Interview Between

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and

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of Purdue University

Eckles: This is a recording for the Purdue University Archives made on the morning of September 22, 1970, in Room 268 of the Chemistry Building, Purdue University. This is an interview between Prof. Herbert Brown, R. B. Wetherill Distinguished Professor of Chemistry at Purdue University, and R. B. Eckles of the Department of History.

Professor Brown, let us start out by asking the usual questions. Where were you born? Where were you educated? Take us up to the time that you came to Purdue.

Brown: I was born in London, England. I came with my parents to America in 1914 at a time when I was two years old. I was raised in Chicago and educated in Chicago schools.

Eckles: What high school?

Brown: I went to Englewood High School on the south side of Chicago, and then went to the city

colleges of the city of Chicago to receive an Associate of Science degree in 1935, and then went to the University of Chicago on a scholarship to receive their Bachelor of Science degree in 1936 and a Ph.D. in 1938.

Eckles: Who had the most influence on you in your graduate work?

Brown: At the city colleges I came into contact with a very unusual man, Prof. Nicholas D. Cheronis who had considerable influence on me. My education was interrupted considerably by the Depression, and I began work at the Crane Junior College in 1933. However, that school was closed after I had attended it for one semester, and there was no city college at that time which I could attend. Professor Cheronis had a small laboratory on the north side of Chicago, known as the Synthetic Laboratories, and there he allowed a number of students to come in and occupy themselves working on chemistry, without any cost or charge, without any payments. It was simply a humanitarian gesture on his part. It was there that I met the girl who became my wife. At that place I did considerable work on my own, for which I later received credit at the University of Chicago after I had established that I was competent in the areas. That's why

I was able to receive my bachelor's degree at the University of Chicago in one year.

Eckles: That's amazing. I never heard of that being done, although I knew that at that time Chicago did honor merit rather than years of servitude.

Brown: I should explain, of course, that the one year involved three quarters, covering my junior and senior years, because I did go to Wright Junior College for a full year.

Eckles: Then you entered graduate school, and whom did you work with in graduate school?

Brown: In graduate school I worked with Prof. H. I. Schlesinger on some relatively rare exotic compounds known as the boron hydrides. These were exceedingly unstable materials which could be handled only in the absence of air and water and were exceedingly rare substances at the time. They were made only in milligram quantities and they were of interest chiefly because they provided a major problem for the current theory of chemical bonding. However, largely as a result of our work, new methods of synthesis were discovered which made these substances readily available. In actual fact, much of my work since that time has been to explore the chemistry of these substances and to apply them to specific applications in chemistry.

Eckles: And what has been the result in commercial products and research?

Brown: In 1939, we received a request from the government in Washington to investigate new volatile compounds of uranium. We were not advised what these were to be used for, but were told it was important for national defense to find materials, other than that which was currently available, uranium hexofluoride which might be used for an important application. We undertook to study this problem and discovered a new compound, uranium borohydride, which possessed volatility of the order of magnitude that was desired. We were then advised to organize a large research group and undertake to prepare this material in quantity for testing. As a result of this work, we discovered a new compound, sodium borohydride, and new methods for making the borohydride in quantity. These developments resulted in making these materials and other boron hydrides readily available. Sodium borohydride was never used for the purpose for which we investigated it. However, it has turned out to be an excellent hydrogenating agent in organic chemistry. It is widely used in the pharmaceutical field for the manufacture of drugs and pharmaceuticals, as well as many other applications.

Eckles: Did some of this research in '39 through '42 point towards the Argonne Laboratories? And the development of nuclear fusion?

Brown: Yes, the real reason for doing this work, originally, was that the government was working on the separation of uranium isotopes. To do this they needed volatile compounds of uranium. Uranium hexofluoride was well-known as a volatile intermediate, but it was a highly corrosive material, and there was some question originally whether the problems of handling uranium hexofluoride could be solved. Consequently, backup material was desired. The compound we discovered, uranium borohydride, was such a backup material. But since the problems for handling uranium hexofluoride were solved, there was no need for our backup material. However, I think it is an interesting point that research which was carried out to find a material for use in the separation of uranium isotopes should have found its major application in the pharmaceutical industry for the manufacture of drugs to alleviate human suffering.

Eckles: In other words, this is the feedback of pure research isn't it?

Brown: Yes, it is.

Eckles: Is it important to continue such things?

Brown: It certainly is. One of the dangers of the present pressure to do research directly only for specific goals is that we cannot foresee all the consequences of research. We need to devote a portion of our research efforts solely to the objective of exploring the physical world. If we do such research and exercise our imaginations, we will be able to apply the new knowledge to solve many of the problems that face us. If we restrict ourselves solely to solving problems that face us using only the knowledge presently available, we would doubtless overlook many more useful approaches.

Eckles: I should think there would be no question of that. Well, let's get back to you and your career. What did you do during the war years?

Brown: During 1939 to 1943, I was at the University of Chicago as an assistant to Professor Schlesinger, and for most of this time I worked on the above project for the Manhattan District to develop uranium borohydride.

Then we received a new project from the Signal Corps. They were interested in developing a convenient method for the field generation of hydrogen, and sodium borohydride appeared to

be a promising material for that application. In 1943, I went to Wayne University in Detroit as assistant professor of chemistry. Wayne at that time had just begun a graduate program, When I arrived there, there were only two candidates for the M.S. degree and no laboratory or equipment. I had to initiate research work entirely through my own efforts. However, things developed there quite rapidly. A Ph.D. program was instituted in 1945. With the end of the war, there was an influx of graduate students. I was making rapid progress there, when I was invited to come down to Purdue by Henry Hass, chairman of the Purdue department, in 1947.

I found it difficult to decide to leave Wayne. It was a place where there was nothing when I arrived, and we had managed to build a considerable research program. I was influenced strongly by another consideration. The university in Detroit was situated in the center of the city. My wife and child were out near the edge of the city. My wife at the University of Chicago had been accustomed to being an integral part of the university community. This was not possible in Detroit. When I came to West Lafayette and saw what a lovely little community this was, without the problems of the large city, I decided that for my family's sake, it would be better to move to Lafayette.

Eckles: Didn't the opportunities for research in an established chemistry department with people like McBee and Hass, and, oh, the old guard that were here. Didn't they have a sufficiently national reputation to make coming here rather exciting to work with these men?

Brown: I'm afraid that this was not a significant factor in my thinking.

Eckles: Was this a good department?

Brown: It was a good department. However, in actual fact, the main considerations in my mind were two things. One, there was a large growing department here, which meant that I would not have to do the enormous spade work necessary to institute new procedures. But more important was the fact that this was, in my mind, a lovely place in which to live.

Eckles: You would be amazed at the number of people who have indicated in their interviews that they came to Lafayette for that reason. A good place to bring up their children, and it was a nice country town, and they sort of liked it.

Brown: Well, let me say that since then I have had a number of invitations to go elsewhere, and I have turned them all down. Many people have indicated that they consider Lafayette to be

a relatively quiet--perhaps I should say dead --place, without a great many distractions. But I found that to be very pleasant. I think it's an ideal climate for students--there's so little to detract them from studies. The time of graduate work should be a time when a man tests himself in his ability to produce new original things. He has his best opportunity for demonstrating this in a place like Lafayette, where he can concentrate without being continually distracted by either physical things, such as boating on the ocean, or swimming, or hiking, or political agitation that goes on in other places. I personally believe that Lafayette offers students an ideal environment to develop themselves.

Eckles: From the point of view of physical facilities, with the addition of the new Chemistry Building, you will have pretty adequate facilities for research in your area?

Brown: Yes. In fact, the University has always been quite good to me. I feel that I have had adequate facilities ever since I arrived here in 1947.

Eckles: What direction did your research and your scholarly production take from '47 to the present time?

Brown: I had worked in several areas. I came to Purdue as professor of inorganic chemistry. But my interests have always been broad, and my work actually cut across many areas. I have accepted students and carried on research in inorganic chemistry, organic chemistry, and physical chemistry. My work has tended to be both theoretical in certain areas, and practical in other areas. I should say that my work has largely centered on the theme of the role of boron in chemistry, and I have applied boranes and boron compounds to the study of both theoretical problems and the solution of practical problems.

Eckles: When you say practical problems, can you detail that a little for us?

Brown: By practical problems, I mean that I have explored the chemistry of boron and developed new methods for synthesizing organic compounds as well as inorganic compounds through the application of boron chemistry.

Eckles: What have they been used for?

Brown: These boron compounds have been used for reductions in organic chemistry. They have been used to make organoboranes which have unusual properties and can be used for synthesis. There is an entire chemistry of

molecular architecture, of building up both complex and simple molecules for which the boranes are extremely useful as tools for molecular construction.

Eckles: Does this have anything to do, for example, with using boron as a detergent?

Brown: No. That is simply borax or a soluble boron compound which is found in nature and is put into the detergent as an alkaline agent to control the pH.

Our work is largely devoted to making organic compounds containing boron. These are substances which are highly reactive. They do not exist in nature, as far as we now know. They were essentially unknown at the time we started our work. However, we have now developed a huge chemistry of these materials. People interested in structural chemistry will have to learn all this chemistry in order to use the compounds to construct the desired structures they need in their work.

Eckles: Is it used in developing let us say, some machinery, or in building, strength in building and materials?

Brown: No, it is used for making large complex organic substances. Such substances, for example, as the steroids, which are used in birth control

pills. They are used for rheumatism and similar difficulties, for sex hormones, and for many other materials which are biologically active materials. At one time, one of our derivatives was used for the manufacture of synthetic vitamine A. In other words, most of the materials that the body utilizes are complex organic substances. Most of the drugs that are used are complex organic substances. Their synthesis often requires that they be built up from simpler molecules. And the boron atom can be used to provide one of the handles by which these more complex structures can be built up from simpler building stones.

Eckles: Have you made the Purdue chemistry department--you and your collegues--sort of the center for this research in the United States?

Brown: Yes. The discovery of the reaction which is at the basis of this development, was made at Purdue. The exploration of organoborane chemistry was largely done at Purdue. So I would say that Purdue, is the center, not just in the United States, but in the entire world, for research in this area.

Eckles: You've had students come from abroad to work with you, haven't you?

Brown: Yes, I have had many students from all over the world. Indeed, I've just returned from an eight-week trip to Japan. While there, I met some of my former associates in practically every part of Japan. I have had 16 postdoctorates from Japan who came here to work with me. There are now six full professors among this group, back in Japan.

Eckles: And at various universities.

Brown: Yet, at various universities there.

Eckles: What nation in Europe sends people to you most? I knew one of your graduate students from Britain. I forget his name for the moment. He married a very charming German girl and was teaching at Leeds for a while, but he was here. . .

Brown: Brian Garner.

Eckles: Brian Garner. He was here about eight years ago.

Brown: That is right. He is now teaching at Leeds. But I would say that the largest contingent that I have had has come from Japan. The first was a Professor Moritani, who came here in 1951. He is now professor at Osaka University. Since that time, I've had many from Japan. I've also had a considerable number from India, England, Germany, Switzerland, Korea, and other places.

Eckles: As you see it, what is the future of research in this area from the Purdue point of view?

Brown: I am now within eight years of retirement. I have uncovered an enormous gold mine and I am busy mining the gold as fast as I can. Whether the work will continue at Purdue after I am gone will depend upon whether the department adds any members to its staff who is interested in the area.

Eckles: Very true. It will depend on who is head of the department at the time, won't it?

Brown: No. No. As we operate in the chemistry department, the head has nothing to do with the fields in which the individual members work. They are completely independent. The only way that he might influence the situation is by attempting to pursuade the organic divisions to add a man capable of continuing the research in this area.

Eckles: Thus you'd have the reputation of Purdue as a great place and continue it?

Brown: That's right.

Eckles: Does Purdue give adequate financial support for your research? Or do you get it from outside?

Brown: Purdue does not contribute significantly to the

support of my research programs. Essentially, all the money that I use in this research comes from grants from outside agencies.

Eckles: Would this be private companies, or would it be national scientific organizations?

Brown: Chiefly from government agencies. For example, I have one grant from the National Science Foundation. I have a second grant from the National Institutes of Health. I have a third grant from the Army Research Office at Durham. I have another grant from Esso Research and Engineering Company. All of these I use to support research in this area.

In addition to this, I have a number of very capable students, who manage to get grants of their own. Thus, I have one man, who was here as a postdoctorate, supported by the National Institutes of Health. I have two students who have National Science Foundation Scholarships, which they won through their own efforts. There are additional students who are here on various scholarships. So that nearly half of my group is supported by funds acquired by these students on their own, through their own abilities and activities, through winning awards in national competitions.

Eckles: You know, I'll wager that the average person, thinking of chemistry, thinks that the Univer-

sity provides the funds, and yet this is normal, isn't it? The average university doesn't, can't support research of any one man doing the sort of thing you're doing. It has to come from grants.

Brown: That is correct. In the 1930's, chemistry in this country was very primitive. There were no sources of funds. What research there was was largely carried out on spare time using pieces of equipment that were around the department, which had usually been purchased for other purposes. We were a backwater of world chemistry. Since the thirties we have come forward to where we are the world leader in chemistry. A large part of this progress was made possible by funds which the national government provided. The university provides primarily the laboratories for the work, but in general, it provides very little of the money used in research.

Eckles: How do you account for the sudden shift of emphasis? Was it due to the war?

Brown: I don't understand.

Eckles: Well, you said in the thirties we were backward in chemistry. Now you say we're not, we're the leaders. What was responsible for the change?

Brown: Well, this is a complex thing. I would say one of the factors was the Depression. I believe the Depression caused a large number of very capable boys to elect to go into scientific careers rather than go into advertising or becoming bond salesmen. So first there was a group of highly intelligent young men who went into science and converted what was then a scientifically developing country into one of the leaders. In addition to this, the government during the war provided the support for science and made it possible for the first time for people to undertake systematic research programs. While these were directed for specific needs connected with the war, the policy set in motion at that time carried on after the war. Various agencies continued to support research until the present time.

Eckles: In other words, science came into its own from 1940 to 1970?

Brown: That is correct.

Eckles: Well, let's get to another thing that began following a pattern. When you look around at chemistry departments in the Big Ten--and I know that this is a loaded question--which in your opinion is the best department in Big Ten chemistry?

Brown: That is a question that I prefer not to answer. I have many friends in these institutions. By answering such a question, one soon loses these friends.

Eckles: How do you rate us on a national scale then? Obviously, Purdue does have a splendid chemistry department. Mr. McBee has told me what he thought his answer was.

Brown: I believe that we would certainly rank in the top ten percent of the departments of chemistry in the country. That is, in quality. In size, we actually rank among the top five departments in the country. That would be in the top two percent.

Eckles: On a regional basis--this is just personal opinion, if you want to venture it--where would you find the best chemistry, say, in the East, in the Ivy League.

Brown: There's no doubt that Harvard has for many years maintained one of the leading departments of chemistry in the country.

Eckles: I don't understand it. Why? I don't mean that as a simple question, but I mean Harvard seems to have so many leading departments. Is it because of the money, or the prestige, or the opportunities in a scientific and intellectual climate?

Brown: I haven't attempted to analyze why, but I believe that the prestige of Harvard causes that school to attract many of the best students, and because they have many of the best students, they have little difficulty in pursuading professors to come there.

Eckles: I understand. Are there other good schools in the East? How about Yale and Cornell?

Brown: Yale, Cornell, Princeton also have first-rate departments of chemistry.

Eckles: If we move to the West Coast, Berkeley and California would be the outstanding ones?

Brown: Yes, Berkeley has certainly been outstanding. I believe most people in many areas would have ranked Berkeley next to Harvard. I would say that in my own area, organic chemistry, I don't consider it to be of the same calibre, but certainly in physical and inorganic chemistry, they have been among the leaders for many, many years.

Eckles: Do we have any outstanding schools in the Northwest? The University of Washington?

Brown: No, that's relatively new; it is growing and developing, but I would say that graduate university training is relatively new in the Northwest.

Eckles: What about the South?

Brown: There have not been any departments that I would consider to be among the leaders in the South.

Eckles: Are there some growing?

Brown: Texas, I would say, is perhaps one of the few that seems to be developing.

Eckles: I'm interested in that. I'll be going down to Texas on another matter in connection with the foundation. Texas seems to have money for equipment, but no money for salaries.

Brown: Well, I have heard that they have oil land in which the revenue can be used for the capital needs of the university, but not for operation costs.

Eckles: I saw books upon books upon books--crates that had not been opened of original editions on the history of science--Dutch and French and English, 17th century and 18th century. They had not been uncrated yet. They didn't have storage space. They didn't have anything else. It's fascinating.

Brown: You see, our problem is exactly the opposite of that. Normally we seem to get money for salaries, but it's almost impossible to get capital funds for buildings or equipment.

Eckles: Well, it's taken a long time, hasn't it, to get this building started. I knew Professor Mellon fairly well at one time. He helped the department structures, didn't he? Did you have a hand in planning it, too? I presume every professor did.

Brown: Not a great deal. Generally, it's best to leave such things to the committee concerned. Too many cooks spoil the broth. But you remember that originally this department had a very small building, about one-third of the present building, which was built in 1928. The rest of it was supposed to have been built in 1940. The war came, and construction was frozen. After the war, efforts began again, and we actually had to spread the construction out over something like five years in order to get the building a little bit at a time.

Eckles: I remember that it was rough going.

Where have you lectured or taught on leaves of absence and so on, besides Purdue?

Brown: I have been visiting professor at a number of universities that I can mention: University of California at Los Angeles, Ohio State University, University of California at Berkeley, University of Colorado at Boulder; last fall, I was at Cornell University; I have spent a month as visiting professor at the University

of California at Santa Barbara; another period at the State University of New York at Stony Brook; I have been at Hebrew University, abroad. . .

Eckles: In Jerusalem?

Brown: In Jerusalem. And at Heidelburg University in Germany, and I've just come from a two-month lecture trip through Japan.

Eckles: When you lectured in Heidelburg, did you lecture in German or English?

Brown: I'm not a good linguist, so I always lecture in English. I have learned to speak slowly and to use slides which tell their own story, so that people who have trouble following the English that I speak can read the slides and follow the story as the talk progresses.

Eckles: All right, is there something that you'd like to put on the record for the archives? Is there anything that you would like to talk about in our interview? We've covered very quickly most of the major topics. Would you like to talk about scientists and men of intellectual calibre in science? Is there anything you'd like to say about them? Would you like to discuss those whom you've met or who have helped you, or you have influenced or been influenced by? Even been opposed to.

Brown: I don't know of anything I care to say.

Eckles: You've never worked cooperatively with men who have been, for example, Noble prizewinners, and so on?

Brown: No, I've always felt that science is a wonderful career. It provides one with the opportunity today to do creative work in which one works for the benefit of humanity. The more knowledge we have, the more things we should be able to do. And so I've always felt that we live in a wonderful time when we can do work that is fascinating and still contribute to human advancement. Except during the war, I have never worked on a program which has been narrowly defined to proceed to a particular objective. I feel that I am one of the explorers of the human race to search out new areas of knowledge, new techniques, new methods, and to make these part of the heritage of our society. I have never attempted to work on a cooperative program with others to solve specific problems.

Eckles: You sound very much like Carl Lark-Horowitz used to sound when you talked to him about physics. Did you know Mr. Lark-Horowitz?

Brown: I knew him, but not well. He was on campus at a time when I was on campus. But one is

usually so busy with his own activities, that he does not have much time to get over into other departments to become acquainted.

Eckles: I hope that you will put down the list of your major publications, and list, of course, the national and international honors that you've received. This, of course, will come as a type of appendix. Is there anything, however, in your research, any piece of research that has been published that you'd particularly like to talk about now? Anything you're fond of? [Professor Brown submitted no material for the appendix--editor]

Brown: Well, no, I think I'm fond of all my research.

Eckles: Well, naturally. Sometimes there's a first article or a first essay that you feel that you sort of look back to with fondness.

Brown: Well, the discovery of the hydroboration reaction came about through an accidental observation. We were studying the reduction of various organic compounds by sodium borohydride. It proved to be a very mild reducing agent, and we were attempting to make it a more powerful one, so that it would reduce more compounds. We discovered that the addition of aluminum cloride to sodium borohydride converted the original mild reducing agent to

a much more active species. And we were exploring the reduction of all the representative classes of organic compounds by reducing agents. Dr. B. C. Subba Rao, a postdoctorate from India, was working with me on the problem, and he recorded that this material reduced nitriles to amines, esters to alcohol, amides to amines, etc. One of the compounds that he ran was an unsaturated fatty ester, ethyl oleate. It should have taken up two moles of hydride per mole of compound before reduction to the alcohol. Yet his results indicated that it had taken up 2.37 moles. I asked him the reason for the high value, and he offered the suggestion that the compound he had used might not have been pure, that there must be present an impurity that had used the additional 37/100 of a mole. He wanted to forget about this little descrepancy. However, a research director is in a good position to insist on high standards--he doesn't have to do the work himself.

Eckles: That is an advantage, isn't it?

Brown: I recommended that he go back to the laboratory and repeat the experiment with pure materials. He did, and obtained the same number, 2.37. Clearly it was not the purity of the ethyl oleate that was responsible for

the high value. We investigated and found that with a longer reaction time, the value went up to 3.0, and then became constant at that value. We concluded that the carbon-carbon double bond in the molecule was reacting with the agent. We discovered it was producing an organoborane. That is how we discovered the hydroboration reaction which now provides us with a new route to organoboranes. Of course, once we had discovered this new simple root to organoboranes, we began to explore the chemistry of these materials. This program has uncovered a major new universe for organic chemistry.

Eckles: Thank you for describing for posterity how it was done. I am chairman for the committee of the Society of American Artifacts to preserve scientific and technological data, and this is the sort of thing that every scientist ought to do. Thank you for doing it. Is there anything else that you have done that you'd like to do in this way? This is for the record now.

Brown: Well, I should say that I believe that being a university professor is perhaps the ideal career. One works with young people at the nicest time of their lives, when the future is ahead of them. They are all striving to

train themselves, to discover their abilities, and hopefully to work towards a promising future. One then works with these young poeple and does his best to teach them the methods, the tools, the techniques of thinking to accomplish worthwhile research. At the same time, then, one not only trains young people, but one is in a position to do creative work and to publish such work and leave it behind him as a memorial to his efforts. So I believe it is an ideal existence. I should say that the hours are long, and the work is heavy. But is is a case where one is really working for oneself, and it is work that one thoroughly enjoys. Many people often ask me about my hobbies. My hobby is chemistry. My work is chemistry. I enjoy both. I see no need to go and try to find some other activity to refresh my interest in my work, or to relieve the frustrations that build up in my work. This does not occur in a career such as I have had in chemistry.

Eckles: Of course that's the secret, isn't it, of science? What you do in science is, in a sense, your hobby. Of course, you may play golf, but that's just a game, it's not what you're doing. You're really trying to do some thinking and make a mark.

What kind of a world, though, have the scientists created. I'd like your reaction to the common theory that science and technology function according to 18th century mores and understandings, whereas, in a sense, we are in the 21st century.

Brown: Now, that's an argument I don't understand. There are more people living today who have access to the good things in life, who can read, who can enjoy literature, who can avoid pestilence and famine, than ever before in human existence. I do not understand the pessimism people have. We have problems, but they are minor problems compared to those of the past, and they will easily be solved by applying our intelligence and our efforts toward the solution.

Eckles: Yes, everything you say is true. And yet, science has made it possible to exterminate life on this globe, within not a matter of days, but within a matter of minutes. What do you say to that one?

Brown: Well, all I can tell you is there have been fewer people killed in the past 25 years through war than probably in any other 25-year period of human existence in the last 2,000 years.

Eckles: You attribute that to science or fear of science?

Brown: I don't know. There are reasons, but the fact is there that. . .

Eckles: Of course, there's been no major international war.

Brown: It is true that we have the horrible capacity to exterminate life. However, let us recall that in actual fact, nature has this ability at her command many times. War in the past has also been horribly destructive. Let's recall that when the Mongols came down through Asia. They killed off two-thirds of the people in the countries they overran. The Black Death in Europe killed off 50 percent or more of the people living in Europe then. No war that we have had has done this; hopefully none will appear. But these are problems that can be solved by human intelligence. Previous generations faced major problems that they couldn't solve by human intelligence on the basis of the available knowledge.

Eckles: The answer is the use of energy such as the atomic bomb. What I think you're arguing is the very fact that science has created this energy source, and intelligent, logical people should be able to determine how to use it for human benefit.

Brown: Yes, let's remember that there's no question that the first man to discover fire did tremendous good for human beings. At the same time he created a weapon that human beings might use to destroy each other. It is up to human beings to decide how to use their knowledge. Hopefully, as we get our environment more and more under our control, we will use the power for the good of the human race, rather than for its destruction.

Eckles: This, of course, is the hope of the scientists.

Brown: Yes.

Eckles: However, people who are not scientists continue to make destructive use of what, obviously, ought to be used by scientists for humanity. For example, more and more people are born into the world now because you've [scientists] destroyed the ecology in the sense that people live longer, have more food, create more waste. Do you think science can deal with these problems?

Brown: Well, science is dealing with these problems and does provide the solutions. It's up then to the people to be educated to these solutions and to be persuaded to adopt them. This is not the role of the scientists. It becomes the role of the politicians and the other leaders

to persuade the people to adopt these solutions. The point is that science provides the solutions; without science we wouldn't have the solutions to these problems.

Eckles: Then you differ somewhat from people like Urey who would say that the scientist is responsible for his actions, and when a man creates something like the destructive capacity of the atomic bomb, he's responsible if the atomic bomb is used to destroy.

Brown: I disagree with that. I believe that all of us are obligated, whether they are scientists or not, to use all the knowledge we have for the benefit of the human race.

Eckles: In other words, the scientist is part of it?

Brown: That's right.

Eckles: It strikes me, however, that our society must learn the limits of the scientific instrumentation and changes that people like you have created. We've got to keep up--I won't say with you in research, definitely not--but society has got to learn to use what science has accomplished and take advantage, correctly, of the opportunities of science. In other words, you've got to learn how to use these tools.

Brown: I believe that we are learning this. I

believe this is no problem in the developed countries, the educated countries, where the population is educated in the role of science. In such countries these problems can be solved.

Eckles: What about putting this into the hands of those who feel little responsibility for the world. I shiver everytime I think of, let us say, an Egyptian, or a Hindu, or an Indian, getting a hold of an atomic weapon. Look at the Chinese, for example.

Brown: Well, hopefully, the time will come when all these things will be under international control, and human beings will learn to live together and solve their problems by peaceful means rather than through conflict.

Eckles: They haven't yet, but maybe they will, and, of course, I hate to say this, but maybe science will create the fear element that will give them pause to think.

Brown: The point, though, is that in spite of all the agitation about what has happened since the end of World War II, all the conflict, the fact is that there hasn't been a really major conflict on this globe in the past 25 years. Recall that in World War II, 40 million people died. In World War I, which occurred 20 years prior to that, another 30 or so million people died.

Eckles: Twenty million alone in Russia.

I'm delighted to hear a scientist being optimistic about his field and about the condition of humanity. It's wonderful to hear this. Is there anything else you'd like to put on tape, to talk about?

Brown: I don't think so.

Eckles: Very good. The transcript will be sent to you. And with your permission, sir, we will say that this is the end of an interview between Prof. Herbert Brown and Professor Eckles of the Department of History. It is for the Purdue University Archives, and will be placed there ultimately.