use of non-expert local people and the characteristic conscientiousness of their work. Mr. Palmer spent night after night studying books, pamphlets and reprints obtained from various sources. This, we know, was his pleasure. Not only was he learning new things for himself, but he had the sustaining satisfaction of working with and for a genuinely receptive group of fellow citizens whose enthusiasm and readiness to learn and discuss made the hard work worthwhile. But there was also the local medical practitioner, Dr. C. C. Hall, who was willing to prepare and lead the meeting on health research, one of the topics known to be of absorbing interest to adults. (For other local resource people, see Chapter IV, "The Group Use of People".)

Third, is the awareness of sources of information available within the state. The Iowa Plan from the State Department of Public Instruction, films from Iowa State College, defense instructions from the civil defense agency; these resources are all that is necessary in the preparation of a sound program.

Fourth, is the effort to gather all the threads and make a group evaluation. This found a permanent record in a mimeographed "Facts and Figures We Ought to Know." In a sense, this is writing our own text in our own language, but apart from the written record, the educational value of estimating and pooling our learning, measuring our achievement, is great.

Fifth, is the influence on the community. There is now in Maynard a nucleus of people who know what to do in the event of war, how to anticipate the changes of peace. More important, there is a group of adults who not merely sanction their public school's teaching of atomic energy to the children (in Maynard atomic energy instruction begins in the fifth grade) but understand fully why this is a necessity for the children who will be adults in the Atomic Age.

But there is a larger community than Maynard, the community of all the similar towns which could follow a good example. That the Maynard program was a happy experience for those concerned is attested by the fact that the group decided to celebrate its achievements by holding a concluding banquet and inviting a member of the Production Committee. Only a group with a fine sense of solidarity and accomplishment feasts itself proudly and invites potentially critical outsiders to its table. The invited guest tasted neither the good food nor the intellectual fare, being miserably stuck in a blizzard! However, the Production Committee heartily endorses the sentiment of the occasion, the expressed hope of Maynard people that their successful local efforts will encourage many other towns to include atomic energy in their adult education plans.

(Courtesy *Davenport Board of Education*)

PING-PONG BALLS AND TOOTHPICKS

Demonstration materials can be cheaply made. Here Dr. Glockler of the State University of Iowa demonstrates molecular structure in Davenport with models made from dime store equipment. Have you seen this picture before?

CHAPTER VII

LECTURER TO LECTURER

Some Help for the Lecturer and Resource Person

HOW TO USE THIS CHAPTER: As was stated in the previous chapter, the Marengo Experiment had a double purpose: to inform the public and by observation of audience reactions and discussion, to help leaders learn how better to present the subject. This chapter is therefore intended primarily for people planning to lecture, especially those who will lecture on science. The social problems raised by the scientists and forming the second part of the Marengo lectures appear in the next chapter so arranged as to be either material on which a lecture may be developed or to be read by the reader of this bulletin as a chapter complete in itself. The *content* of these latter lectures is not to be found in any one publication; some of it is not to be found outside of this publication as it is the original thinking of the Iowa people who produced the Marengo lectures. It is not necessary to present in detail the scientific material. Any modern physics text contains much of the basic information needed; any science journal of the type read by science teachers contains from time to time articles on the application of atomic energy to war and peace useful for lectures on this topic. The chief problem for the lecturer is what to select and how to present his selection. This chapter deals with what the Production Committee has found successful, but recognizes that each lecturer will ultimately work out his own destiny.

Though mainly a guide for resource persons, this chapter may also be used by the lone reader or the study circle director as a guide to the sort of scientific knowledge that will most help him to consider intelligently the social problems of the Atomic Age.

The Introductory Lecture

In a well-planned program there need be no introductory lecture. Through films, quizzes and lecturettes, as recommended in the previous chapter, the introductory material may be combined with motivational programs in clubs, churches and discussion groups prior to the opening of the lecture series. If this is not feasible, the introductory lecture should be built about the three themes around which the subsequent series is arranged, like the overture of an opera. These themes are: science and its applications, social problems arising therein, citizen attitude and action. In the information lectures they follow this order as being the logical order. In the introductory lecture they should *not* follow this order but rather the *psychological* order, the order of importance in the mind of the public.

First comes the question, why does this concern me? An excellent answer lies in the public reaction to the news that America was exporting radioactive isotopes to Norway for research into jet engines (see Chapter I). No better episode exists to illustrate that the public is actually faced with policy decisions arising from the scientific facts of atomic fission, and that the public, through letters to press and congressmen and other pressures, may influence policy and even force legislation that is wise or foolish according to its understanding of the science that underlies the issue. In posing this problem the lecturer, who is probably not a scientist, should explain confidently that radioactive isotopes are made in the atomic pile at Oak Ridge, Tennessee, but that they may also be made in a cyclotron; that any nation with electric power may build a cyclotron; that even were their manufacture to be confined to atomic piles, there are atomic piles in Canada, England and Russia. As they may be obtained from so many sources outside the U.S.A., we would be making ourselves look foolish if we insisted that our government cease to export radioactive isotopes because we want to feel "safe." The lecturer may now switch abruptly to the question: "Would you like to know what isotopes and atomic piles actually are?" He has already demonstrated that he, who is not a scientist, has somehow acquired enough knowledge of the subject to be able to consider the social problem intelligently.

The lecturer has thus dealt simultaneously with two of the themes, social problems and required scientific knowledge. The third, citizen action, is double-edged. In the first place the citizen has to adjust personally to modern times. He must acquire whatever knowledge it takes to remain free; no one can do this for him unless he is willing to delegate, to the person who knows, the power also to make his decisions for him (see Chapter I, proposals of Dr. Conant). One of the chief reasons we know so little of atomic energy is that it arrived among us fully grown up. In 1763 James Watt discovered the power of steam. Thereafter it grew slowly *and publicly* from a model stationary engine to a mighty ocean going liner. We were not surprised or frightened when it appeared as a battleship. In 1770 the first automobile sputtered down the streets of Paris. Thereafter it grew slowly *and publicly* from the laughable "one-lunger" to the tractor and the limousine. We were not surprised or frightened when it appeared as a jeep and a tank. In 1879 Thomas Edison threw a switch to illuminate New York with a new type of light and make possible the Great White Way. Thereafter it grew steadily *and publicly* until we could floodlight the statue of President Lincoln or hear and watch without wires a great party convention. It was neither frightening nor surprising that Air Transport Command should fly "on the beam" or anti-aircraft guns be sighted with radar. But in August, 1945, an atom bomb exploded and atomic power came violently out of nowhere. This, we were told, was not simply a bigger and better bomb in the uninterrupted ancestry of gunpowder extending from Chinese toys to 25,000 pound R.A.F. super-blockbusters. This was something new. It arrived abruptly; it had grown up *privately*. Why? Because we the citizens are little interested in science until it appears in applied form—steam trains, automobiles, deep freezers. The atomic submarine and the "tracer" that helps locate cancer and maybe cure it are early applications of atomic science looking toward the atomic age. "What is a tracer?" The lecturer has again readied his audience for the series to follow, and bared the second edge of his third point.

The second edge is the fact that for most people atomic energy is a bomb. Because the bomb came before the medical tracer (if the lecturer does not already know what a tracer is the local doctor can explain from his medical journal), the average citizen is afraid. It is as though the tank had come before the one-lunger. The fearful aspects have been constantly in the news. We all know of the big and little bombs exploded on the proving grounds out west; how many know that ordinary electric power for radios and electric lights has already been produced from a "breeder" at Arco, Idaho? "What is a breeder? How can you make power from atomic energy?" Again the listener's curiosity about science is aroused, but he is also faced with the fact of his own attitude and its influence on today. Should there be a breeder instead of a coal-burning power plant in Des Moines? Is it economic to replace hydro-electric power with atomic power? Can an enterprising citizen start an atomic powered utility empire? Would we have such a thing in our town? *Will we get the chance to decide?* If not, who rules America? And when a presidential candidate raises the question, "Shall atomic power remain under the direction of the Atomic Energy Commission or be handed over to private enterprise?" how shall we vote? The lecturer has faced his audience with the final theme, citizen action. And the question to answer was actually raised in the presidential campaign of 1948.

Enough has been said of the content and continuity of this lecture. It cannot be too much stressed that its presentation must be lucid, fluent, humorous if possible, eloquent where necessary, and convincing certainly. Because he appears as a citizen reasoning with fellow citizens, the lecturer should definitely not use notes; a person who is already convinced of the rightness of his cause does not use notes when arguing with others he is trying to convince. Nor should he learn it by rote, which is also unnatural when speaking from conviction, but he should do much thinking about it and possibly rehearsing for some days. As it is not a long lecture, it can be "punctuated" with one or two short films if the lecturer is used to using them. Such films as "Atomic Power" (see Chapter V) will fill in the historic background. Films like "One World or None" illustrate how we have tended to emphasize fear. An evaluation form, to be filled out in leisure time during the week, may be used with the latter film. It helps at once to incorporate the audience in the series as participants.

The Science Lectures

Readers of Chapter II know that the Production Committee, in consultation with national leaders, believes that the public should endeavour to grasp sufficient scientific knowledge to understand the social problems arising today and also to understand scientific method, the way the scientist and the social scientist think. To these two strong opinions the Marengo lecturers add the belief that enough science should be known in order that the home atmosphere in which tomorrow's citizens grow should not be one of indifference to or fear of the atomic age. But they are the first to agree with national leaders that teaching *about* science is not the same as training scientists. It would be foolish and impossible to try to turn everyone into an amateur scientist. It is neither foolish nor impossible to let everyone in on the scientific mind, how it looks at things, how it thinks about what it sees, and what the results of this thinking are. In other words, a lecturer is trying to pass on to the public not the details, nor even the facts, of science, but its concepts. Facts and details illustrate these concepts, but the concepts are what remain in the listeners' minds.

First of these is the concept of matter with its physical and chemical properties. It is advisable to start with the word "substance," the common adult name for matter. It is also advisable to start with visible examples of well known substances, for the lecturer will succeed in proportion to his capacity to clarify scientific abstraction by concrete illustrations. He can well begin with a piece of coal, a piece of iron, or a glass of milk, any of which he can hold in his hand while talking of it and its "properties" which all are familiar with, though not necessarily scientifically.[1]

For example, all three substances have weight (mass) and size (extension). The piece of coal may be cracked in half, shattered into coal dust, but it is still visibly coal. On the other hand it may be burned and what is left is lighter, smaller and different in appearance. Iron rusts and the resultant rust is different in appearance from the original iron. Milk turns sour, becoming a thick substance more like cottage cheese suspended in almost clear liquid.

Without mentioning scientific terms the lecturer has been calling attention to physical and chemical changes familiar to everyone. Now he should remind the audience that the scientist sees these same natural phenomena just as a layman does and is just as annoyed if his glass of milk turns sour. He differs only in that his type of curiosity leads him to inquire (a) what has occurred, (b) whether it always occurs the same way and (c) whether he can describe it in an accurate generalization. Adopting the role of this inquiring scientific mind the lecturer may now deduce the ideas of physical and chemical change (what has occurred), the law of definite proportions and the law of conservation of mass (that it always occurs the same way), and the idea of symbols combined in formulae, such as $C + O_2 = CO_2$ (the scientist's accurate generalization). He is also able to introduce incidentally and naturally general terms such as matter and mass and to establish the existence of elements, mixtures and compounds. Always using the common substances and playing the role of the scientist thinking aloud the lecturer has really been letting his audience in on the way a scientist looks at and thinks about substances around him, and has incidentally established for them the concept of matter and its properties and the symbols of scientific expression.

Second is the concept of the Conservation of Mass. By this time the lecturer has a chemical formula on the blackboard and a piece of coal ready in hand. He is easily able to establish the relation between the coal burning in the basement furnace and the chemist's way of describing what took place. He has already shown that if we pulverize coal it is still coal, but if we burn it, it is something else. And every Iowa householder knows that the "something else" is ash or clinker and some sort of unpleasant fumes or gas which make him cough if the furnace is not working right. It is not difficult now to help adults grasp the Law of the Conservation of Mass. If there is time and equipment available the process of electrolysis can be demonstrated to bring home the point of chemical *re*action, the idea of looking at the equation from either side.

[1]A lecturer dealing with science will do well always to have some object in his hand. If he is not using a pointer to indicate diagrams or slides on a blackboard or actually demonstrating a homemade model to illustrate an atom or a molecule then he would be wise to form the habit of holding some ordinary substance relevant to what he is talking about. This very simple device is of far greater assistance than the lecturer may think in helping adults to tie the abstractions he speaks of to the concrete things they know.

Here the lecturer has an opportunity to introduce a little humor and the human touch into his lecture. He may explain that in 1905 Albert Einstein (everyone present knows his name) published a certain formula which implied that the Law of Conservation of Mass would need modification. The mysterious formula can be written on the board but not explained. This modification was the beginning of the long road to the atomic bomb but, as scientists are also human, many struggled against recognizing the new idea. One of the Marengo lecturers admitted that he tried not to recognize it for nearly twenty years, for it meant thinking everything through all over again. Just so, the atomic age may mean thinking some things through all over again when it is so much easier not to recognize change, to stick simply to the ideas of granddad and the "good old days."

It is also to be noted that this item is a "link" with a future lecture. Many links appeared in the introductory lecture. Their importance cannot be over-emphasized. Not only do they strengthen the major concepts and form the continuity, but they enable the lecturer to dramatize his work, to use a little of the technique of the serial movie. To the moderator a knowledge of the links is indispensable.

Third of the major concepts is that of energy and the Law of Conservation of Energy. It may be explained in much the same way, and with the same homely illustrations, as the previous concept. Just as mass is measured by scales of weights that are sometimes different in different countries, so heat, the form of energy most common to us, is measured on scales of temperature which are different in different systems. But though heat energy has been measured by temperature for centuries, it did not occur to scientists to measure it by weight. Does heat weigh anything? Can one "weigh a handful of electricity"? In returning to Einstein and the concept that energy has mass, the lecturer must not be afraid to exaggerate, or to use simple terms. The idea that energy has mass is a "silly" one for the average citizen. At the same time it is intriguing and leads easily to a first discussion of explosions.

Fourth is the concept of the interchange of mass and energy. Using still the familiar illustrations of furnaces and stoves, the lecturer may show that there is little difference between a fire in the gas ring and an explosion in the oven other than the amount of gas involved and the speed of change. In blasting out a tunnel for a railroad or trying to smash the reinforced concrete hangars of submarines in Hamburg the problem of mass is always involved. The bigger the bomb the bigger the aeroplane. The bigger the plane the bigger its fuel tanks or the shorter its flight. How big can a bomb be? The atom bomb, we remember, was not nearly as big as the super-blockbuster, yet it appears to have been far more powerful. Why? Is there an essential difference?

The lecturer has arrived at the fifth and crucial concept, the difference between combustion and fission, the difference between energy derived from change in molecular and nuclear structure. Obviously this cannot be explained without an understanding of the structure of matter. Obviously, too, it cannot be explained in the same lecture as the above without giving the audience hopeless intellectual indigestion. This is the convenient jumping off place for the next lecture, but the lecturer can emphasize the link and at the same time conclude with an amusing and climactic finish. Everyone has seen the black smoke that results from even a small explosion, the black smear on the gas heater after it has "popped." This smoke consists of tiny particles of carbon that were not burned or "exploded." If we could find a way of changing every smallest bit of matter instantly into energy, that would really be some explosion! The lecturer should now turn to his mysterious formula, $E = mc^2$, and turn it into figures. One gram of matter (hold up to view an ordinary gram weight), if *entirely* turned into energy, would release 21,500 billion calories of heat. Start to write this figure out in full. The sight of the silent lecturer writing up a seemingly endless line of noughts always brings laughter, which is a good release at the end of a scientific lecture. Tell the audience that this is as much heat as comes from 3,000 tons of coal. Tell them how long 3,000 tons of coal normally lasts in their community. Remind them that it takes at least 300 great trucks to deliver all that coal, whereas a gram is lost in a vest pocket. Start to turn 3,000 tons into grams on the blackboard, and when the laughter is at its height and you at your maximum confusion of figures, break off to remind them that this is the difference between combustion and fission, between the age of the automobile (internal combustion engine) and the atomic age.

Illustrations and Demonstrations

The Production Committee feels that it is unnecessary to deal extensively with the subsequent lectures in science and applied science. The method of presentation is in sufficient detail above to indicate an approach of known success. The content of subsequent lectures is recorded in the "group memory" notes in the next section of this chapter. Moreover, while the broad concepts of basic science remain unchanged, the content of applied science will change with new discoveries and with the interests of the lecturer who presents those lectures.[2] It is necessary to say something about the importance of illustrations and demonstrations. Scientists are in the habit of thinking abstractly and are sometimes impatient with the pictorial diagrams and simple experiments that appeal to laymen. It should be remembered that the average person thinks in terms of concrete objects. He repairs a chair, a radio or a tractor without a blueprint, or he does not repair it at all. A few figures for the month's books or the year's taxes are his biggest excursion into the abstract. He is also afraid of basic science because he recalls that in school it was both abstract and abstruse. The visible model on the table, the object in the lecturer's hand, the self-explanatory diagram are therefore not merely teaching aids but psychologically reassuring to the adult.[3] Each time a concrete illustration helps him understand an abstract idea, he has not only learned a new concept but removed several subconscious barriers between himself and his growing interest in science. Achieving this basic change in adult attitudes is a far more important resultant from atomic energy education than the full and immediate recall of any one lecture.

Any experienced lecturer has already used his imagination in this way. For the less experienced a few hints follow.

Where relevant, everyday objects, like a piece of coal or a glass of milk, are better than strange ones. This

[2]E.G.: The Atomic Breeder is a new development since Iowa's first educational experiments.

[3]The writer has watched the eyes of adult audiences move continually from lecturer to visible object or picture. They were "fixing" a concept *emotionally* as well as intellectually.

is true also of verbal illustrations which should be adapted to the particular audience. Women are more interested in the use of tracers to test the quality of floor wax than to find flaws in steel beams; men the reverse. A city audience will avoid a lecture on applications to agriculture but will attend one on applications to gardens and pot plants. Everyone is interested in cancer; only a few in thyroid diseases.

Where blackboard diagrams or pin-up charts are used, they should be large enough to be seen by all, and simple. Lantern slides are often better because they are limited only by the size of the screen. Many science teachers have made their own slides based on diagrams that are common in all texts. There have been and will always be feature articles from time to time in the popular weekly magazines with excellent illustrations which may be used by a lecturer as they are or as a source of ideas for his own adaptations. As a rule, the magazine companies are glad to learn that their publications are being used for public education and have been known to supply extra copies free or at cost and to offer readily their own ideas for development. There are also good films available to Iowans from the state institutions of higher learning and other sources. A word of warning is in order concerning the use of films. Because he already knows his subject, the lecturer may believe that seeing a film teaches more than it actually does. On a single viewing an audience learns only a limited part of what is presented and by missing a point early in the film may fail to understand a concept presented later. Films are audio-visual *aids*, excellent where used with excellence. A short and catchy quiz can always be used to follow a film (see Chapter V), or a series of quick oral questions of a deliberately catchy nature. These will bring laughter, for the joke is on us all, and will also serve as a "breather," a relaxation between periods of concentration. At the same time they indicate to the lecturer those points to which he must pay further attention.

Simple models to illustrate molecular or atomic structure may be made cheaply from ping-pong balls, wire, string and matches. They should be strong enough to be handled. When the lecture-demonstration is over members of the audience will tend to crowd around the table and handle the objects on it. This should always be permitted, for it has a certain psychological value. It is not merely that the adult is recapitulating some portion of the lecture; he is also following his own natural method of "fixing" an abstract concept by handling a concrete object. In any community lecture series the cooperation of high school and even elementary school boys can be obtained for model making. They enjoy the work and it can be made of educational value to them, and to their families, if they are encouraged to do it at home. A high school boy who is fond of radio mechanics can easily make a simple Geiger counter and demonstrate it against the luminous hands of the kitchen clock.[4]

One of the difficult concepts for adults is that of a chain reaction, but it is also one of the easiest to demonstrate. A series of stick matches so arranged that the igniting of one leads to the ignition of the whole is a good demonstration, especially as the heat generated will cause a general flare of many matches, an "explosion." Even better for a large audience is a series of ordinary spring mousetraps in a transparent container such as a wire waste paper basket.[5] As they set each other off, they fly about inside the basket, "neutrons" shooting around in the chain reaction.

Demonstrating the use of radioactive tracers in plant or animal research is difficult. The Marengo lecturers had the advantage of the resources of the University's laboratories which obtain radioactive isotopes from Oak Ridge under agreement for research purposes for which the laboratories are equipped in accordance with legal requirements. They were thus able to demonstrate the actual rise of radioactive sap in a plant, and to follow tracers in the blood stream of living rats. Except to approved institutions, radioactive tracers are not available. It is, however, possible to fake a demonstration by the use of luminous paint which will cause a Geiger counter to react. It need hardly be said that the paint should be applied to the object being used to follow the "tracer" on the side not visible to the audience!

Diagrams and photos or films are the only way of "demonstrating" the application of atomic energy to the production of power, or the principle on which atom and hydrogen bombs work. The Canadian film "Inside the Atom" takes the viewer into the atomic plant at Chalk River Valley and is sufficiently well done to create the illusion of paying a visit.

It should not be necessary to remind a lecturer to avoid the habits of some of the teachers we have all known at one time or other. Talking to the blackboard, standing in front of the diagram, talking to instead of about the object held in the hand, addressing only one side of the auditorium, talking down at the table while leaning over it to demonstrate, reading an extract from a book held directly in front of the face, letting people in on "secrets" in a voice so confidential that no one hears, and the like. As we all form such habits unconsciously, it is well to plant a few friendly critics in the audience to give us the high sign if we are falling into any of these errors.

And rehearse, rehearse![6] It is axiomatic that a person who knows enough of atomic science to give a series of lectures about it knows already more factual data than he needs in order to explain broad concepts to a lay audience. The heart of his problem lies in the judicious selection of lecture content, a clean presentation and meaningful illustrations. The effective lecturer must do a little artistic thinking.

"The Questions People Do Ask!"

The asking of questions and free discussion are to be encouraged. As questions often reflect not merely the interests but also the deap-seated worries of adults, such as whether radioactive waste from the research center at Iowa State College will endanger residents of Ames or whether people can be "infected" by others who have been in contact with radioactivity, a lecturer should be conscientious and thorough in this part of his work. He will probably find it surprising and exciting, for adults ask mature and sweeping questions, such as the above, rather than technical questions concerning details of science, though there will always be a sprinkling of the latter.

If the Production Committee's audience research was effective, there will be differences in the extent and nature of questioning in different audiences even in a state with so uniform a cultural background as Iowa.

[4]A circuit diagram for the preparation of a home-made Geiger counter may be obtained from the Atomic Energy Commission.

[5]See Volume II, Iowa Plan: Preparing Elementary Pupils for the Era of Atomic Energy, pp. 34-35.

[6]One of the Marengo staff, an experienced public lecturer, spent two months intermittently rehearsing his three science lectures for adults.

Both rural and urban audiences will ask questions far more readily than college or college-town audiences. The latter are apparently more conditioned to accepting authority unquestioningly or more afraid of appearing ignorant than the former! There will be more technical questions from the urban audience for there is likely to be a larger element of skilled labor and engineering occupations present. Naturally, urban audiences are more concerned with industry and rural audiences with agriculture. Possibly because cities are the logical targets for atom bombs, urban audiences will ask more questions about bombs and weapons, but these questions seem to reflect a type of curiosity rather than fear. Rural audiences will ask many questions, and express opinions, concerning national and international political problems of the atomic age; urban audiences are more cynical. Rural audiences will not break up into side discussion as do urban audiences, for they do not contain as many "amateur experts." The lecturer should not be disconcerted by these side discussions that may develop among groups in an urban audience. The group is, after all, answering a stimulus supplied by himself.

All questions should be recorded, mimeographed with answers, where answers were given, and returned to the members of the audience for their records. There are no answers to some questions and the lecturer should not feel embarrassed if such questions are asked, but should indicate lines of reading or thinking. Where an answer may not be known but is known to exist, the lecturer can defer the answer till a subsequent lecture, or arrange to give it at a stated time over the local broadcasting station or in the local press. This latter device is quite useful. Press and radio enjoy being used in a community project, especially if the use made is in terms of their natural operations. At the same time it accustoms an audience to using other media of information.

A selection of typical questions from the Committee's records is printed below. These, of course, are not all the questions on record from its various experiments but serve to show the variety that may be expected. The answers are not here given. It is assumed that they will be obvious to those preparing scientific lectures. If not, they can be referred to a member of the Production Committee.

If a substance is giving off rays continually, will it not soon be used up? What happens at the end of the half-life? If uranium and radium eventually turn to lead, will lead one day be the heaviest metal, and uranium unobtainable? Why has an atom to be bombarded with neutrons when radioactive substances are constantly changing of their own accord? Why was so much silver used at Oak Ridge? What would happen if the stopper of the (demonstration) bottle of radioactive carbon were removed? If dangerous radioactive rays cannot penetrate the glass and stopper of the bottle, why does the Geiger counter react when the bottle is brought near it? Why is the "c" of Einstein's formula the same as the velocity of light?

Is the cost of the manufacture of radioactive isotopes too high for their adequate peacetime use? Is silver a strategic mineral since the coming of the atomic age? If radioactivity can go on for fabulous periods of time, how can we dispose of radioactive waste, such as the plant and animal tissues used in research at Ames and Iowa City? Will the water around the sunken hulks used in the Bikini tests become radioactive, and if so, will not this water drift in ocean currents to where it will do damage? What precautions are taken for those who work with atomic energy? In what form will atomic energy be applied to industry? If radioactive fertilizers are developed for farming, will their use eventually render soil dangerous to walk over? Is it true that an adequate supply of skilled labor and of engineers is as important in the production of atomic energy as scientists? If so, will it not give America further industrial advantage over Russia?

In medical research how is it possible to gauge the amount of radioactive tracer that will locate the diseased spot without damaging healthy tissue on the way? Can radioactive isotopes be used as cures as well as research tools? If a person is irradiated, but not strongly enough to kill him or make him permanently sick, will effects be passed on to another generation? What are the symptoms of radiation sickness? Is radiation sickness infectious or contagious? What is the difference between a radiation burn and one from an open flame, such as a gas jet? Even if it were possible to develop superior fodder through radioactive fertilizers and germicides, would not this fodder destroy or sicken the stock eating it?

What is the difference between an atom bomb and a hydrogen bomb? Why is the latter more powerful, and by how much? What is the difference between fission and fusion? Can metals other than uranium and plutonium be used for weapons? Could gases other than hydrogen be used for weapons?

Questions concerning social problems often arose as a result of the science lectures. They were either answered at once or deferred as the lecturer chose. Social questions were sometimes raised at different lectures as different aspects of the one problem. They are discussed in the next chapter.

The Group Memory Notes

The importance of notes has been discussed at length in Chapter VI. A selection of the notes used in the Marengo Experiment is printed here, both to indicate their style and as a guide to the content of the science lectures not discussed fully in this chapter.[7]

Group Memory Notes, 1st Science Lecture

WE LAYMEN LEARN FROM DOCTOR GLOCKLER

1. THAT substances, the ordinary objects around us such as iron or coal, have definite properties. Some of them are mixtures of several things. Air is a mixture of nitrogen and oxygen, and these can be separated.
2. THAT chemists use the word "matter" to include all of these substances. There are properties common to all matter. It has weight, whether it is lead or feathers. It has "extension"—that is, it fills up space. It takes a great variety of forms and shapes.
3. THAT there are chemical changes in matter, such as the rusting of iron, milk turning sour, or dead things decaying. An example of chemical changes occurs when we stoke the furnace. Coal combines with oxygen to form the gas carbon dioxide. The chemists express this change in symbols, thus: $C+O_2=CO_2$. Now we know what a chemical formula is.
4. THAT in chemical changes substances combine in a definite proportion by weight always. This is known as the Law of Definite Proportions.
5. THAT this led scientists to believe in the Law of Conservation of Mass (mass is the scientific name

[7]Only the group-memory notes of the science lectures are here printed. A full set of all notes may be obtained from Prof. Hew Roberts, State University of Iowa, Iowa City, Iowa.

for weight). This law simply means that whether we combine carbon and oxygen to form carbon dioxide, or take carbon dioxide and change it back into carbon and oxygen in separate quantities, there will always be the same amount of mass. We would have a certain mass of carbon dioxide or the same mass of carbon and oxygen separately. Chemists *believed* that this law was final and unchangeable.

6. THAT at long last, belief in the Law of Conservation of Mass had to be modified. Modification began the long road which led to the discovery of atomic energy.

7. THAT just as there are mixtures and combinations, there are also elemental substances which cannot be reduced to anything more simple. We can break an iron bar in half, but we cannot change iron to two more simple substances. We can pulverize coal, but we cannot change carbon. We simply have smaller pieces of carbon. These elementary substances are called "elements," and there are 98 of them known today.

8. THAT the more than 400,000 substances we know of in the world and have names for are each made up of various combinations of these elements.

9. THAT when chemical changes or "reactions" occur, they are accompanied by an "energy" change. When coal burns in the furnace, it makes carbon dioxide, which goes up the chimney, and also heat, which warms the house. For every piece of coal we burn, a certain number of calories are produced in heat. While we used to measure the temperature of this heat, it did not occur to us to try to weigh it or measure the size of it with a yardstick.

10. THAT it was always believed that energy had no mass—in other words, heat did not weigh anything. This turned out to be wrong. The famous Dr. Albert Einstein came to the conclusion that energy must weigh something, that when carbon combines with oxygen the result was an amount of carbon dioxide that we could weigh easily and an amount of heat that could also be weighed if we could just invent a balance fine enough.

11. THAT THIS IS A FUNDAMENTAL CONCEPT for understanding atomic energy. No matter how difficult or unusual it may be for us to believe that we could weigh heat, we must accept the idea if we are to understand the atom bomb. If we could take a little bit of matter and change ALL, instead of only a part of it, into energy, a tremendous force would result. This "tremendous force" is another name for explosion. If we could suddenly turn a little piece of gold entirely into energy, we would all be watching the effects from heaven.
Dr. Einstein expresses this in another formula of symbols used by chemists and physicists:

$$E = mc^2$$

The capital E means Energy; the small "m" stands for mass lost, and the small "c" for the speed of light, which is 186,000 miles a second. These figures are bigger than the national debt, and we cannot really comprehend them. It might be illustrated if we would say that one gram of matter completely turned into energy would give 21,500 billion calories in heat, or as much as we would get from burning 3,000 tons of coal.

Dr. Einstein's little formula was published in 1905 and few people paid much attention to it, but the two ideas which stem from it are ones that we must remember:

1. Energy has mass (weight).
2. If we can convert matter into nuclear energy, we can generate tremendous force.

Feel Familiar With Some Words: Matter, mass, extension, properties, mixture, element, compound. Chemical changes or reaction, energy. Chemical formulae and equations, Law of Definite Proportions, Law of Conservation of Mass. Dr. Albert Einstein.

2nd Science Lecture

WE LAYMEN CONTINUE TO LEARN FROM DR. GLOCKLER

(Dr. Glockler says: "This gets tougher every second!")

1. THAT just as we can think of the human body as a constitution of bones, organs and muscles, or nerve cells, tissues and blood corpuscles that we do not see from the outside, so scientists think of matter as being constituted of very small and unseen particles with definite characteristics.

2. THAT if we grind a piece of common yellow sulphur for days and weeks until it is finer than cake flour and then keep on grinding it finer than we can possibly imagine, it is still composed of tiny particles. We cannot even think of grinding it away to nothing at all, even to the infinitely small particle called an "atom."

3. THAT elements (see Lecture 1) are composed of atoms. Sulphur is an element like gold or iron or carbon.

4. THAT if we grind common salt, which is a compound of sodium and chlorine, the finest particle would be called a "molecule."

5. THAT ALL compounds are composed of molecules, and that all molecules are composed of atoms. This follows our idea from Lecture 1, that substances can be either elements (which cannot be divided into other substances) or compounds, which are combinations of elements and can be divided back into their separate elements.

6. THAT chemists believe that all matter is composed of molecules, which can be very simple, like salt with its two atoms, or very complicated. This was a process of deduction, a way of thinking about matter, just as we may think about houses as being composed of wood or brick or stone. But recently some molecules have actually been seen under the electron microscope.

7. THAT the CONSTITUTION OF MATTER is always a vast number of molecules, each molecule having a fixed arrangement of atoms, whether matter is solid, liquid, or gas. Water is always H_2O whether it comes as ice, or from the hot or cold faucet, or as steam. The forms in which we find matter (solid, liquid, gas) are called STATES OF MATTER.

8. THAT there is a definite number of molecules in any given mass of substance. Eighteen grams of water (about a thimbleful) contain 602,400 billion billion! The chemists write this:

$$N = 6.024 \times 10^{23}$$

It is called "Avogadro's Number," but we need not try and remember Mr. Avogadro's name, as we are not likely to meet him and argue about it.

9. THAT we can also find out the weight of an atom by dividing the number of atoms into the mass or weight of the substance that we have. We can also calculate the size of an atom. It would be something like four billionths of one inch. (If that means anything to you, you ought to be a scientist.)

10. THAT we also know that different substances and families of substances have the atoms inside each molecule arranged in a very definite pattern. In ordinary gasoline, for instance, and some hydrocarbons, the atoms are arranged in straight lines. In some other substances they are arranged in rings or in combinations of rings and lines. These combinations can become immensely complicated, like a modern painting. But, unlike a modern painting, the structure of molecules is always symmetrical. (Diagrams are used to illustrate.)

11. THAT we think we know the structure of the molecules that make up all the substances known to man. We can think of this structure as the "architecture" of a molecule. We can calculate the angle between one atom and another within a molecule just as you know that the kitchen is north or south of the living room within a house.

12. THAT this is the basis of synthetic substances like sulphanilamide. When we know the number of atoms and what elements there are and how they are arranged inside a molecule, we can obviously construct a molecule. This is how synthetic substances are made. The *position* of the atoms, as well as what sort of atoms they are and how many, determines the nature of the substance. Scientists refer to this as MOLECULAR STRUCTURE.

13. THAT we have thus far been thinking of the atom as the fundamental unit in building up matter, just as we think of bricks as the fundamental unit in building basements. But bricks are themselves made up of clay and sand and other things, so it is natural for scientists to ask if atoms have a construction of their own as distinct from molecules. If we think of electricity we gain a clue. The flow of electricity inside a radio tube where tiny particles moving from a point to a plate make the tube glow and feel warm is an illustration. The flowing particles are called "electrons."

14. THAT we have found out that an atom consists of a nucleus with a number of electrons revolving around it, something like the planets around the sun. The nuclei of atoms have a positive charge and the electrons a negative charge. Opposite charges, like opposite sexes, attract each other whereas like charges, like two women, can't get along.

15. THAT we have been able to find out about ATOMIC structure as we found out about molecules. We know the mass of atoms, their radii (the distance between the nucleus and the revolving electrons), their electronic charge (the amount of electricity in an atom), and many other things.

Feeling Familiar: Let us now add to our list of new words from the previous lecture the ones from this lecture we want to get to know. Let's each make his own list before next lecture.

3rd Science Lecture

DR. GLOCKLER FINALLY CONVINCES US:

1. THAT we must think of atoms as dynamical systems—and we all know what "dynamic" signifies. Inside the atom, electrons are whirling around the nucleus like planets around the sun. And although the atom is so very small, the distance between the nucleus and the electrons (atomic radius) is in much the same proportion as the distance between the earth and the sun. This distance is about 100,000 times greater than the diameter of the nucleus.

2. THAT all this energy is in the form of electric charges and we can measure the exact amount of electric charge that any atom has. The smallest and simplest atom is hydrogen (H), which has one particle in its nucleus and one electron revolving around it. The hydrogen nucleus is called the PROTON. Helium, the gas which flew the zeppelins, has two electrons revolving around its nucleus (composed of two protons and two neutrons and called the ALPHA PARTICLE). Uranium, which we hear so much about these days, has ninety-two electrons around its nucleus.

3. THAT now we encounter a new complication. It was found out that some substances behave chemically in almost exactly the same way as other substances, and may even look the same, but differ in their nuclear mass (the weight of the nucleus in the atom). Such a substance is deuterium. This substance occurs in water, one part in 4,000. The molecule, when it occurs in water, is D_2O just as ordinary water is H_2O. If all the water consisted of deuterium and oxygen instead of hydrogen and oxygen, it would be Heavy Water. We read in the papers that Heavy Water was used in atomic experiments. The nucleus of deuterium is called DEUTERON (the deuce it is!).

4. THAT substances like hydrogen and deuterium which have the same chemical behavior but different nuclear masses, are called ISOTOPES. There were 286 known isotopes in 1940. Scientists have made a table of isotopes according to their relative weights, with hydrogen as number one. Carbon has an isotope, so we can write the symbol for some carbon as C^{12} and some as C^{13}. The difference is the difference in the weight of the nucleus.

5. THAT scientists now began to ask another ultimate question. Once there was nothing smaller than the molecule, then the atom was the last word, and finally, the nucleus. After the discovery of isotopes scientists began to ask "What constitutes the nucleus?" By a process of deduction they arrived at the conclusion that the nuclei of some substances are made up of protons plus NEUTRONS. Protons have a positive electrical charge, electrons negative. But neutrons are neutral. Now we can see inside the nucleus and it looks like this:

$H = 1$ proton
$D = 1$ proton $+$ 1 neutron
$C^{12} = 6$ protons $+$ 6 neutrons
$C^{13} = 6$ protons $+$ 7 neutrons

We remember that Albert Einstein suggested that energy (for instance, heat) actually has some very infinitesimal weight. In other words, energy has mass, and the difference between C^{12} and C^{13} is the difference in their nuclear mass, because one of the atoms has an extra neutron. And yet they are both carbon! We now have a confusing number of new terms, and are quite sure that the nucleus has a constitution of its own, just like atoms and molecules.

6. THAT the mysterious conduct of radium is now quite simply explained. Radium is a very heavy element, 226 times as heavy as hyrodgen. Scientists who were burned by handling radium (although it was not hot and did not look dangerous) were discovering the phenomenon of radioactivity. Radium is a substance which is decomposing of its own accord, so slowly that the amount of decomposition would not be noticeable in our own lifetime. In decomposing it gives off alpha particles, which we encountered in the helium nucleus. These particles can easily be stopped. It also gives off beta particles, which are really electrons, and are traveling like mad. They are much harder to stop. Finally, it gives off gamma rays, which are high frequency rays traveling as fast as light. Light has the highest velocity known to science.

7. THAT this raises the curious situation wherein a substance is itself and in the process of becoming something else all at the same time. The processes of disintegration can be produced artificially by bombarding the nucleus of an element with a stream of high speed neutrons properly directed. This is something like a submachine gun shooting innumerable bullets at a target in a fraction of a second at unimaginable speed.

8. THAT uranium occurs in three forms—it has isotopes:

U^{234} = 92 protons + 142 neutrons
U^{235} = 92 protons + 143 neutrons
U^{238} = 92 protons + 146 neutrons

Notice that the figures behind the U, i.e., 238, are simply an addition of the number of protons and neutrons. All uranium is radioactive, and in its natural state 99.3 per cent occurs in the form U^{238}.

9. THAT when we bombard U^{235} with a stream of neutrons, something very exciting happens. The uranium nucleus explodes or "fissions" giving off two new elements, barium and krypton, for example, and two or more neutrons flying off into space. So by shooting with one neutron we release two or more. If there are more uranium nuclei in the path of the two neutrons, the same reaction will take place all over again. Each of the two neutrons will split a uranium atom, making barium and krypton and two more neutrons, so there will now be four neutrons. In the next collision there will be eight neutrons, etc.

10. THAT this is the principle of the chain reaction which goes on in a uranium pile, rapidly increasing the number of neutrons and by-products. The increasing number of neutrons represent an increasing amount of energy—power or force.

11. THAT we now discover that what Einstein deduced in 1905 proves to be quite correct. The mass of barium and krypton and the neutrons given off in atomic fission when put together is *less* than the mass of the original piece of uranium which disintegrated. What became of the missing mass? It is represented by released free energy, exactly as Einstein predicted.

12. THAT by controlling chain reactions we have been able to produce still more elements, one of which is more useful in atomic fission than uranium itself. Under *controlled* bombardment, U^{238} can be turned into U^{239} and then into a new substance called neptunium. This in turn can be changed into plutonium. The first bomb which was exploded in New Mexico was probably a uranium bomb. Modern bombs are probably plutonium bombs.

13. THAT we must not imagine that we could blow up Pike's Peak just because we have a few atoms of radioactive uranium and plutonium. A powerful explosion takes place only if the piece of uranium is big enough. There must be enough of it for the chain reaction to go on until such time as there are so many neutrons flying around that there is a sudden release of energy powerful enough to call an explosion. There is an exact weight or mass of uranium for this to occur. It is known as the CRITICAL MASS. Below the critical mass (i.e., if we have less than the necessary weight) the chain reaction will not begin. Above the critical mass (i.e., when we have more than the minimum required weight of uranium) the reaction will result in an explosion. This exact point is "a military secret." Now that we know all about molecular and atomic structure and nuclear fission we can sit down and calculate it for ourselves—if we take long enough!

14. THAT the new elements, barium and krypton, are themselves radioactive and give off beta and gamma rays. These are the dangerous things which cause atomic sickness and the terrible burns that result from the human skin not being strong enough to keep them out. This is why an atomic pile is dangerous unless special means of protection are devised for catching these rays. A great deal of heat is also generated. In the Hanford plant in Washington State, the heat is discharged into the Columbia River where it is carried away, just as circulating water carries away the heat of your automobile engine.

15. THAT the application of atomic power to industry is now obvious. Instead of burning coal to make heat to generate steam to drive dynamos to generate electricity to run engines or heat houses or boil kettles (now take a breath), we would collect the heat from a uranium pile, which is simply the name given to the apparatus in which a controlled chain reaction takes place. It is unlikely that we shall be doing this on the grand scale for many years, although we have already a number of designs as to how it can be done. The chief reason against the use of atomic power is the cost, both of raw materials and the complicated plant. Secondary reasons are the possible danger of illness or explosion and public fear of such power plants. Commercial application is still in the dream stage, though we have already an experimental power station in Idaho.

Feeling Familiar: Let us again make our own lists—and don't forget ISOTOPES; they are the atomic V.I.P.!

Applied Science Lecture

WE LAYMEN INQUIRE WITH DR. ROUTH INTO:

(A) The Usefulness of Isotopes. We Conclude:

1. THAT we can disregard electrons when we consider the weight of an atom. The electron weighs only 1/1895 of a proton or neutron which are fundamental particles of the nucleus. So we state the atomic weight of carbon in terms of its nucleus only.

2. THAT we should remind ourselves that there are natural isotopes and synthetic isotopes. In the natural state C^{13}, a carbon isotope, occurs once in every one hundred atoms of carbon. But physicists can make it occur once in twenty. This makes isotopes much more available for use. Physicists also give us isotopes of oxygen, hydrogen, nitrogen and many other substances. We particularly remember carbon, oxygen, hydrogen, and nitrogen because all the parts of the human body are made up of compounds of these substances.

3. THAT, despite their infinitely small size, atoms are mainly space. The distance between the nucleus and its electrons is comparatively very large. If we took a 200 pound man and removed all the space in the atoms in his body he would be no bigger than one particle of dust. The earth without the space in its atoms would be a ball one-half mile through.

4. THAT there are stable isotopes and radioactive isotopes. C^{13} is stable. C^{14}, C^{10}, or C^{11} are unstable, they want to break up, to discard or add neutrons until they form a stable isotope. In breaking up they give off atomic energy. There are more than 800 isotopes from our 98 elements and more than 400 of these are radioactive.

5. THAT the radioactive isotopes are the useful ones in research. Because they are extremely sensitive, they will cause reactions by which their presence can be traced even when they are present in minute quantities. For this reason we sometimes change non-radioactive substances into radioactive ones. This is done in a "cyclotron," or in an atomic pile, which bombards substances with a stream of neutrons.

6. THAT isotopes are available readily to hospitals and experimental stations. They are made at Oak Ridge. Because of the big developments during the war they are made in great numbers and shipped to over 300 laboratories here and abroad. There are more than 185 projects using just one of the carbon isotopes, C^{14}, and these projects are of 72 different types. Many of the isotopes are quite cheap and will be cheaper. Some of them are even given away. They are shipped from Oak Ridge in "millicuries." A "curie," named for Madame Curie who did so much work on radioactivity, is a standard equivalent to one gram of radium which gives off 37 billion disintegrations per second. Substances are measured against radium because it was the first radioactive substance known. Note that it is a measure of ***rate of disintegration***, not of size, so a millicurie of one isotope may take up more space than a millicurie of another.

7. THAT the uncertain international situation is the only thing that slows down even greater production of isotopes for peacetime use. The Atomic Energy Act of 1946 states that the development of peacetime applications of atomic energy must, at all times, be subject to the needs of common defense. Peace uses are, therefore, a by-product.

(B) Isotopes as the "Seeing Eye." We Conclude:

1. THAT isotopes, like trained dogs for the totally blind, give us eyes to see what we could not even see through a microscope. Because isotopes are very sensitive their presence can be easily detected. One millicurie of C^{14} can be detected in a quantity of material ten million times its size. If there were only one teaspoonful of it in five thousand tons of any carbonate we could still trace it. There would be enough to enter the tissues of fifty million rats, and we could find it in one rat without killing it.

2. THAT this sensitivity makes it possible to use radioactive isotopes as "tracers." Animals eat carbon in various forms and the carbon travels through the system undergoing various changes. If there is a tiny portion of radioactive C^{14} in the food they eat, the food can be followed with a Geiger counter and we can get an idea of what is happening to it. So this is a new mode of perception, the best improvement in three hundred years of scientific research.

3. THAT tracers can also be used in studying plant life, both healthy plants and plant diseases. We can trace what is happening in the leaves of plants without cutting up the leaf or killing the plant.

4. THAT tracers have a habit of collecting or forming concentrations in certain types of tissue, such as cancer. They are, therefore, useful in locating and studying diseases of the body. A concentration will cause quicker and louder reactions of the Geiger counter and so the infected spot can be localized.

5. THAT radioactive isotopes can also destroy some cells or glands in a plant or animal without damaging the surrounding organs. This makes it probable that they can be used for cures as well as for tracing disease.

(C) Applications to Agriculture. We Conclude:

1. THAT the mysterious process of photosynthesis in the lives of plants is beginning to be explained with the help of radioactive isotopes. The leaves of plants take up carbon dioxide and water from the air. Under the influence of sunshine they turn this into plant food by making many complicated chemical compounds, and plant food becomes animal food and energy and cash for human beings. We have not been able to recreate this process artificially, but we have been able to make some of the complicated compounds synthetically. Now we can put these in the soil, trace them through the plant and so find out what happens. One day we may be able to reproduce the whole process of photosynthesis.

2. THAT, whether we recreate photosynthesis or not, we can at least find out how to grow better plants, cure or prevent plant disease, improve soils. We can have the most nutritious plants growing at the right time for the fattening of stock.

3. THAT this will make it possible to increase the world's food supply by increasing the total yield per acre of either fodder or stock. This is more important because at present it is not possible to feed an adequate diet to the total population of the world.

4. THAT this can be done more economically because we can control the disease factor and possibly we

may be able to turn soils now unproductive into fertile areas.

(D) Applications to Medicine. We Conclude:

1. THAT just as we can study the digestive process of plants we can also study metabolism in animals and human beings. For example, the group of foods known as amino acids enters the body tissues, blood proteins, etc. The presence of C^{14} in the food which is eaten makes it possible to study the tissues and the blood. We hope to find out how blood proteins are made, why they break down, and why some diseases prevent the body from making them at all.

2. THAT starvation and malnutrition ultimately result in a breaking down of the proteins. The body uses up its stored fats and carbohydrates and then begins to use the proteins. This is why prisoners of war in some of the Japanese camps lost not only their spare fat but even a lot of their muscle. By using isotopes to find out what occurs when protein breaks down, we will vastly increase the possibility of preventing malnutrition.

3. THAT radioactive iodine (I^{131}) can already be used both as a tracer and a cure. It is so sensitive that the presence of one billion billionth of an ounce can be detected in the system. Now ordinary iodine accumulates in the thyroid gland so radioactive iodine will eventually end up there also. It has been found by studying rabbits that it is possible to destroy the thyroid gland completely without upsetting the other natural processes in a rabbit's body. Conditions such as hyperthyroid can, therefore, be cured with radioactive iodine. It is hoped that the same processes can be extended to destroy cancerous growths in the body without affecting the healthy parts. Radioactive iodine is given free by the Atomic Energy Commission to centers of research (studying the cure of such diseases).

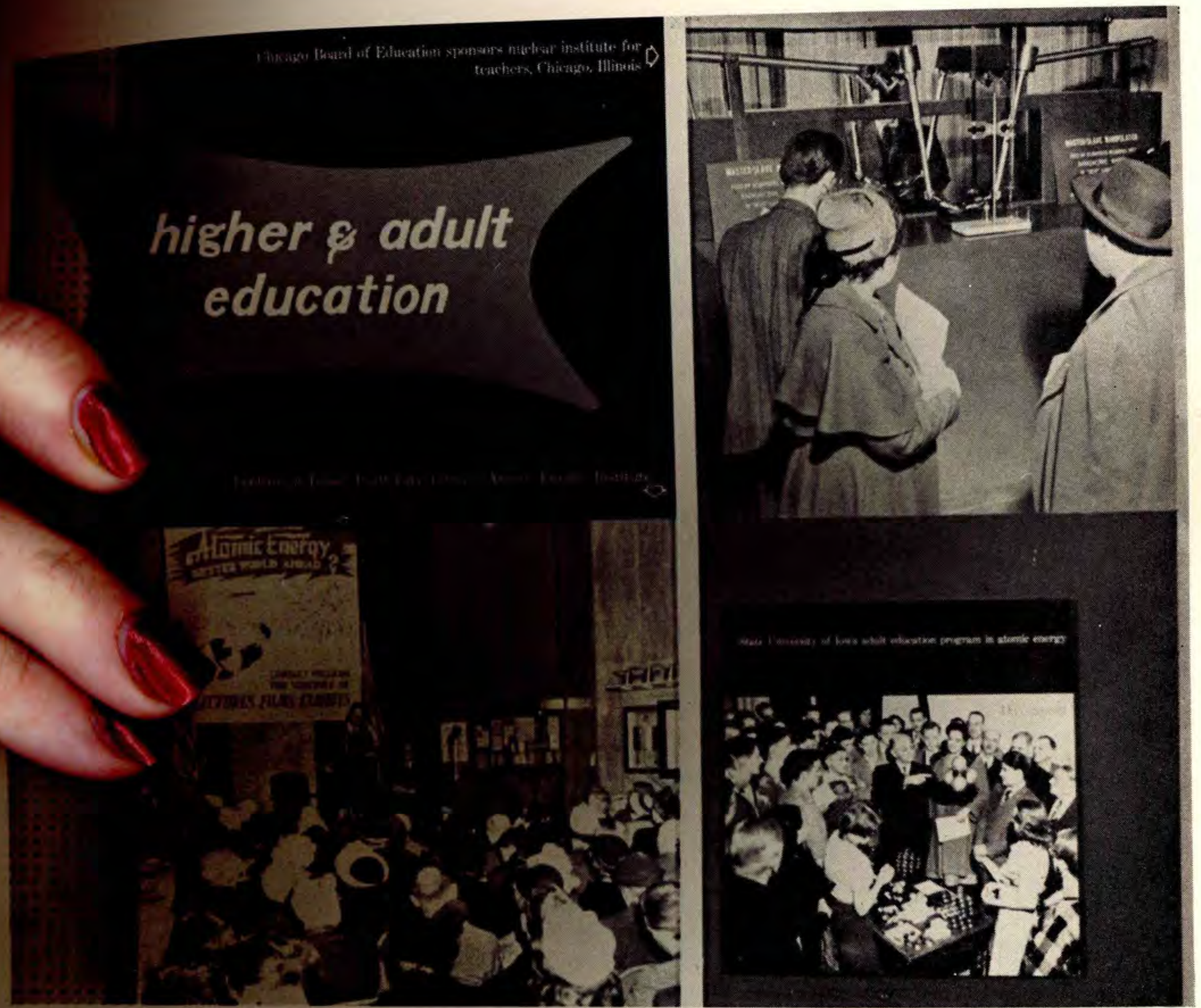
4. THAT the strange phenomenon of death from shock may also be ultimately understood. In acute shock, the red blood cells die, but why they do, what happens to them chemically to cause death, is not known. With radioactive isotopes we may discover what actually takes place when red blood cells disintegrate or die.

5. THAT we are now able to handle serious accident cases with greater accuracy. X-rays have told us how badly crushed or shattered the bones may be after an accident, but they did not tell us how far the circulation has been affected. Amputations are usually necessary because of the stoppage of circulation which results in the disease called gangrene, so common amongst wounded soldiers in the past. Using radioactive sodium and following it along the blood stream we can now find out if any circulation remains and to what extent it is restricted.

6. THAT the process of bone knitting, its speed and its strength can be measured with radioactive strontium.

7. THAT these are examples of the uses of a few radioactive isotopes. Remembering that there are over 400 such isotopes and that more may be discovered, we can imagine what tremendous strides may be made in the future of the study, prevention, and cure of diseases which have so far defied medical science. The peacetime uses of isotopes seem to be unlimited but the world has not yet grown wise enough to solve the problem of its one wartime use, violent death. This must be done. This is a concern for all of us.

FURTHER ACTIVITY: Scientific research and its application to human use is never static. These lectures can make us aware of present developments and give us sufficient understanding to follow future developments ourselves. We are as likely as not to run across radioactive isotopes in the columns of *Time* or *Newsweek*, or the editorial page of our daily. Our high school sons bring *Popular Science* and similar journals home. An occasional reading, alone or with our group; an occasional invitation to a speaker for our club; with the foundation laid we can keep abreast of our age in atomic events as we do in other matters. *It is a matter of attitude.*



(Courtesy *Atomic Energy Commission*)

IOWA GETS A NATIONAL BILLING

Can you pick the Iowa photo from this panel exhibit at a national convention in Atlantic City?

CHAPTER VIII

PROBLEMS, PEOPLE AND GOVERNMENT

Some Help with Personal Adjustment to the Biggest Problems

HOW TO USE THIS CHAPTER: All scientific discoveries and technological changes create new social problems or enhance existing ones. This chapter deals with some of the more alarming social problems that have worried us since we learned of the harnessing of atomic energy. Though we have argued about them, not always intelligently, none of these problems has been completely solved. While they remain unsolved we should not let our interest in them lag. We should at least be clear as to what each problem is and what possible solutions have been proposed. The Atomic Age is very young. We should not despair because a solution of its problems has not been found in these first few years. If the opportunity to solve a problem should come to America unexpectedly, we the public should be willing and ready to grasp that opportunity.

Though the ideas contained in this chapter formed the substance of lectures at Marengo and other places, they are not here arranged as lectures. If you happen to be preparing a lecture, you will find the material useful for it has been gathered from many inaccessible sources. But you may also sit alone in your chair and read it to yourself. You may read it aloud to your family or friends. You may use it as discussion material at your club. You will find there is no difficulty in raising a discussion about the material of this chapter, and you will find there are already strong opinions as to what we should do about the problems raised. Where opinions are strong, there is always good discussion. The problems are interrelated, but if you use them for club programs, it is advisable to consider them separately, for each is extensive.

THE PROBLEM OF KEEPING A SECRET

Grandmother is a secretive old lady. In her old-fashioned desk is a secret drawer. Exactly what she keeps in this drawer none of the family knows and she is very mysterious about it. Despite ingenious attempts none of the family has ever been able to get from grandmother the slightest indication of what she keeps hidden in this drawer. I suppose the secret will be kept until she chooses to tell someone, or till she dies and the lawyer goes through all her papers.

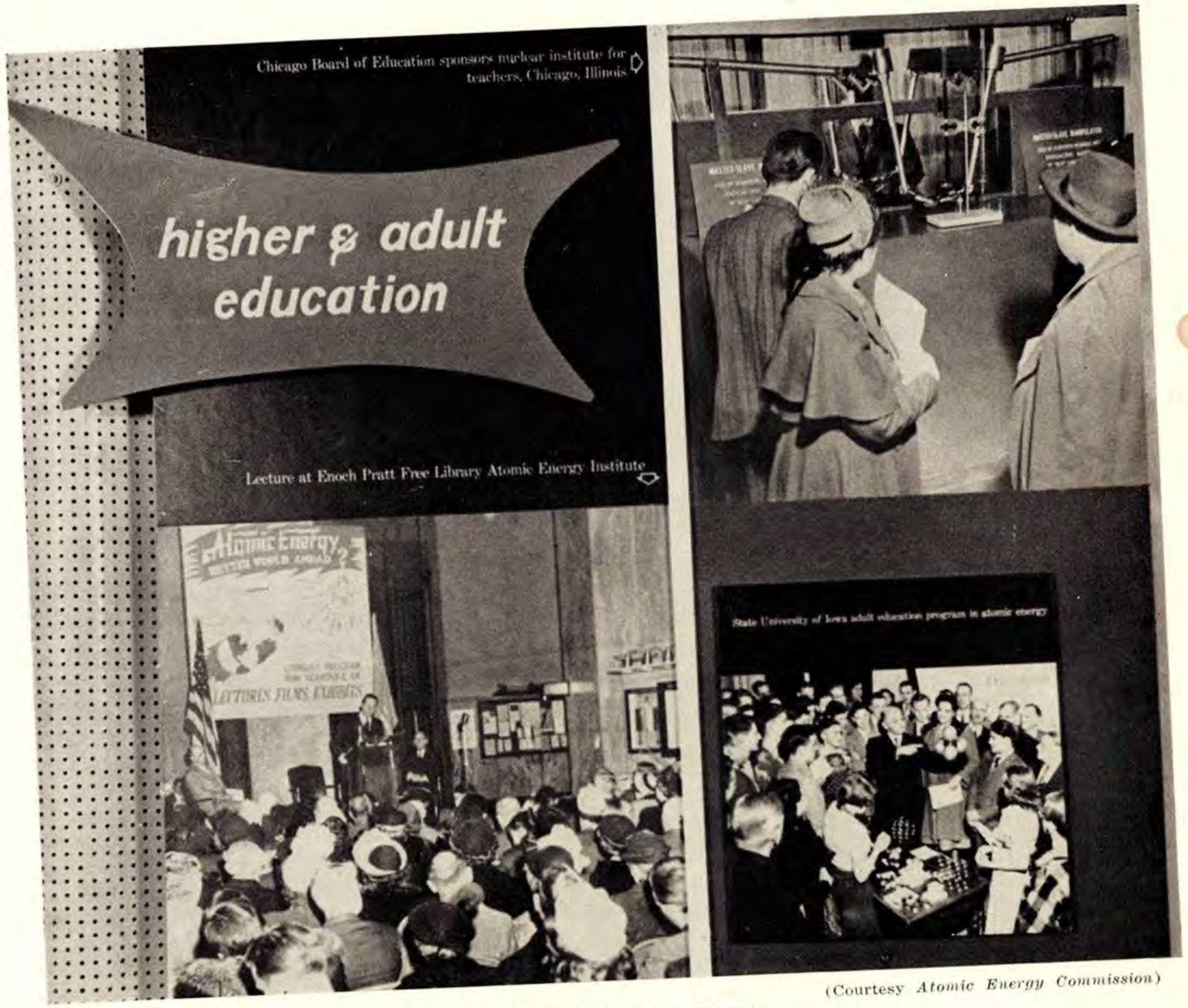
Grandmother was also a famous cook in her day, and she still bestirs herself before Thanksgiving, or Christmas, or one of the family birthdays, and makes a special chocolate fudge of which we are all very fond. She never would give the recipe of this fudge even to her very best friends. Actually it isn't very much different from the chocolate fudge one can purchase in the drug store. I suppose mother or sister could make chocolate fudge just as well as grandmother, but in our family it is tradition for grandmother to make her secret fudge on days of celebration, and I doubt if any other tastes quite as good.

The secrets kept by this fine old family character are of two types. The first secret is arbitrary, a decision made by the old lady of her own accord and without reference to outside circumstances. She can keep this secret as long as she wishes, and there is no way of other people finding out what it is short of their breaking into her drawer. She could even ask for police protection for her secret if she suspected that someone were going to break in. The second secret, the special variety of chocolate fudge, is a secret only in degree. There are a number of published recipes for chocolate fudge, and the results all look pretty much alike. When grandmother dies some other member of the family will make the fudge for Christmas. It may not be quite so tasty at first, but eventually, after a little experimenting in the kitchen, it will probably be just as good as grandmother's.

Military secrets and the secrets of national security follow these two types. The arbitrary secret is the sort that a general makes when he plans to attack a certain place at a certain time with a certain number of troops. This secret is an arbitrary decision, can be locked away, and guarded by a sentry, and is under the complete control of the general who made it. The actual date of the invasion of Normandy in World War II, the actual date and hour for the dropping of the first Atomic Bomb, these were arbitrary secrets locked away in secret drawers and under guard. The people who made the decisions were the same people who subsequently made them public knowledge, by issuing the orders that caused troops to cross the English Channel or aircraft to drop the bombs.

An example of the second type of secret is a modern bomber plane. It is really a transport plane. It can carry a certain load for a certain distance at a certain altitude and speed, and it requires a certain number of people to operate it. Perhaps it has four engines or even six, they may be jet engines or propeller type. But other nations can build such an airplane too, though they do not have access to the blueprint and the designs from which ours was built. They can use the same number of engines, they can be propeller or jet engines, and their airplane can fly swiftly at high altitude and carry an unknown weight of bombs. It may not be as good an airplane as ours. On the other hand it may be better. We do not know the exact figures of its speed, altitude, and bomb load, and they do not know ours. But each of us knows that we have such airplanes and that they will fly. The plans are not identical but they are similar, and they may accomplish identical purposes. Since the Wright Brothers first demonstrated that it was possible to fly, the secrets of the flying machine have been secrets only of degree. There is no known way of preventing another nation, friend or foe, from building airplanes bigger and better or smaller and worse than our own.

Nearly all technical secrets belong to the second type. They are an accumulation of many facts gradually discovered by many people, often in different countries. The existence of the atom was originally suggested by an ancient Greek. Englishmen, New Zealanders, Danes, Italians, Germans and finally



(Courtesy *Atomic Energy Commission*)

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Some Help with Personal Adjustment to the Biggest Problems

HOW TO USE THIS CHAPTER: All scientific discoveries and technological changes create new social problems or enhance existing ones. This chapter deals with some of the more alarming social problems that have worried us since we learned of the harnessing of atomic energy. Though we have argued about them, not always intelligently, none of these problems has been completely solved. While they remain unsolved we should not let our interest in them lag. We should at least be clear as to what each problem is and what possible solutions have been proposed. The Atomic Age is very young. We should not despair because a solution of its problems has not been found in these first few years. If the opportunity to solve a problem should come to America unexpectedly, we the public should be willing and ready to grasp that opportunity.

Though the ideas contained in this chapter formed the substance of lectures at Marengo and other places, they are not here arranged as lectures. If you happen to be preparing a lecture, you will find the material useful for it has been gathered from many inaccessible sources. But you may also sit alone in your chair and read it to yourself. You may read it aloud to your family or friends. You may use it as discussion material at your club. You will find there is no difficulty in raising a discussion about the material of this chapter, and you will find there are already strong opinions as to what we should do about the problems raised. Where opinions are strong, there is always good discussion. The problems are interrelated, but if you use them for club programs, it is advisable to consider them separately, for each is extensive.

THE PROBLEM OF KEEPING A SECRET

Grandmother is a secretive old lady. In her old-fashioned desk is a secret drawer. Exactly what she keeps in this drawer none of the family knows and she is very mysterious about it. Despite ingenious attempts none of the family has ever been able to get from grandmother the slightest indication of what she keeps hidden in this drawer. I suppose the secret will be kept until she chooses to tell someone, or till she dies and the lawyer goes through all her papers.

Grandmother was also a famous cook in her day, and she still bestirs herself before Thanksgiving, or Christmas, or one of the family birthdays, and makes a special chocolate fudge of which we are all very fond. She never would give the recipe of this fudge even to her very best friends. Actually it isn't very much different from the chocolate fudge one can purchase in the drug store. I suppose mother or sister could make chocolate fudge just as well as grandmother, but in our family it is tradition for grandmother to make her secret fudge on days of celebration, and I doubt if any other tastes quite as good.

The secrets kept by this fine old family character are of two types. The first secret is arbitrary, a decision made by the old lady of her own accord and without reference to outside circumstances. She can keep this secret as long as she wishes, and there is no way of other people finding out what it is short of their breaking into her drawer. She could even ask for police protection for her secret if she suspected that someone were going to break in. The second secret, the special variety of chocolate fudge, is a secret only in degree. There are a number of published recipes for chocolate fudge, and the results all look pretty much alike. When grandmother dies some other member of the family will make the fudge for Christmas. It may not be quite so tasty at first, but eventually, after a little experimenting in the kitchen, it will probably be just as good as grandmother's.

Military secrets and the secrets of national security follow these two types. The arbitrary secret is the sort that a general makes when he plans to attack a certain place at a certain time with a certain number of troops. This secret is an arbitrary decision, can be locked away and guarded by a sentry, and is under the complete control of the general who made it. The actual date for the invasion of Normandy in World War II, the actual date and hour for the dropping of the first Atom Bomb, these were arbitrary secrets locked away in secret drawers and under guard. The people who made the decisions secret were the same people who subsequently made them public knowledge, by issuing the orders that caused troops to cross the English Channel or aircraft to drop the bombs.

An example of the second type of secret is a modern bomber plane. It is really a transport plane. It can carry a certain load for a certain distance at a certain altitude and speed, and it requires a certain number of people to operate it. Perhaps it has four engines or even six, and they may be jet engines or propeller type. But other nations can build such an airplane too, though they do not have access to the blueprint and the designs from which ours was built. They can use the same number of engines, they can be propeller or jet engines, and their airplane can fly swiftly at high altitude and carry an unknown weight of bombs. It may not be as good an airplane as ours. On the other hand, it may be better. We do not know the exact figures of its speed, altitude, and bomb load, and they do not know ours. But each of us knows that we have such airplanes and that they will fly. The plans are not identical but they are similar, and they may accomplish identical purposes. Since the Wright Brothers first demonstrated that it was possible to fly, the secrets of the flying machine have been secrets only of degree. There is no known way of preventing another nation, friend or foe, from building airplanes bigger and better or smaller and worse than our own.

Nearly all technical secrets belong to the second type. They are an accumulation of many facts gradually discovered by many people, often in different countries. The existence of the atom was originally suggested by an ancient Greek. Englishmen, New Zealanders, Danes, Italians, Germans and finally

Americans worked in their own countries on the problems that led to the splitting of the atom. Each added a little bit more to the general store of knowledge. The discoveries were published in scientific papers, translated into other languages, and so total knowledge was advanced.

As early as 1935, it was possible, at least in scientific theory, to make an atom bomb. By 1941, it was virtually certain that this was a practical possibility. There followed the Manhattan Project which made and exploded the first atom bomb and the bombs subsequently used in Japan. It should be obvious that the real secret was simply that an atom bomb could actually be made. Once the bomb had been dropped, the secret was merely one of degree. In all modern nations there are great physicists and chemists and engineers, and the basic knowledge of atomic energy was never the monopoly of any one nation. Once it is publicly proven that this energy can be harnessed in the shape of a bomb, then any nation can make an atom bomb by accumulating knowledge already available and putting forward sufficient effort in brain power, experiment, engineering and finance. The degree of the secret is simply the time that another nation takes to work by trial and error to the result which we had achieved earlier. No one can accurately judge this degree. We thought that the Russians would take fifteen or twenty years, but we were wrong. Our judgment of the degree of secrecy was inaccurate.

It would be reassuring if we could blame only the spies for the speed with which Russia was able to conduct an atomic explosion, but we would be misleading ourselves. A great many relevant facts are already public knowledge. We all know that isotopes are manufactured at Oak Ridge and that plutonium is made in the atomic pile at Hanford. We also know that the first bomb was made of uranium and that later bombs were made from plutonium. Here are two different types of bombs which any member of the public may know about. We members of the public do not know the "critical mass" of plutonium, the point at which it will explode, but we know that competent scientists can find out the critical mass of this and any other substance any time they choose. Now there may be other types of bombs which we do not know about. New types were tried in the Pacific Ocean and possibly on our own proving grounds in the United States. How many new types there are is a secret. But other nations now have developed new types. These may be the same as ours or similar. We do not know for certain whether the atom bombs of our ally Britain or our enemy Russia are identical with or just similar to our own; they do not tell us. To this degree their secrets are their own. But one thing is certainly not a secret, other nations with good scientists and engineers are devoting brain power and money to the improvement of atomic weapons.

Where do they get the materials to work with? Again it is a matter of public knowledge. There is an atomic pile in Canada—a publicly released film inside this plant has already been mentioned in this bulletin. The British say they have two atomic piles. The Russians must have at least one. The raw material, uranium ore, is being mined now in the United States, Canada, Australia, Africa and Czechoslovakia. Here are mines in four of the world's five continents. Even assuming they were under one flag, the policing of these areas would be a global business.

The obvious answer, let's quit publishing, is no answer at all if we pause to examine it. The Iron Curtain countries, the world's most secretive in many ways, still publish their basic scientific research. Why? They are afraid that if they did not release to the other parts of the world what they have discovered they would eventually be denied the knowledge of what has been discovered outside the Iron Curtain. If this were so, a revolutionary discovery might take place in a laboratory in Switzerland, say, that would give the Swiss an advantage over the entire world. So we are in a dilemma. We would like to be able to keep our own secrets, but we must know the secrets of the other nations. We dare not let another nation leap ahead of us in scientific research. Therefore the only course open to us is to use every bit of scientific knowledge available from every source, to apply to it our great technical skill, and to make every endeavor in this competitive world to stay ahead. Our advantage is not in the possession of knowledge which others can eventually discover for themselves, but in always having more knowledge earlier. From the time the first chain reactor went into operation under the bleachers in Chicago University's disused stadium until the time that an atomic bomb fell on Japan was less than three years. That is our start, the lead which we hope to maintain.

It will be seen that the scientific secrecy of our atomic weapons is really a secret in degree only. Even though we may invent new substances from which to make atomic bombs, these can be discovered by other nations after we have held our test explosions. Atomic dust is blown around the world. When it falls from the air currents which carry it, it is known as "dropout." By analyzing the dropout from the Russian explosion we were able to tell the materials used in the composition of their bomb. It is like the recipe for chocolate fudge. Once it is on the table and in your mouth, someone is going to figure how to make it. There are, of course, military secrets of atomic weapons that cannot be found out. How many bombs do we have? How many war heads for other types of weapons? Where are these things stored? These are arbitrary secrets like the one in grandmother's secret drawer, but atomic fudge is an open recipe. The only secret about it is who makes the most and the best.

So we come face to face with ourselves. Most of us have always thought of a scientific secret as a formula one line long written on a small piece of paper. Traditionally the piece of paper is locked in a safe by a kindly old scientist who trusts everybody. A suave villain tries to get the formula by making love to the scientist's beautiful daughter. He gets the secret and makes off, but at the last moment a hero appears, retrieves the secret before it is too late and gets the scientist's pretty daughter. This is the way it goes in spy fiction and the movies. There is nothing wrong in such books and movies; let us read more of them for relaxation. But we should not be led to believe that they are any nearer to scientific reality than historic novels and films are to history. We who have learned something of atomic science know that it is not the sort of "secret" that can be stolen by the traditional villain because it is not the sort of secret that can be put down in one formula on one piece of paper and locked in a safe. It is a mass of differing knowledge and skills and machines operated by a mass of differing peoples, many of whom know only a small part of the whole. The thought that it cannot be locked away is disconcerting to say the least, but there is worse to follow. If we knew nothing about it and never thought of it at all, we would feel personally more secure. The proverbial ostrich, a sitting target, probably *feels* secure. Security lies not in what we *feel* but in how secure the nation of America actually *is*, and our own attitudes can influence that security for good or ill. They spell the difference between burying a mythical secret, as the ostrich buries its head, and making continuous strenuous efforts to use our long intellectual legs to stay way ahead of the field. No one realized the danger of wrong attitudes more than the responsible members of the Atomic Energy Commission, as is seen in the following extract from a letter from a Commissioner to the writer:

"The most bedeviling and the most dangerous fact in the atomic energy field since 1946 has been the resistless inclination of nearly all our political leaders, especially those in Congress, to look upon national security as a simplicity, not as a tough and delicate complexity that it is. Hence the appalling tendency to identify Security completely with Secrecy . . . . Not until the Russians produced an atomic explosion was even a dent made in this stubborn obtuseness. And apparently the only dent that has been made is in suddenly convincing some of the politicos that there *is* something, after all, in the concept of "security through achievement"—that progress is actually important."

Or take the idea that security lies in loyalty oaths and checkups. Because of the importance of atomic energy in national defense, the Atomic Energy Commission was set up to control all atomic energy projects and by law all of its employees are subject to a loyalty check by the FBI before being employed. This was our democratic decision made through our representative government, and reflects the personal insecurity we the voters felt. Assuming that such checks can be carried out with absolute efficiency, we have still the difficult task of defining what we mean by loyalty. We know what we mean; we mean the average decent educated American citizen. But how to set this out in a series of rules to guide the FBI agent making the investigation? How many "average decent educated American citizens" hoped in 1945, that Russia would prove a good neighbor as she had proved a strong ally, and expressed this aloud? How many may have remarked casually, "there must be something good about Communism because it appeals to so many people?" How many have been heard to say, "we don't want Communism here but it might be all right for the Russians?" Are such ordinary remarks an index of deep disloyalty? In addition to our own casual conversation our loyalty may involve our associates. Who was your wife's brother-in-law talking to last night? Is the lady who cleans out the office on Saturday, including the desk with the secret drawer, related to people who are related to people who are friends with people who are friends of communists? This sort of inquiry can obviously become absurd. But exactly where lies the fine line between what is necessary and what is absurd? Can any of us instruct our congressman how to define loyalty that the words may be included in the bill he will propose in Congress? Because this is impossible we must trust to the common sense and good faith of those who conduct the investigation. In other words, we are dependent upon human judgment. So are those who are employed. A casual remark to a wife or a fellow worker may turn out to be one of a chain of casual remarks which fitted together amount to uncovering a secret. Remember that this secret is not a single thing but a collection of many bits.

Even though the various specialized workers in an atomic project may be segregated, some idea of what the other fellow is doing will sooner or later get around. It is humanly impossible to prevent the people from getting together in their spare time and it is humanly impossible to prevent the people from making casual remarks about something that happened in the plant or the office today. A worker in an atomic energy plant is just as entitled to read the morning paper as are we. The morning paper often has news about atomic energy. For example certain papers had panic headlines when it was known that we shipped isotopes to other nations for medical research. A worker devoting his time to the production of a new bomb may have been uninformed about other uses of the products of atomic energy, but reading the paper he would learn of many uses that he may not learn about at his work. Loyalty checks, then, are a precaution; they are not an absolute guarantee of security.

Because atomic workers like ourselves are only human, checks and regulations may sometimes defeat the end for which they were instituted. There is a limit beyond which human beings refuse to be pushed around. If our government, under pressure from a frightened public, puts so many restrictions on its scientific workers that the result not merely offends their pride but begins to interfere with their work, they may resign. This is impossible in Russia but it is quite possible in the United States. Immediately after World War II, the Smythe Report listed 150 scientists employed by the Atomic Energy Commission. By the end of 1948, only 12 of these remained. At Oak Ridge, 40 per cent of the physicists and 60 per cent of the chemists had by that time quit public work and gone back to private employment where they would be more free to pursue their research without interference. These large scale resignations can be ascribed at least in part to governmental and public pressures brought to bear because of a misunderstanding of the nature of a secret. Once again we are returned to face ourselves. The only true security, obviously, is to stay ahead of the field. If it is impossible to obtain really qualified scientists for our government work, it at least jeopardizes our chances of staying ahead. How far are their difficulties due to the normal red tape of bureaucracy, and how far are they traceable to us, our attitudes, our elected representatives. And at the local level, how far do our science courses in the local school, the quality of our teachers in our schools and our colleges, the public expenditure on equipment and research reflect a public that has found for its natural fear of the Atomic Age an intelligent and constructive outlet because it understands the nature of the problems involved and the importance of not wasting the most valuable natural resource, human brains.

THE PROBLEM OF PEACE AND WAR

For centuries mankind has desired peace and much of his most intensive thinking has been concerned with ways of achieving and maintaining it. The present witnesses a major struggle between two of these ideas, the religious idea and the communist idea. All the great religions, from Hinduism to Christianity, have one thing in common: they believe that the best way to reform the world is to reform the individual man. Karl Marx believed that man was a product of the environment in which he lived, and therefore he advocated reforming the environment and letting man look after himself. This was to be accomplished by a minority of chosen people believing in his views, just as religious teachings come down to us from a group of chosen people who believed in their religious leader. Setting aside political, geographic or economic issues, this is the root of the ideological struggle between the western and communist worlds.

Ever since man invented the airplane, it has been fashionable for leaders to say that he now has in his hands the power of destroying himself. Two great world wars have proved that was not the case. There is every reason to believe that it is not the case now, despite the atom bomb. The vigorous research for civilian defense which we share with our allies indicates that there is considerable hope of mankind surviving an atomic war should he be foolish enough to start one. But you and I may not be among the survivors, even though we be too old to fight. The next war will certainly bring vast death and devastation within the continental boundaries of the United States, whose air-age frontier is the midwest. War will come suddenly, for an aggressor will probably not declare war,[1] and it will come with terrific force.[2] Though civilization will survive this blow, and the long war which would follow it, our economy will probably be so distorted as to be unrecognizable in terms of the economy we sought to defend.

For this reason constant efforts toward the peaceful solution of international problems must be maintained. But it is the very continuousness of the process that tires us, disillusions us. Why? In the first place we have developed the sad habit of regarding wars as the beginning of a millenial age. World War I was the beginning of the League of Nations and a world made safe for democracy. World War II was the beginning of the United Nations. In point of fact, organizations like the League and the United Nations have been dreamed about and written about and proposed many times during peace. But we have not shown much interest in them at the time. Wars are not beginnings but ends; they are the tragic concluding paragraphs of chapters in human relations that have registered failure. In the second place we forget that the state of high civilization we enjoy within our own nation was not achieved in a decade. The U. S. is certainly one of the most advanced of civilized nations, but it is not perfect. We began the task of perfecting it in 1789, but found it so difficult that at one stage we degenerated into civil war. The United Nations began its operation in January of 1946. Already it has stopped wars in Palestine and Indonesia and is at present trying to stop a third war in Korea. But a "war between the states" is as possible within the U. N. as it was within the U. S. Knowing from our experience the enormity of such a war[3], we should not cease our efforts to avoid it merely because the results do not appear as quickly as we would wish. An atomic war between international states would not only be more devastating than previous wars, but would be different in strategy and in the economics of war. If we make a small effort to understand these differences we may wish to make a large effort towards the preservation of peace.

It will help us if we review briefly the state of affairs before the atom bomb fell. Throughout the centuries there has been a steady change in the right to wage war. Private individuals such as feudal barons once had the right to make war. Independent cities held wars against each other. Factions within one nation reserved the right to make war; there were eight private armies in Germany in 1933, but these were illegal. In the 20th century the only organizations which could make war legally were national states and attempts were being made even to outlaw war at this level. Wars have also grown steadily more costly. Once they were profitable to the victor but today the allied nations are a good example of victorious nations faced with the tremendous financial cost of the results of war. Perhaps even national states cannot now afford war. For this reason there has appeared the sort of conflict which is referred to as a "cold war." Wars are fought to convince the enemy that he has lost his case. Because of costs in money, life and property, cold war is probably better than hot war if we cannot have complete peace.

Along with changes in the cost and the right of waging war have come changes in the foundations of war strategy. We tend to think of technical changes as merely changes in the power of armaments, but changes have been much more basic. Once armies fought each other and civilians took as little notice as possible. Then the attack was both on the enemy armies and on their lines of communication, such as submarine warfare against transports. Now the strategy of war is dedicated to the destruction of the enemy's armies and his civilian workers and productive power. Its aim is complete paralysis, even complete destruction of the enemy nation. For this purpose air power is absolutely necessary. It is used to kill soldiers, to disrupt supply lines, and to destroy productive civilian efforts. It is therefore a universally useful weapon and there are some thinkers who still believe it is the only necessary weapon.

The latest strategical development of air power was "saturation bombing" which simply means the overcoming of all opposition including the disruption of medical services, Red Cross, light, heat, fuel and water supplies. Towards the end of World War II in Germany whole villages and suburbs were being wiped out and as many as 100,000 people killed in one night. The thousand-plane raids on Cologne, Hamburg and Bremen were examples of saturation bombing. In saturation bombing of Tokyo with incendiary bombs, the greatest achievement was setting fire to twelve square miles of the city and suburbs in one night, a fire so fierce that airplanes 30,000 feet above the city felt the air currents and their crews could smell the burning. This raid took about 300 B-29s. They were then classified as large bombers but are now only medium bombers.

This strategical development is not changed but merely improved by the atom bomb. Not only does it destroy more people outright but because of general devastation more people will die. Of 170 medical men in Hiroshima only one was left uninjured after the A-bomb fell, and of five hospitals only one could take in patients. Naturally many of the injured died. An unscrupulous enemy may deliberately adjust his strategy to achieve this end. For us in Iowa an example is ready to hand. If an enemy bombed the Quad Cities with A-bombs he might at the same time endeavor to destroy the State's Health Center in Iowa City with stick bombs big enough to accomplish that task.

The new weapon seems to support the idea that saturation bombing can reduce an enemy in a comparatively short time, though it may not cause him to surrender. The first atomic bomb used in Japan—and modern bombs are considerably more powerful—exploded about 1,000 feet above its target. First it created a ball of fire about one-quarter mile wide with a temperature of 1,000,000 degrees. Of course this temperature cannot be imagined but most substances vaporize at temperatures below 10,000 degrees. The ball of fire was so hot that the ground temperature 300 yards from the explosion was still over 1,000 degrees. The first effect therefore was the creation of a great number of fires.

The enormous heat generated caused an inrush of air which makes the familiar mushroom of smoke. It is this sudden inrush of air which creates the explosion which, in the Hiroshima bomb, was equal to the explosion of 20,000 tons of TNT. Buildings were shattered a mile away, windows three miles away. The second effect therefore is explosive destruction.

Finally the bomb gives off various types of deadly radiation. In Japan all people to a distance of nearly half a mile from the center of the explosion died. Some of these were not visibly wounded and were not killed instantly. They appeared to have escaped harm but in the next few weeks they died. So the third effect is death by radiation. The new weapon is heat plus blast plus radiation.

This incredible piece of saturation bombing was accomplished by one bomb carried by one airplane. In terms of machines, men and fuel, this is obviously far cheaper than the 300 planes used for fire bombing Tokyo or the 1,000 planes used in the effort to destroy Cologne. It is probably the best value per dollar spent to achieve the strategy of 20th Century warfare. It brings us to a major difference in both the strategy and economy of modern war.

In World War II the loss of 10 per cent of the aircraft in a raiding mission was considered too high. Of a thousand planes taking off, 900 would have to return to base for the amount of damage done to warrant the cost of the expedition. That is why there was a considerable lapse in time between the first thousand-plane raid on Cologne and later thousand-plane raids on other cities. But the power of an atom bomb is such that if one plane bearing the bomb got through to its target the mission would probably be regarded as successful. An air force could therefore tolerate far greater losses per expedition and could thus proceed with its saturation bombing at a much greater rate of speed. This would not only shorten the time for devastating the enemy's territory but it would devastate so much of it so fast that the problem of temporary rehabilitation could probably not be solved.

But we should not confine our thinking to airborne bombs only. An atom bomb need not be dropped. It can be brought by a submarine and exploded at the dock where it will create a radioactive wave, drown people, destroy buildings and leave part of our cities radioactive for an indefinite period of time. All our large cities are near bodies of water—rivers, lakes or the ocean. It can be smuggled into an inland city like opium or bootlegged whiskey, and timed to explode later. How long its lethal effects will linger after the explosion is not definitely known. Though the after-effects are not as dangerous as was originally supposed, sand from Arizona which was turned to glass by the heat of the first explosion there on July 16, 1945, is still radioactive today, although not sufficiently so to do a person injury.

Now let us look at the economics of defense during war. The basic idea of all defense is to get out of the way of the lethal missile. There is no defense against an arrow if it hits you. Against arrows we made shields. Against bullets we made trenches and pill boxes and parapets. Against bombs we made holes in the ground and covered them with concrete. For defense against an atom bomb an air raid shelter would need to be 150 feet below the surface of normal ground, or have a roof of extremely heavy reinforced concrete. It is not practical to build enough shelters of this nature to save populations like that of Chicago or New York. In any case saving the people does not save the city and the factories from destruction or lingering radioactivity.

This situation gives a strategical advantage to the less developed nation. We already have a vast capital expenditure invested in our industrial cities. To decentralize our industry into new villages that would be comparatively safe against saturation bombing would entail a vast new expenditure of capital and considerable loss of the existing investment. But a nation which is experiencing today the rapid industrial expansion that we experienced 50 years ago may so design the location of its strategic war industries as to avoid the concentration in existing cities. If a nation has adequate industrial equipment to manufacture and maintain the necessary number of aircraft for its saturation bombing purposes, the nation which is "backward" in urban development has the strategic advantage over the nation which has the same industrial facilities but a more advanced urban development.

America has no adequate defense against atom bombing at the present time. Whatever we may develop in the way of guided missiles to destroy aircraft in the air, we certainly do not plan the major economic expense of changing the face of urban and industrial America. No absolutely reliable defense is conceivable at any time; some of an enemy's craft must invariably get through. If we do reach the stage where we have scientific means of preventing any aircraft from crossing our natural boundaries, our enemies will probably reach that stage also, as we may judge from our examination of the nature of scientific secrecy. In that day war would become scientifically impossible but it is not now foreseeable. The only true defense against atomic warfare at this date is to keep the hostile aircraft on the ground, in other words to keep peace. Mankind must advance the clock of history to the time where nations, like feudal barons, no longer have the legal right to make war. To this end, more than to any other, the United Nations was primarily dedicated.

But nations, like individuals, will not necessarily obey consistently the law "thou shalt not kill." Guns are weapons of self-defense against mad dogs, they are also weapons of murder in the wrong hands. Liquor in the hands of a doctor may be used to stimulate a sick man, in the hands of a motorist it may become the means to death on the highway. For this reason states try, by licensing processes and other means, to control the distribution of things which are dangerous. In the international world man has for many years devoted his brains to the problem of controlling armaments, and America has done its fair

[1]Since the American Neutrality Legislation of 1928 denied American Supplies to an aggressor nation, aggressors have not declared war formally. Japan did not declare war on China; Italy did not declare war on Ethiopia; Russia did not declare war on Finland; and Germany did not declare war on Poland.

[2]It is anticipated that an enemy would strike its initial blow with the maximum airforce at its command in the hope of dealing a lethal wound at the outset. Airforce General Hoyt S. Vandenberg has stated that if such should occur, between fifty and seventy-five percent of the invading airforce would probably get through our defenses.

[3]In loss of life, damage to property, and financial cost the American Civil War was bigger than all the other 19th Century wars in the rest of the World put together.

share of constructive thinking to that end. Should the limitation and control of atomic weapons be the same as has been proposed for the more traditional weapons of war? Understanding a little of atomic science would help us to answer that question. The efforts of the U.N. Commission on Atomic Energy were devoted to trying to find a type of control which would actually suit the scientific facts.

Whatever type of international government or co-operation we may favor, if any, the only existing machinery for making international agreements without the use of force is the United Nations. Amongst its many agencies and committees is one concerned with atomic energy. Through it, efforts are still being made to seek agreement for the international control of atomic energy. Like so many other problems before the United Nations, the committee is at present practically dead-locked because there seems to be no possible compromise between what the Russians and the Americans believe to constitute adequate control. We all know that Russia's conception of government is ideologically different from ours, that Russia's political and economic ambitions are often in conflict with our ideas of freedom and security in the world. For this reason we would probably support the American plan for atomic energy control without bothering to look at it, but the issue is not one of conflicting ideologies but of which plan actually solves the technical problem involved. There is no reason to believe that Russia's proposal was merely a political bluff for in the matter of atomic warfare Russia is as undesirous of being bombed with atom bombs as are we.

The American proposal, known as the Lilienthal-Acheson-Baruch Plan or simply the Baruch Plan, was first presented in 1946 in good faith. It divides atomic energy projects into dangerous activities and non-dangerous activities. It suggests that all dangerous activities be under an international board of control, a board which would have direct and absolute authority over all such projects irrespective of what nation they were located in. Such a board, having complete power across national lines, would obviously be a real step toward genuine world government and a real sacrifice of an element of national sovereignty on the part of proud and powerful nations like our own. It is also obvious that the proposal actually favors nations like Russia, whose technical skill and whose trained labor force are probably not as great or as competent as our own. Through this international board the "atomically backward" nations would have access to all secrets, both of theory and practice, concerned with dangerous activities. Though they would be experiencing international supervision, such nations certainly have everything to gain and nothing to lose.

Nevertheless Russia made a counter proposal. It makes provision for periodic inspections by visiting inspectors from an international board of control but gives to this board no power beyond that of inspection. The plans concerned with the manufacture of dangerous or non-dangerous atomic products would remain completely under national control. The Russians claimed that this plan would be effective because inspection of atomic energy plants is not difficult provided the inspectors have access to the countries concerned. Atomic energy plants are few in number and large in size and cannot be hidden away.

America opposed this plan, not on political or ideological grounds, but because it shows no real knowledge of the technical problem involved. It is not a case of hiding atomic energy plants but of their products. In American activities every millicurie (1/28,000 of an ounce) of plutonium or other substance manufactured in our atomic plants has to be accounted for. It would be easy enough to "lose" such small quantities, to dispose of them to secret enterprises, or hide them in secret storage places. For this reason control is absolutely necessary. It is a necessity inherent in the nature of the substance produced and having little to do with whether we are socialists or capitalists, producers by private or by government enterprise. Inspection would not achieve a true internationalization of the production of dangerous atomic materials. American political leaders, including the three whose names are attached to the American Plan, consulted with many scientists in making their proposals. Russia's political leaders, though extremely well versed in human history and philosophy, apparently do not understand the basic sciences and therefore cannot understand the technical issue of atomic control. In an autocratic totalitarian government the political leaders apparently cannot be reached by the scientists.[4] Events in Russia would sometimes lead one to the conclusion that politicians with no scientific knowledge even seek to tell Russian scientists what is "true" and what is "false" in science. Certain of their leading biologists were disgraced for daring to suggest that plants can be changed by heredity instead of merely by the environment in which they grow.

It is obvious that this situation inevitably affects the democratic control of atomic energy in the U. S. In the production of every day things such as radios and automobiles, control by government or private enterprise is not a matter of life or death. It is merely a matter of efficiency, prestige and profit. We do not have to make international commitments about automobiles and radios. But we have to make international commitments about atomic energy for this is not a matter of profit but of life and death for western civilization. It is not merely involved with the whole question of the nature of armaments, of the possibility of disarmament or armament limitation, but of production and import of raw materials such as uranium deposits from neutral and possibly backward nations and of the export of peaceful products such as those used in medical research for the health of the world. It will be seen that policy and procedure governing atomic energy production are integral to both national and international relations. Atomic energy is not "a matter for politics"; it IS policy.

These issues seem enormous and remote. Actually they are intimate and personal. What is their significance for you and me, what we know, the things we think about and talk over?

THE PROBLEM OF YOU AND ME AND GOVERNMENT

As free citizens of a free country we must each be able to help keep free institutions in line with scientific developments. This may mean making a distinction between what is politics and what is policy. Federal aid to education is a political issue—education will go on and will continue to improve whether it is financed one way or another. The choice of ways of financing it is a political choice. Weather reports are quite different. We all agree that residents in Florida should be notified of an approaching hurricane, and

[4]At a meeting of UNESCO in Paris in 1947, Russian and American physicists were discussing the problem of atomic energy control and the Russians revealed themselves perfectly aware of the fact that the Russian proposals were not technically satisfactory. On being asked why they could not change this situation, they smiled cynically and replied "Unlike you Americans, we do not have the ear of our government."

that we in Iowa should know when a blizzard is bearing down from the continental divide. It would be disastrous for Iowans if the Colorado storms were to be inspected by a federal inspector once a month and then reported through the Federal Government. It would be equally disastrous if the Colorado weather men reported their storms in technical language that we in Iowa could not understand. Meteorology, the study of those natural forces that make hurricanes and storms, is therefore a national activity and not a political issue. Similarly we have international agreements over such things as the telegraph and the telephone which are natural forces harnessed by man. These international agreements remain the same whether Britain has a conservative or labor government, America a democratic or republican. Atomic energy is also a natural force being harnessed by man and belongs in the category of meteorology and the telegraph, not in the category of federal funds for education. As we have seen, the Russian plan for control of atomic energy was unsound because her political leaders lacked the necessary scientific knowledge and her scientific leaders lacked access to the personnel in government. In America our scientists and governors can consult with each other, but whether any plan they make is accepted by the people or not depends upon you and me. Ultimately we are the policy makers of democratic America.

We have had to face the same sort of issues concerning national control of the manufacture of atomic energy as are still unsolved at the international level. The Atomic Energy Act created an Atomic Energy Commission whose personnel is appointed by the President subject to the approval of Congress. As a further safeguard of the people's rights there is a joint-congressional committee consisting of members of both the House of Representatives and the Senate which has general jurisdiction over the policies of the Atomic Energy Commission. Iowa's Senator Bourke Hickenlooper was a member of this committee. In addition the budget for expenditures on atomic projects must be approved by Congress. We thus have national control over the production of atomic energy. But this is not a national monopoly. Just as the American Plan for international control classified atomic energy projects into dangerous and non-dangerous activities, so in America we operate on a similar idea. The manufacture and control of our secret weapons are carried on by national organizations, but much of our medical and industrial research is carried on through private enterprise and products of this research are made by private enterprise. If you have enough money you can buy a Geiger counter, possibly made by the same company as made your radio. Like your radio it must meet certain standards required by the nation, but otherwise there is no interference with its manufacture or distribution. Iowa State College has an atomic energy research center under contract to the Atomic Energy Commission. At the State University of Iowa research using the products of Oak Ridge is continually in progress. Radioactive materials arrive on the ordinary train and are delivered through the regular railway express service. So in America the problem is not one of whether we have government or private enterprise, but of how much of each we should have for efficiency and security. It will be seen that the answer to this problem of how much is not a matter of our personal opinions concerning government enterprise but one of the technical problems involved. This is why in a free country citizens must do for themselves this "catching up" in the changing educational requirements of a changing technical age. If we cannot or will not do this catching up, Jeffersonian democracy will become a mere memory. Foreign visitors have been known to remark that Americans seem more afraid and uncertain in the modern world than citizens of nations bordering on the Iron Curtain. Modern life is so constantly filled with congressional inquiries, spy scares, loyalty oaths and investigations, and vitriolic attempts to attach blame to local politicians for what happened in the domestic affairs of nations thousands of miles away from us, that the foreigner may easily think we have lost our sense of balance, that we are nationally a little unstable. Stability in a democracy is a balance of two types of skills which all citizens of modern democracy must use. These skills can be classed as technical skills and social skills. Technical skill is the ability to use things for human purposes. Social skill is the ability to share those purposes with others.

In days gone by most individuals could keep a balance between social skills and technical skills because both types of skills were imitative of the past. Our business and farming methods and our ideas of social organization were traditional. A hundred years ago the individual knew how his food was grown, how his water was pumped, how his house was built, and he could do most of these things for himself. But today the individual is afraid even to relight his gas furnace for fear he will blow up the house. He turns knobs on a radio. If all goes well, he has music, he knows not why. If not, he cannot fix it. The announcement of the atom bomb was the climax of this development. A source of energy was used which the ordinary individual had not heard of. It had been developed in secrecy. It was so terrific that it ended history's greatest war within a matter of days. Now we have reached a point where we must regain some measure of understanding of our environment or must surrender the attempt to govern ourselves. The day is gone when a youth could learn from his father most of what he needed to know for the rest of his life because the kind of world he grew up in would be the kind of world he would live in as an adult. Change is no longer slow. It comes so fast now that the world a child grows up in disappears before he gets a chance to practice the things he learned when young.

The chief reason for this is that we as a nation have become so much more skillful with things. Our technical skills are no longer imitative of the past. We do not use the implements and methods of our fathers or even of our own youth. Technical skills have become inventive of the future. Moreover we have completely adjusted our state of mind to this characteristic of our age. Our attitude to technical things is that *change is normal and desirable*—"How American it is to want something new" reads a familiar advertisement.

But our social skills remain imitative of the past. With regard to the social and political structure, our basic attitude is that *change is abnormal and undesirable*. The older we grow the more we tend to resent social change; we often try to prevent it. Much of the evidence of insecurity and uncertainty around us is due to this imbalance between our technical and social skills. Summing up the situation at mid-century Mr. G. T. Robinson, Director of the Russian Institute of Columbia University, put it this way: "The United States is facing the crisis of 1949 with the military equipment of 1950 and the ideological equipment of 1775 . . . American theory has lagged far behind American practice; often it has seemed that without benefit of philosophy, we are backing tail first into the future."[5]

If we are not to remain unbalanced as a nation, we must as individuals achieve the sanity of balance between our technical and social skills. This can be done in either of two ways, by going back to imitative technical skills (the horse and buggy) or going forward to inventive social skills (modern methods of administration). We know that man will never willingly give up knowledge of superior technical skills once he has learned them. Therefore our only logical answer is to make our social skills inventive to match our technical skills. The problem reaches its greatest urgency with the release of atomic energy. It was the most spectacular illustration of the success of inventive technical skills. Remember, *no man has ever seen an atom*, yet the logic of inventive science has released a power whose possibilities for good or evil are still beyond known limits.

The reason why humanity is in danger of being destroyed instead of blessed by this new achievement is tension within the individual, between individual and individual, and between group and group—the split personality phenomenon. There are two ways of responding to tension, the instinctive and the scientific. Instinctively we react to tension in kind—to fear with fear, to anger with anger, to suspicion with suspicion, to hatred with hatred. This is the road to war and catastrophe. Scientifically we react to tension by trying to understand the reason for it and then to remove the cause. This is the road away from catastrophe and towards peace and atomic plenty.

Bearing these things in mind let us glance back at our past social skills and estimate their condition today. Nineteenth Century democracy was based on three institutions: national sovereignty in international relations, parliamentary democracy in politics, and private capitalism in economics. In the past we thought this system would be permanent and perfect. In the present we see it breaking down partially or completely all over the world. As a result of developments which climaxed in the release of atomic energy, which we may think of as approximating a world shattering power, four things may be said about each of these institutions:

1. The old institution is no longer adequate as it is.
2. If we just do nothing or do the wrong thing the alternative to the old institution will not be acceptable to us.
3. The old institution and whatever alternative we may arrive at cannot be mixed hodge-podge.
4. A new approach is needed. Indications of the nature of this new approach are suggested by the realities of national and international control of atomic energy enterprises.

In terms of the continued safety of you and me and our families it should be quite obvious that in contemporary international affairs the sovereign state is just plain inadequate. Sovereign states have not prevented two world wars and the ever looming threat of a third.

Our studies have given us some indication of what this third world war would be like. Whether we outlawed them or not, atomic weapons and maybe even more dreadful biological weapons would certainly be used. Such a war cannot be regarded as tolerable. If we do nothing or if we do the wrong thing about this problem of the inadequacy of the national sovereign state, we will evolve some replacement for it that is not acceptable to us. We will probably get a world empire under a conquering nation—maybe Russia. We have already proved in our resistance to imperial and nazi Germany, to imperial Japan, and to expansionist Soviet Russia that we find the idea of world empire unacceptable. By counter-force we limited their sovereign decision to expand by force. Through the United Nations we have endeavored to remove from all nations the sovereign right to initiate aggressive war.

In other words unlimited national sovereignty and effective world cooperation cannot be mixed. We have attempted this mixture in both the old League of Nations and in the new United Nations but in the latter we have endeavored to reach collectively an agreement to abandon unlimited national sovereignty. The atomic energy plans and the Korean War are examples. The continued right of individual nations to do exactly as they please can break the United Nations just as it broke the League, and this would make World War III inevitable.

The inescapable logic of events shows a new approach is needed. The realities of the problem of controlling dangerous atomic activities for all mankind throughout the world indicate this new approach. Dr. Harold Urey, one of our atomic scientists, has told us that the minimum powers essential for the world control of atomic energy are also the minimum powers essential for world government and peace. It will be remembered that the Russian plan, though possibly genuine and sincere, was unacceptable because it retained national sovereignty over atomic energy production. It was imitative of the past. How far are you and I prepared to face this cold clear logic of modern technology? The attempt to establish world control of atomic energy is stalemated, but some day the peoples of the world must move along that road.

Turning now to parliamentary democracy as it was in the 19th Century we find it inadequate to the administrative requirements of the atomic age. Its main faults are periodic deadlock between the executive and the legislature and inefficiency and partisanship through logrolling, porkbarreling and the spoils system. In our own lifetime we have seen more power accrue to the executive, even the power to initiate as well as execute public policy. There have been times when congress seems more the critic than the creator of national policy.

If we do nothing or do the wrong thing, the alternative to parliamentary democracy that we will get will be dictatorship or oligarchy, which are quite unacceptable to folks like us. Parliamentary democracy and dictatorship cannot be mixed within one system any more than national sovereignty and world control can be mixed in one international system. Again a new approach is needed, and once more it is suggested by the nature of the atomic problem. Our only reason for needing to know anything about the Atomic Energy Act is that its provisions are not imitative of the past but inventive of the future. As we have seen, it sets up both a commission appointed by the executive and a joint committee appointed by congress. This arrangement is beginning to spell out a new role for the executive and the legislature and a new relationship between us as common citizens and the experts in control of atomic energy development. Briefly our role through our elected representatives in congress is the setting of basic policy and its control

[5] Foreign Affairs July 1949, page 525.

through legislation and finance. Meanwhile the commission permits the trained experts in the executive branch to plan the details which make it possible to carry out these policies, to execute them without usurping the functions of government.

Glancing now at the institution of private enterprise, capitalism, we find that it has already changed much since the 19th Century when it would have been quite inadequate for the Atomic Age. Its main faults today are fluctuations between "boom and bust," or over-and-under production, and lack of clear definition between competition and monopoly, either within private enterprise or between it and the government. The development of atomic energy requires a satisfactory solution of these problems because it demands the concerted and undivided energies and resources of the whole nation operated at a steady pace.

If we do nothing or do the wrong thing, the alternative to private enterprise that we get is some form of completely regimented economy which is not acceptable to us. Private and public enterprise cannot just be mixed any which way. If carelessly mixed they will frustrate each other and duplicate each other as they have so often done in recent years. We have obviously been groping for a new approach to this problem in a number of ways. One of the most promising of these ways is exemplified by the atomic energy project.

As we have seen, the Atomic Energy Commission makes a distinction between dangerous enterprises and non-dangerous enterprises. Its philosophy is to decide in advance and quite clearly what can best be done by private enterprise and what must be done by public enterprise, such as the development and storing of atomic weapons with all their important secrets. Having arrived at the desirable division of jobs, the next thing is to remove the obstacles in the way of both public and private enterprise and let each go ahead as fast as possible. Though the Atomic Energy Commission has a complete monopoly in the field of atomic energy, nothing is done by government enterprise that can be better done through contract with private enterprise. In point of fact, only about 10 per cent of the persons on the Atomic Energy Project are in government agencies. So, at least as far as atomic energy is concerned, the Atomic Energy Commission solves the problem of steady even production and of who shall do what. It is an inventive use of the social skill called capitalism, the skill we Americans believe to have made the greatest contribution to human society up to date.

In looking over America's atomic project we have been examining the social logic which invented the means for us to control within democratic freedom the power given us by scientific logic. Science came first in our generation, and has also come logically first in the sequence of studies suggested in this bulletin. Through understanding the technical problem we have been able to solve the social problem. We have put our split personality together again and found that America is still sane enough to match inventive technical skills with inventive social skills. Were this the case throughout the world, there would be little fear and no occasion for further war. But while the shape of the Atomic Age is still undetermined it is a concern for all of us.

FURTHER ACTIVITY: Obviously the most useful continued activity is further thought and discussion. This chapter concludes our survey of the larger problems of atomic energy. It almost concludes our booklet. It serves to show that none of the problems of the Atomic Age are beyond the understanding of you and me, and it also brings to consciousness the fact that many of the problems are long term problems that will not be solved next week or next year. Meanwhile you and I hope to stay alive next week and next year, even in the event of a third world war. For that reason it may be necessary for each of us to know just a little bit about civil defense.

(Courtesy *League of Women Voters*, Burlington)

YOUTH HELPS AN ADULT PROGRAM

People of differing ages and skills should be involved in a well-planned community program. Here YMCA lads paint street signs to arouse public curiosity in Burlington Atomic Energy Week.

CHAPTER IX

A PLACE TO HIDE

Atom Bombs Are No Worse Than You Let Them Be

HOW TO USE THIS CHAPTER: Those who have read this bulletin and have acquired the minimum amount of general understanding of atomic energy which it recommends know that the only really effective defense against atomic weapons lies in the international control of dangerous atomic projects. We also understand why, in the event of World War III, it will be technically impossible for America to escape atomic bombing whether we win or lose. This knowledge should be a double stimulus. It should prompt us to continue activity in local organizations dedicated to understanding world problems and working for world peace, and it should place us amongst those intelligent leaders who endeavor to remove the existing strange and irrational prejudice against organizing for civil defense.*

This is not a chapter about civil defense; that is the concern of the civil defense director in each county. It is merely a summing up of our knowledge about atomic energy and atomic weapons as they affect civil defense. This knowledge will not merely help us to organize our civil defense intelligently but will also guide us toward educational work in understanding atomic energy which may help prevent citizens from doing silly things in the event of atomic war. A panic starts with one fool.

This chapter's chief use is personal. It will help you to correct misimpressions and to classify your learning and activity under appropriate headings, e.g., family knowledge and conduct; neighborhood organization; the best use of your own abilities, and so on. A lack of classified thinking is one of the causes of confusion or inertia. It will also help you to visualize real situations and prepare yourself to meet them. Because it will help classify your personal thinking, it should make your efforts to organize your community more effective. Finally, it will indicate ways in which, alone and without special effort, you can personally begin the education in awareness that our citizens so need.

Like atomic science itself, much of the necessary knowledge of civil defense is specialized knowledge, such as the work of the police, fire brigades, medical personnel and disaster engineers. But there are certain things which everyone should know quite clearly in order to cooperate with those who fulfill the special duty. First, we must remove permanently the idea that there is no defense against the atom bomb. When the U. S. was the only nation with atomic weapons ready for war, it seemed politically wise to spread publicly throughout the world the rumor "there is no defense against the atomic bomb," the "big stick" method of keeping the peace. Many foreign nations, notably Great Britain, who saw themselves as on the receiving end of atomic weapons in the event of war, studied carefully what happened at Hiroshima and found out ways of minimizing the damage and the danger to human life. They have had their civil defense plans and training schools in operation for a considerable time and have now made available to us all that they have achieved. With at least three nations manufacturing atomic weapons, the time has come to dispel the rumor that grew partly from political expediency and partly from fear and general ignorance of the limited effectiveness of atomic weapons. We must change our negative psychology of no defense to a positive psychology of prepared defenses.

Second, we must get out of our heads for all time the curious idea that atom bombs are somehow magical, like the mysterious death rays of the comic book. The almost superstitious attitude that exists in some members of the public is the sort of thing that inhibits preparedness and creates panic in crisis. It can result in people running madly away from a rumored disaster as so many did during the famous Orson Wells' broadcast, "The Battle of the Worlds," in 1934. Panic of this nature clutters the streets and the highways, stirs the mob psychology of anarchy and makes effective civil defense measures quite impossible of operation. Atom bombs are simply enormously powerful explosions with a few complications. They do not start mysterious rays that kill people thousands of miles away. We have been able to study them intimately and we know that there is far less danger of dying of radiation sickness and similar causes than we had originally imagined. If a person is near enough to an explosion to receive a lethal dose of radiation, he would also be near enough to be killed outright or at least seriously wounded by the blast. When we know that there is no unseen and mysterious ray operating in thin air to destroy us, we are able to avert our superstitious self-hypnosis and go to work to protect ourselves.

Third, if World War III should come, American territory is certain to be bombed. All our leaders, including air force leaders, have warned us of this fact. Atomic weapons are comparatively small and can be assembled in separate parts and brought into communities by secret ways, not necessarily in airplanes. Nevertheless we in Iowa are fortunately free of extensive danger of atomic war. This is not because of our geographic location at the center of America—in the age of air routes over the North Pole, Iowa is more a frontier state than either Florida or California—but because there are few military targets in Iowa large enough to warrant the use of an atom bomb. But civil defense, like flood disaster, requires an interrelated organization. Those who are not bombed out or flooded out have a function to play in helping the workers in and the refugees from the disaster areas. So we have a third positive mental adjustment to make: In the event of war we will be reasonably safe from atomic attack but we will still have a large function to play in area civil defense.

Fourth, we must remove the curious public fixation that all weapons used in a future war will be atomic bombs carried in aircraft. Many types of

*The Iowa State Department of Public Instruction has but recently produced a bulletin entitled "A Program for Civil Defense in the Schools of Iowa."

weapons new and old are liable to be used. Among these is a new weapon which Iowa is definitely *not* likely to escape. In one sense, the whole of Iowa is a military target, precisely because it is the world's richest and most highly developed piece of agricultural earth. Modern war will attack not only armies and armament works but all the sources of supplies including food producing areas. This will probably be done by biological warfare against crops and stock and we can say categorically that the scientific advances toward the possibility of this sort of war are as real as the scientific advances in atomic weapons. Such a threat can only be met by intelligent organization, so the Iowa farmer and village dweller have as great a need to become civil defense minded as the resident of Pittsburgh or the Rock Island arsenal. These four factors are concerned with the public's state of mind. Given the right state of mind, the details of organization can be accomplished with greater speed, smoothness and efficiency. The details are concerned with community organization at the top level which is the business of leaders, and the right conduct of citizens at the bottom or individual level which is the concern of us all. Many manuals of instruction on civil defense begin with community organization. As this is not a manual of civil defense, the Production Committee feels that it is more intelligible for us to understand first the few things that we the common folks should know and why. In the event of a disaster most of us will simply stay right at home and wait for instruction. If the disaster has touched us at all, what should we know in order to report it intelligently or to begin to deal with it ourselves?

Let us try to imagine some realistic situations. You live on a farm. Your water supply is your own deep well and your sewage system a septic tank. You are a good American and only too glad to open your home for the use of refugees from a bombed area. You have blankets and spare cots for quite a number of people. How many refugees can you accommodate and for how long without over-taxing your sewage system and running a health risk or over-burdening your water supply? Now is the time to know the answers, not after undeclared war has begun.

If these mechanical problems do not arise, as a good American you are willing to open your house to anyone who is in serious trouble as long as that trouble lasts. You are neither anti-semitic nor do you have color prejudices but it so happens that your normal circle of friends and acquaintances contain no Jews or Negroes. The first refugee to be brought to your door is a Negro woman with three children about the same ages as your own family. The second is a Jewish family, displaced persons with only a limited command of English. What is your reaction?

You are a Methodist and also a good housekeeper with fresh coffee and cookies always at hand for those in need. The first refugees to reach your home are practicing Roman Catholics. They are frightened because they have been exposed to danger and would like to see a priest. What do you do first, ring for the priest or serve coffee and cookies?

Though normally a tolerant person you are inclined to be anti-labor in some respects; you think the steel workers have been asking for far too much. The first refugee brought to your door is a sheetmetal worker, staunch trade unionist, a man who has spent all his life in industrial plants and knows nothing of country life and country conversation. Can you make him feel at home?

These are not merely possible, but probable situations in the dislocation of war. Have you prepared your mind in advance for the social shocks that may come with the performance of your duty?

You have had a course in first aid sometime ago and a little experience with home nursing. Because you have raised four children and have time to spare you would very gladly take refugees whose injuries are so slight that they need not be hospitalized. The first such patient to be brought to your house has red burn scars on his face and hands due to exposure to atomic blasts. It looks just like a bad case of sunburn, but you are aware that he is from a city that experienced an atom bomb. Is he infectious? Will the things he touches become radioactive? Can you bed him down in the same linens that may later be used by other members of your family? Will you feed him from the same plates and with the same cutlery that you use yourselves?

Are you really as ready to do your duty as you thought you were? It is obvious that those of us who may never experience bombing may yet require a certain amount of knowledge in order to extend the common decencies of mutual aid to those who have experienced it. What sort of questions face us when we live in a city that may be bombed?

You are in your basement following instructions after an air raid signal. There is an explosion some distance away and apparently no damage is done to your house. You wait a few moments and then proceed upstairs to see if there has been damage. You are a little anxious and reach for your cigarettes. Should you strike a match? Anxiety has made you thirsty. Should you draw water from the faucet? The dog was outside and is now scratching on the door. Should you let him in?

You are in your basement and the force of the explosion cracks one of the windows so that a little air gets in from the outside onto your face and hands. You have been told to wash yourself after exposure. Should you let the water from the faucet run while you wash yourself over and over again?

The explosion was strong enough to cause some flying glass, a piece of which cut you rather seriously. You do not feel alarmed because you know there is a first aid station for your area and that you can get in contact with it. Do you know your own blood type? Do you know the blood types of your family? Do you know the nearest person on your street of the same blood type who would gladly go along and be a blood donor for you in the case of necessity? Does everybody in your neighborhood know everybody else's blood type or are they at least known to some central authority, i.e., is there a "walking blood bank" in your town?

You are seated in your basement. There has been a blast but no damage done. You are waiting for instructions from the portable radio plugged into the electrical circuit. The local station has been destroyed. To what station do you next turn your dial for instructions relative to your town? The power station has been hit and your portable radio is dead. Which of your near neighbors has a portable with a battery? Have arrangements been made so that someone from his house will communicate instructions to yours? Have you the fortitude to sit quietly by your dead radio until that messenger arrives with the instructions?

Your house has been shattered but you are fortunately still alive. Do you get into your car and make for the nearest highway? Do you know where you are going? Do you know that that highway has already been declared closed to civilian traffic in order that it may be used by fire engines, ambulances, gasoline trucks (now laden with pure water) and other emergency vehicles coming into town from neighboring points of mutual aid? Do you know that these vehicles will be converging on your town with maximum speed because they have been instructed that the highway is clear? Should you not know *in advance* the proper assigned streets to travel, and whether to take your own car or go with neighbors?

It is again obvious that however good our top level organization, individuals can shatter its effectiveness unless we each know those few simple facts which will help us to play our most difficult role, the role of waiting passively and calmly for instructions and then carrying them out even when they do not appear to make sense. The simple facts are: (1) adjustments to the people we will be caring for in the event that our community is a receiving center—adjustments to color, religion, attitudes and opinions, habits; (2) the similar problems we may create if we are evacuated to a receiving community; (3) our resistance to mob psychology; (4) our personal responsibility for educating our own family with regard to these problems; (5) our responsibility for obtaining information and for seeing that it is available in our community; (6) our ability to obey orders. It will be easier for us to remember the necessary information and to help organize the dissemination of it in our community if we classify it under four headings: preparations that can be made now, what to do when there is an air raid warning, what to do during an attack, and what to do after an attack.

Under the first of these, present preparation, we have things to do in our own home and things to do in our neighborhood. At home we should see that there is first aid equipment; that fire hazards are removed; that we know where the chief gas, water and electricity controls are and how to operate them; that there is at least one flashlight in a readily accessible place; that there is a clothes bucket in which radioactive clothing could be washed separately; that we know the correct radio stations to listen to for instructions in our district; that we know the symptoms of radioactive sickness and that the entire family is familiar with these necessary measures. Within our immediate neighborhood we should assist in certain arrangements. There is the collective care of children. A doctor resident in our street may have married a trained nurse and both may be required away from home in the event of disaster; someone must be prepared to look after their children. There is the matter of information should power cease. Someone on our street has a battery set and communications from this set to other houses should be arranged; several high school boys anxious to be of some use and not lacking in courage can do this job excellently. There is the matter of special abilities. Somebody may have had experience in home nursing and be willing to serve throughout the neighborhood. Some families have no children and can undertake work that other families could not. Some people are temperamentally unable to be alone and some are natural leaders. Some houses have basements and some do not. Some have emergency equipment, such as a well, an amateur radio transmitter or a home generator. Some people have physical strength should it be required and some have physical disabilities. Every neighborhood can be organized in such a way that the best use is made of its personnel and facilities.

If an air raid warning is sounded we should know what to do. Shut doors and windows; close shutters, draw shades and drapes, lower venetian blinds to prevent flying glass; shut off electricity and gas; close all the dampers on the heating system; fill the bath—you may need the water, but remember that it must not be used if windows have been shattered and the water exposed to contaminated air; leave the keys in the car in case it should be required by civilian defense workers in the emergency; carry a flashlight.

During an attack you should be in a prone position, your face buried in your arms, your body shielded as much as possible. If you have a basement retire to it and see that the windows are shielded if they protrude above the level of the ground and that you have water available without using the faucets. It is also a good idea to have a few tools like axe and shovel. If you have no basement stay away from the centers of rooms where flying debris will alight in the event of some shattering taking place.

After an attack, wait where you are at least one minute. Do not strike a match. If you have to go outside wear some sort of filter over the nose and mouth and do not let pets or people from the outside track in radioactive dust. Wait for instruction from the radio or from the messenger in your neighborhood and keep doors and windows shut. If the water has not been contaminated, bathe thoroughly and more than once. Do not drive unless it is part of your duty, nor use the telephone. Wash all eating utensils before using them and above all do not start or spread rumors.

This is about all we need to know. It is simple enough but the importance of these little items of knowledge and activity can not be over-emphasized. The greatest of all dangers that the civilian runs is panic and the chief cause of panic is the fear that spreads infectiously from the individual who does not know what to do or who, knowing, has not habituated himself to doing it automatically. When we are dazed by sudden shock it is the automatic right reaction that will stop the panic and save the day.

A final consideration for the individual is voluntary service. So much publicity has been given to atomic bombs that we may have developed one of two attitudes to civil defense, both of them dangerous. The first is that we can do nothing. That impression should have been sufficiently contradicted by what has already been said. We who stay at home have plenty to do and know. The second is the romantic view of ourselves as heroes prepared to do all sorts of things that we are not capable of doing at all. No matter how much pity you may feel for those who are wounded, there is no use volunteering to serve if you faint at the sight of blood. In rescue service after atomic explosions which destroy so much property and injure so many people, you have to be quite hard. Not only must you be prepared to see unpleasant sights but you must face the awful decision of saving first the casualty who has the most chance of survival rather than the one who is the most badly injured or in the greatest pain.

Atomic war, like anything scientific, demands that people be used in those activities for which they have most skill and training. The science teacher in the high school may happen to be an expert at first aid, but his job after an atomic explosion would be to serve as a monitor[1] because he can understand and use scientific instruments and a monitor at work must learn to ignore the cries of the injured and the dying. Maybe the local science teacher in a consolidated school will not serve in his district at all but in a nearby city through organized mutual aid. A local building contractor may also be the obvious leader of people in a community but his job in civilian defense will be concerned with estimating the security of damaged buildings and supervising their demolition or repair. Whatever other skills he may have, the job of the waterworks engineer is at the waterworks and of the power plant engineer at the power station. Though his hobby may be outdoor cooking, the clergyman's job is that of morale. He knows a great number of families intimately and his greatest use is the dissemination of information and the prevention of panic. For a great many of us who work in factories, food distribution, and services, our job will simply be—staying on the job. So we must remove from our ego all romanticism in considering our volunteer work, weigh carefully our skills against the scientific facts, place our regular job and family responsibilities first and remember that social prestige and professional status count for very little in disaster. The writer is a university professor but his function in civil defense will be that of shoveling bricks anonymously amongst the debris.

A knowledge of atomic energy by a few adults in the community can be a considerable stimulus to civil defense organizations. Conversely, the needs of civil defense can be a considerable stimulus to acquiring the necessary knowledge of atomic energy. In setting up community adult education for defense against atomic war it is not sufficient to organize a class under the title "Civil Defense" or even under a more fancy title such as "You Can Survive the A-bomb" and expect people to attend. Considerable preparation has to be done at the grass roots. This chapter has been designed to make that task a little easier by suggesting those channels of stimulating adult interest which are so obvious as to be easily overlooked. All of the questions raised when we were imagining real situations can be asked in normal conversation. Over the coffee after a game of bridge the conversation can be directed and group thinking initiated by the casual question, "By the way, what is the blood type of that fine youngster of yours?" How often are we warned to be careful of the plates at meals because they are very often hot? This is an excellent opportunity for introducing the remark, "I wonder if radioactive burns are infectious?" The problem of social adjustments of refugees can be raised in the sort of casual conversation that so often takes place outside church after the service. A series of these questions can be developed into a little quiz for presentation in any circle. The questions on blood groups and radioactive burns are known to create interest readily. They have been tested in civil defense training courses at the University. So does the question about what neighbor has the nearest battery radio set, which is invariably followed by the rejoinder, "Why do you want to know?" If all the churches, men's and women's groups in a community initiated this sort of talk simultaneously, classes for defense against atomic warfare and for understanding all one needs to know about atomic energy would be crowded within a month.

The Production Committee believes that civil defense against atomic war shows clearly the need for some understanding of atomic energy by all members of the public. While defense can be organized where this knowledge is extremely slight, the Committee believes that the greater the knowledge the easier the organization of defense. The American public is the best educated public in the world. Its apathy towards civil defense is not just stupidity. It is an expression of the unease arising from our ignorance of atomic energy and the wishful feeling that if we don't think about it at all atomic warfare will never come. "Don't look now, but we are being followed by an A-bomb!" Is it better to keep right on walking fast or to turn and size up "the thing" and start digging in? In the unwanted event of war, there *is* a place to hide in comparative safety. It may be your own basement, the basement of a building on your street, or merely, if you are caught outside, the curb of that street itself. If your mind is alert and informed, it will quickly find the appropriate hiding place. There is only one type of hiding that we can state definitely to be *never* safe—hiding your mind from exposure to knowledge.

[1]Monitors are the first men to enter a bombed area. They carry Geiger counters and colored flags to mark the "hot" radioactive places so that rescue squads can follow in comparative safety.

THE END

CHAPTER X

THE COMMITTEE CHECKS OUT

This is an Iowa book, designed *by* Iowans *for* Iowans at the instigation of certain famous Iowans who have from time to time been called to national service. This is not said in a spirit of provincialism but of humility. It explains why this does not pretend to be a comprehensive account of all that has been or can be done in adult education concerning atomic energy. Other states, cities, and groups have developed their own plans. There is the New England plan, the Chicago plan, the Nebraska Plan,[1] to name a few. Many of these are now finding their way into print and, the Committee hopes, into the highways and byways of Iowa.

This bulletin has confined itself to Iowa projects for three reasons. First, because it would have been presumptuous for us to rewrite at second-hand accounts of projects in other states which have already been well written by those who tried them out. Second, because it is reasonable to assume that every project described herein can be recommended for repetition in Iowa with considerable hope of success, for all have been tried out in this state.

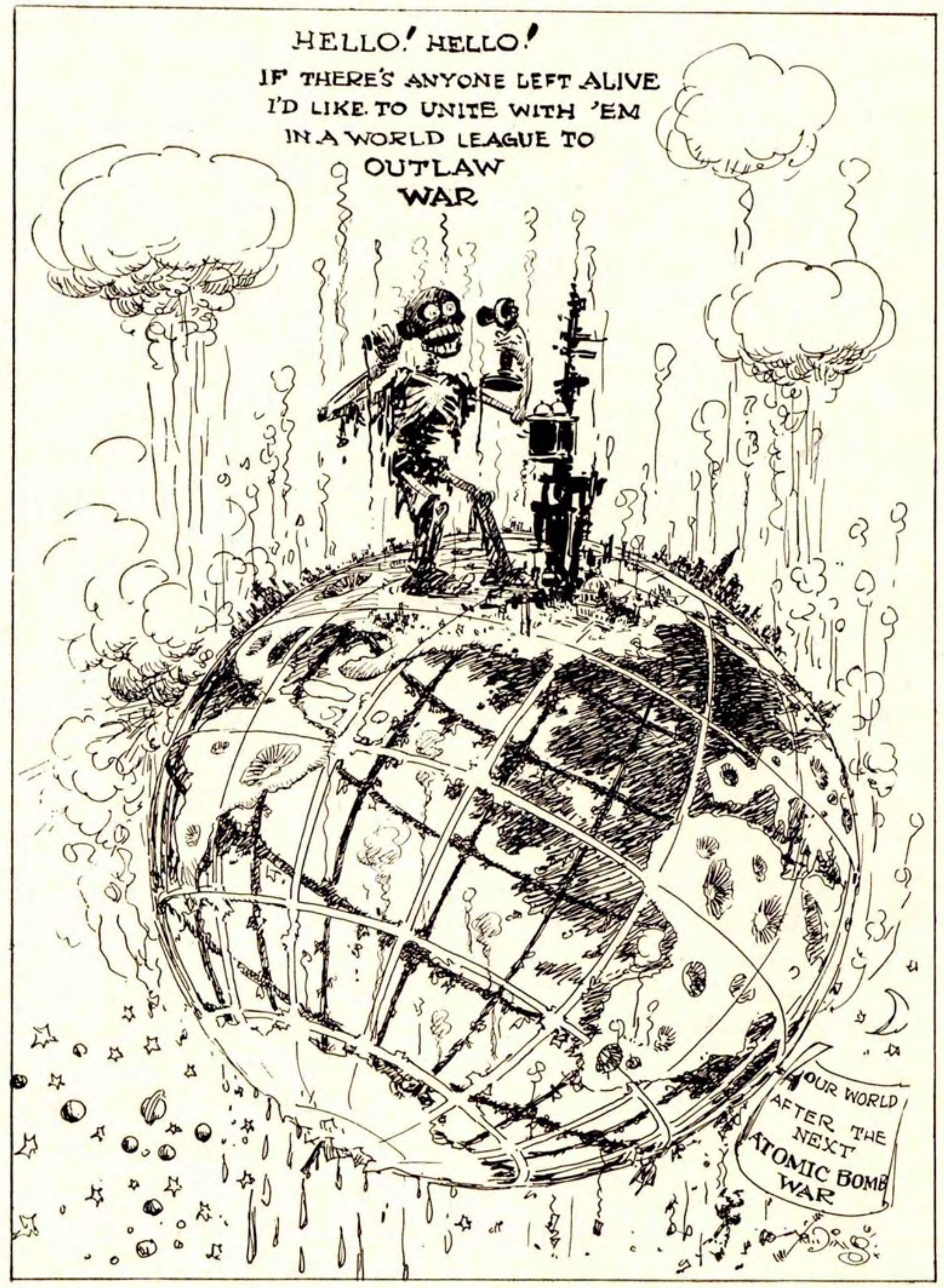
Third, because this is Volume V of a series which endeavors to avoid unnecessary duplication. The other volumes are already available to all Iowans. *Two of them should already be in your town.* The responsibility of adults to see that their district schools are preparing youth for the coming atomic era cannot be overemphasized. Volumes II and III of the series are designed for your schools. With them a small library or "kit" can be obtained from the State Department of Public Instruction. It contains much authoritative material that an adult Iowan may need to know. Volume IV should also be available at the nearest college. It is a resource book of scientific and social studies facts designed for the use of both students and instructors. The suggested activities in this volume are therefore to be considered in conjunction with a content library which is no further away from you than the nearest schools.

The Committee hopes that this is also a contribution to the growing national literature on the subject. If it is of use to any American who likes to plan for tomorrow while living in today, so much the better.

For the Production Committee
Hew Roberts, *Chairman*

[1](Editor's note): Sample copies of these plans are in the possession of the State University of Iowa. For further information write to Professor Hew Roberts.

EVENTUALLY, WHY NOT NOW?



(Courtesy *Des Moines Register*)