NUCLEAR PHYSICS

"Much Shall Be Required"

Well-qualified youth is needed in all fields of science, 40 boys and girls were told at the Awards Banquet, which culminated the Science Talent Search.

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Excerpts from an address delivered at the Awards Banquet of the Science Talent Institute in Washington, D. C.

➤ WHAT I have to say this evening is intended primarily for just 40 persons in this large room. The rest of you are welcome to listen if you choose. But for good and obvious reasons I am addressing directly the 40 youngest members of my audience

To you fortunate 40, however, I am speaking only because you are representatives of all young people of your age and interests in the country. You are here only as the lucky survivors of a particular screening process.

The permanent task of running the Atomic Age is appropriately one for youth. We present members of the Commission must acknowledge ourselves to be venerable—we average 51 years. But we are deliberately building an organization of young men to enable us to deal with new problems of great complexity and of immeasurable importance to all our people.

In this procession of essential youth, places are reserved for you and other science-minded young men and women like you.

Youth and Revolution

The war-hastened birth of usable atomic energy is generally recognized as a revolution; and young people are traditionally the riders of revolution's wild horses.

I do not need to stress to you that our primary needs, for the long pull, is not the guarding of "The Secret", as I sometimes find necessary in addressing audiences of your elders. You know without needing to be told now that while much information about our atomic energy development must necessarily be kept "restricted" (official gobbledegook for various grades of secrecy) the basic facts of atomic physics have been in the books, foreign as well as American, for some years. Anybody who can read a page of modern physics or mathematics can learn of the fundamental contributions of Niels Bohr, and Fermi, and Szilard, and Meitner, and Einstein and all the rest.

Yet in another respect, and a very important one, all these openly published works are in a restricted category. For only the educated eye can read these pages and only the trained mind can understand their contents. The number of persons who have seen an atom bomb, or helped to put one together, is not large. Even so, it may possibly be larger than the number of Americans who have a really good reading knowledge of the scientific language in which the underlying facts of all atomic energy are stated. We have altogether too few such trained minds. We must find more of them, and soon, among the young men and women who are now in high school and college.

Need of Scientists

Refilling the ranks of atomic scientists is of course not the only responsibility of today's science-minded and science-talented young people. The world has need of workers in the whole alphabet of the sciences, from astronomy to zoology, in fields not yet touched by atomic energy as well as in those already being revolutionized by it, and in all the varied applications of science—medicine, engineering, agriculture, forestry, and all the rest. The harvest is indeed great, and the laborers far too few. It is to be hoped that public aid and private aid, too, for the training of scientists and the support of their research will soon vastly extend the field which the Science Talent Search has so brilliantly pioneered.

The Atomic Energy Commission, appreciating the importance of building up a corps of thoroughly trained young scientists in fields affected by the utilization of atomic energy (and that means, or seems likely soon to mean, just about all fields) has undertaken to do some searching on its own account for science talent at the college-graduate level. Altogether we expect to offer graduate fellowships to 355 young men and women, most of them in their second or third year of graduate work, but some already with their doctors' degrees. A total of $2,500,000 has been set aside for the first year of this program.

Let me give you a quick sketch of the responsibilities and activities of the Atomic Energy Commission:

The Congress and the Executive of the United States, by the law that became effective on August 1, 1946, made the development and use of atomic energy in this country a government monopoly. It set up the Atomic Energy Commission, and provided for a General Manager and his staff working under the Commission.

A.E.C. Responsibilities

On the Commission was put responsibility in the whole range of atomic energy, from the procurement of raw materials wherever they might be reached on earth to and including the production of atomic weapons, to and including the development of power for peaceful uses, to and including the then unforeseeables. The Commission, for the people of the United States, owns and controls all fissionable materials. It owns and directs operations of our atomic energy industry, which produces fissionable materials. It controls information as well as materials, much of the information necessarily being kept secret. It is under orders to conduct atomic energy research on a great scale and with real drive, and to see that research is pressed by others with its aid. Its real job, almost incredibly complex, is to get ahead, all along the line.

We have four main installations and rather numerous smaller ones. Three of them, largest and most conspicuous, are primarily production plants and one is a proving ground. At Oak Ridge, Tenn., which was and is the largest of those strange anomalies, "company towns" owned by the government, the principal production activity has been the separation of uranium 235 from its more abundant isotope, uranium 238. At the Hanford, Wash., plant some uranium 238 is converted into plutonium. The Los Alamos, N. M., plant is the one place where atomic bombs are made;

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naturally I can't talk about that. And far out in the Pacific, at Eniwetok atoll, is the new proving ground for routine tests.

Production of fissionable materials is by no means the only activity at Oak Ridge. It is also a great research center, one of three national atomic research laboratories, involving participation of both industry and universities. The two other national laboratories are the Brookhaven laboratory on Long Island, operated by a group of Northeastern universities, and the Argonne laboratory near Chicago, in which 29 universities participate.

Radioactive Materials

In one part of the National Laboratory at Oak Ridge intensive work is being done on methods and means for safeguarding the health of persons who work with radioactive materials—and they are dangerous, as X-rays are dangerous, or radium. A fine record of safety in this work, I may add, has been made.

Another of the Oak Ridge laboratory establishments is the recently opened Biological Laboratory, where a staff of brilliant researchers are pioneering in work on the effects of fissionable materials and their radiations on living animals and plants. Still another is the center for distribution of radioactive and stable isotopes for research in university and other research laboratories both in this country and abroad. We sell radioactive isotopes of a large number of chemical elements to institutions needing them in their research problems. Requests for radioisotopes are reviewed and approved by a special allocations committee, and in case of foreign distribution a progress report on the results of the investigations is required every six months.

At Berkeley, Calif., is another very important laboratory, the "Radiation Lab," which has done magnificent things in the past and which will do more of them in the future. At Iowa State college, in my own state, work of which the same could be correctly said, goes on with our support. These are not all; but I am not trying to be comprehensive.

Wide Range of Research

Thus you will see that research in atomic energy, all phases, is being conducted on a wide range of bases, from work requiring large teams of men and the most massive facilities, available only in one or a few places, to one-man problems in small colleges or remote agricultural experiment stations. Some of the problems are so involved with national security that their very nature cannot be discussed; others are so open that you can go and kibitz over the researcher's shoulder—if he'll let you.

I have already mentioned research on atomic power. I can't be very specific about possibilities here, except to say that immediate application is not in prospect, and that when it does come it seems likely to be in rather large-scale installations. Stationary power plants, especially where conventional steam and water power are not cheaply available, and perhaps propulsion for warships, are the likeliest initial efforts. Some rather difficult but, we believe, not insuperable problems have to be solved first, and those we are "at."

We have certainly progressed if we are able to work toward the use of this newly available form of energy for constructive purposes within a couple of years after its first use for destructive purposes. Remember, the first use of expansive thermal force confined within a cylinder was to push cannon-balls, and it was about 400 years before people got around to using the same force in the modified form of steam to push a piston to do useful work, and more than 200 more before an engine directly utilizing explosions was developed. So you really shouldn't be impatient about our slowness in developing atomic power.

Most active use of atomic energy at

Do You Know?

Chlordane is an American-made insecticide effective in killing grasshopper invasions.

A new plant-growth inhibitor, and possibly a *weed-killer,* has been obtained from a Southwestern desert plant called brittle bush.

Household *moth larvae,* that damage clothing, are hatched summer and winter, but the time required to hatch the eggs of the moth is greater in cold weather than when warm.

The plant that produces *mace,* widely used spice, produces nutmeg also; mace is the covering which envelopes a part of the shell of the nutmeg and one can not be grown without the other.

A chemical compound, relatively new commercially, is claimed as a valuable aid in soaps and detergents to make white clothes stay white longer; it is sodium carboxymethyl cellulose, called *Sodium CMC* for short.

present is the indirect one involved in the employment of what is becoming known, even in everyday discussions, as "tracers." Exposing chemical elements to bombardment with atom-particle streams of various kinds renders them, in turn, radioactive. Thereafter they can be detected, even in smaller quantities, by instruments such as Geiger counters or electroscopes, or in some cases simply with photographic film. Compounds of these radioactive elements can thus be traced wherever they go, which is why they are called tracers.

Tracer Elements

Tracer elements have been a godsend to plant physiologists, and to that outdoor application of their science which we call agriculture. So seemingly simple a thing as the rise of sap in plants has for ages been a riddle; we did not know how fast it went, with any real accuracy, and we did not know at all what paths it followed. Now we are beginning to find out. An even denser mystery surrounded the making of sugars, starches and other foods in the green leaf, on which we all depend for our very lives. Now we prepare radioactive carbon, burn it to make carbon dioxide, feed this to a plant leaf on which light is shining—and the tracers start telling their story. There had long been dispute as to whether starch came first and was changed into sugar, or sugar came first and was changed into starch. Tracers have shown both theories to be wrong; the initial stage in food-making is neither starch nor sugar but a third something that has not yet been completely identified.

Of particular practical value has been the use of tracers in the chemical mixtures that are commercial fertilizers. Plant nutrition, especially under outdoor conditions, has always had more guesswork in it than we liked to admit. Tracers are beginning to tell us when we are wasting one chemical by putting in too much of it, or leaving the plant technologically unemployed by not giving it enough of another to let it work at full efficiency.

Important though tracers are, they are not the only way in which the new radioactive elements can be used. It has been known for some years that bombardment with X-rays and exposure to radium can change the germ-cells of animals and plants, producing hereditary changes in the offspring. The same kind of thing can now be done much more cheaply with radiations from our atomic ovens. What this may mean to genetical science and practical plant and animal breeding is for the future. It may be considerable. There are also possibilities in the radiation treatment of diseases. They may be of tremendous importance. But all we can say now is "*may* be."

Well, these are a few random samples of the research uses that are now being made of atomic energy and its products, the fissionable isotopes of the elements. They look impressive as they pass in review, but really they represent only a small fraction of the possibilities. There simply aren't enough workers now.

Here is where you come in. I have several times addressed you as the fortunate 40. Fortunate you are. Not because you are here, but because you have the intelligence and aptitude that have enabled you to pursue your education thus far with credit, and can reasonably be expected to make good use of your further opportunities.

Good fortune is yours. Responsibility is also yours, proportionate to your proven abilities. "For unto whomsoever much is given, of him shall much be required; and to whom men have committed much, of him they will ask the more."

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Science Service Radio

➤ LISTEN in to a discussion on brains of animals and humans on "Adventures in Science" over Columbia Broadcasting System at 3:15 p.m. EST Saturday, March 13. Dr. Ralph Gerard, professor of physiology of the University of Chicago, will be the guest of Watson Davis, director of Science Service. Dr. Gerard is going to explore the brain and try to tell us what makes us think.

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